Syllabus

UG0101 – Three/Four Year Bachelor of Science (Bio Group)

III-Semester- Botany

BOT-63T-201-Microbiology and Plant Pathology

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
III	BOT-63T-201	Microbiology and Plant Pathology				6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	Major	4	2	6	Yes	60 lectures with diagrammatic presentations and informative assessments during lecture hours	
Prerequisites		Botany course of Foundation/Introductory level					
Objectives of the Course:		➢ To gain in-depth knowledge about bacteria, viruses and other microorganisms, including their structure, function, genetics, and role in ecosystems, ➢ To learn about the interactions between plants and microorganisms, ➢ To understand the beneficial relationships (e.g., symbiosis) and harmful interactions (e.g., plant diseases) between plants and microorganisms					

COURSE OUTCOMES

On completion of the course the student would be able to develop the following

Understanding	• To gain in-depth knowledge about bacteria, viruses and other microorganisms, including their structure, function, genetics, and role in ecosystems. • To learn about the interactions between plants and microorganisms, • To understand the beneficial relationships (e.g., symbiosis) and harmful interactions (e.g., plant diseases) between plants and microorganisms.
Memorizing	• Different types of microbes with structure, function and their economic importance. • Host-pathogen interaction and its effects on plants. • Syptomology, disease cycle and control of different pathogens causing diseases.
Applying	• Acquire proficiency in various laboratory techniques, such as culturing microorganisms, gram staining, microscopy, and biochemical assays. • Will be helpful for students further developing interest in agricultural research, crop protection, and pest management to improve crop yield and quality. • Work in disease prevention and control, focusing on plant diseases that impact food safety and public health.

Detailed Syllabus
BOT-63T-201 - [Microbiology and Plant Pathology]

Unit – I

Microbiology	Introduction to microbial word: History and Development in the field of microbiology, Systemic position of Micro-organism (R.H. Whittaker's five kingdom concept, Carl Woese's Domain System), Origin of Life, contribution of Louis Pasteur and Robert Koch, Germ theory of disease.	**(7 Lectures)**
Virus	Discovery, General account, structure with special reference to TMV, Pox virus, Bacteriophage; Replication of T4 phage (Lytic and Lysogenic).	**(6 Lectures)**
Mycoplasma	General Characteristics, Morphology and Reproduction.	**(2 Lectures)**

Unit –II

Bacteria	General Characteristics, Classification, Cell structure, endospore formation, Reproduction- asexual and recombination (Conjugation, Transformation and Transduction).	**(10 Lectures)**
Applied Microbiology	Economic importance of viruses, Economic importance of Bacteria with reference to their role in agriculture and food industry, Biofilms	**(5 Lectures)**

Unit –III

Phyto-pathology	Terminology and basic concepts (Primary and Secondary inoculum; infection, Pathogenicity, Pathogenesis, Disease Cycle); Biotic and abiotic diseases, General symptoms caused by Viruses, Bacteria, Fungi, Mycoplasma, Nematodes, Insects (smut, rust, mildews, canker, mosaic, vein clearing, spots, lesion, knot, galls).	**(8 Lectures)**
Diseases	Viral, Mycoplasmal and Bacterial diseases: Brief account, Symptomology and control of the following plant diseases:- Tobacco Mosaic, Little leaf of Brinjal, Citrus canker and Angular leaf spot of Cotton.	**(7 Lectures)**

Unit-IV

Fungal Diseases	Symptomology, disease cycle and control of the following plant diseases with special reference to Rajasthan: White rust of crucifers, Downy mildew/green ear disease of Bajra, Black/stem rust of Wheat, Loose and covered smut of Barley, Early blight of Potato	**(10 Lectures)**
Diseases	**Disease caused by insects and nematodes:** General account of diseases caused by insects and nematodes, Brief account and histopathology of root knot of vegetables, leaf gall of *Pongamia*	**(5 Lectures)**

Suggested Books and References –

1. Pelczar, M.J. (2001) Microbiology, 5th edition. New Delhi, Delhi: Tata Mc-Graw- Hill Co.
2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
3. Agrios G.N. (2004) Plant Pathology, 5th Edition, Academic Press
4. Pandey B.P. (2001) Plant Pathology (Pathogen and Plant Disease), S. Chand Publishing
5. Mehrotra RS and Aggarwal A. (2003) Plant Pathology, 2nd Edition. Delhi: Tata Mc-Graw-Hill Co.
6. Sharma P.D. (2013). *Plant pathology*. Deep and Deep Publications.

Suggested E-resources:

1. **https://archive.nptel.ac.in/courses/102/103/102103015/**
2. **https://onlinecourses.swayam2.ac.in/cec21_bt16/preview**
3. **https://www.pdfdrive.com/plant-pathology-concepts-and-laboratory-exercises-e179105354.html**
4. RRC E-resources

Raj Rishi Govt. (Autonomous) College Alwar (Rajasthan)

B.Sc. Semester – III (2024-25)

BOT-63P-202 Botany Practical-III

I	Microscopic techniques- handling of light microscope, general idea of SEM and TEM. Write major contribution of leading scientists of Microbiology Study of TMV, Bacteriophage and Pox virus, Mycorrhiza (Photographs/3D Models)
II	Study of Bacteria by Gram Staining and Negative staining Preparation of Liquid and solid media for culturing microbes Pure culture techniques- pour plate, spread plate, streaking
III	Study of symptoms of plant diseases (specimen/permanent slide)- Downy mildew/green ear disease of Bajra, Tobacco Mosaic, Citrus canker, Little leaf of Brinjal, Study of spores of *Alternaria* from Early blight of Potato
IV	Study and identification of spores from temporary slide preparation from infected plant material:- white rust of crucifers (conidia stage), Black/ stem rust of Wheat (all stages). Study of histopathology using temporary slide prepration of infected part of root knot of tomato, Leaf gall of *Pongamia*

Raj Rishi Govt. (Autonomous) College Alwar
(Rajasthan)

B.Sc. Semester- III (Bio Group) Botany Practical-III
Scheme of Practical Examination and Distribution of Marks

BOT-63P-202 **Duration: 4 Hrs**
Maximum Marks 10*+40 Marks Minimum marks 4*+16 Marks

S.No.	Exercise	Regular	Ex. Students
1.	Perform exercise of Microbiology Gram'/negative staining of bacteria or Identification of virus/mycoplasma	**4**	**5**
2.	Perform the exercise based on the microbiology – media preparation/any pure culture technique	**6**	**10**
3.	Study the material "A" carefully, prepare a suitable stained preparation, and identify the casual organism associated with the disease giving reasons (Fungal disease)	**6**	**10**
4.	Identify the material "B" carefully, prepare a suitable stained preparation, and identify the casual organism associated with the disease giving reasons (Insect/Nematode disease)	**4**	**5**
5.	Spotting (5 spots)	**10**	**15**
6.	Viva voce	**5**	**5**
7.	Record	**5**	**-**
	TOTAL	**10*+40=50**	**50**
	Regular students' internal marks are based on Viva voce /Group discussion/Project/ Field Study/Herbarium/Chart/Model/Specimen.		
	Regular Candidates must keep a record of all work done in the practical classes and submit the same for inspection at the time of practical examination.		

Course Learning Outcomes: Upon completion of course, students will be able to-

1. Understand about morphology and function diverse microbes.
2. Understand about diagnosing plant diseases, understanding their causes, and implementing management strategies to control or prevent them.
3. Understand and perform different laboratory exercise to further microorganisms.
4. Acquire knowledge about different types of microbes with structure, function and their economic importance, Host pathogen interaction and its effects on plants.
5. Apply control and management strategies for plant diseases caused by fungi, bacteria, nematodes, insects etc.
6. Acquire proficiency in various laboratory techniques, such as culturing microorganisms, gram staining, microscopy, and biochemical assays.
7. Develop interest among students in agricultural research, crop protection, and pest
   management to improve crop yield and quality.
8. Work in disease prevention and control, focusing on plant diseases that impact food.

Syllabus

UG0802 -BOT-64T-203
Plant Taxonomy and Economic Botany
IV-Semester- B.Sc. (Bio Group)
Botany

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
IV	BOT-64T-203	Plant Taxonomy and Economic Botany				6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	Major	4	2	6	Yes	60 lectures with diagrammatic presentations and informative assessments during lecture hours	
Prerequisites		Botany course of Foundation/Introductory level					
Objectives of the Course:		➢ To gain in-depth knowledge about plant taxonomy and economic botany. ➢ To learn about the various aspects of taxonomy like nomenclature, classification and identification ➢ To understand the benefits of plants with their products in various field. ➢ To learn about plant collection and preservation of plants in lab (herbarium).					

COURSE OUTCOMES

On completion of the course the student would be able to develop the following

Understanding	• To Understand the historical development and modern approaches to plant classification systems, including the principles and criteria used for categorizing plants • Understand the evolutionary relationships among different plant groups and how phylogenetic trees represent these relationships. • Understand the key morphological features that are used to identify and classify plants at various taxonomic levels (family, genus, species).
Memorizing	• Memorize the hierarchical classification of plants, including ranks such as do ain, kingdom, phylum, class, order, family, genus, and species. • Memorize the characteristics and representative species of major plant families, including their economic and ecological significance.
Applying	• Apply knowledge to identify plant species in the field using keys, guides, and floras, demonstrating proficiency in using diagnostic features. • Apply techniques for collecting, preserving, and preparing plant specimens for herbarium collections, ensuring accurate labeling and documentation. • Conduct independent or group research projects involving the collection, identification, and classification of local plant species, integrating field and laboratory work.

Detailed Syllabus

BOT-64T-203 – Plant Taxonomy and Economic Botany

UNIT-I

Classification	Artificial (Linneaus), Natural (Bentham&Hooker) and Phylogenetic (Engler and Prantle's) System.	**5 lectures**
Nomenclature	Angiosperm Phylogeny Group (APG). International Code of Bota ical Nomenclature. Introduction, principles, rules (Name of Taxon, Priority & publication) and Recommendations. Introduction to International code of Nomenclature for algae, fungi and plants (ICNafp),	**5 lectures**
Herbarium	Equipments, herbarium sheet preparation & preservation and significances. Introduction to Botanical Survey of India (BSI).	**5 lectures**

UNIT-II

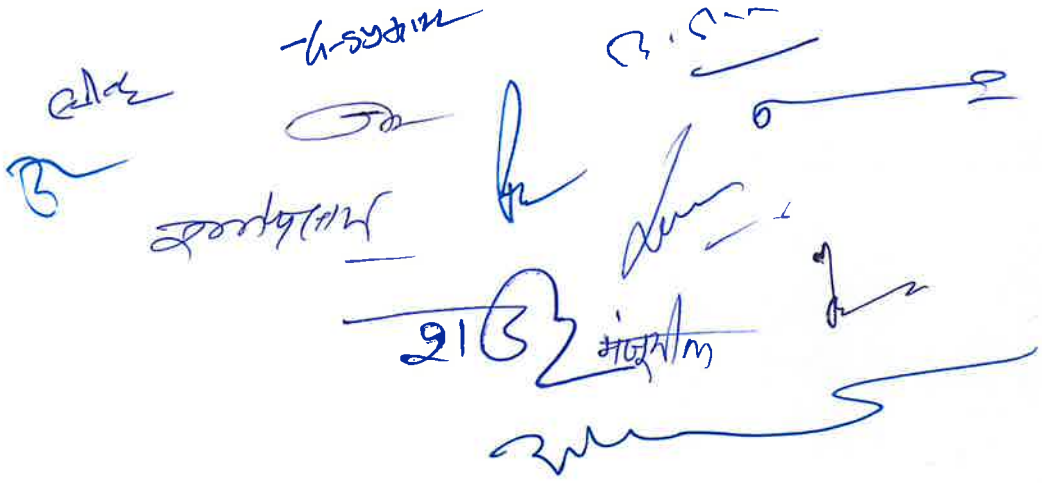
Taxonomic literature	Floras, Monographs, Icons.	**3 lectures**
Modern Trends	Cytotaxonomy, Chemotaxonomy, Palynology, Embryology Anatomy and Numerical taxonomy.	**5 lectures**
Study of Families	Diagnostic characters and economic importance of Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae And Asteraceae.	**7 lectures**

UNIT-III

Study of Families	Diagnostic characters and economic importance of Apocynaceae, Asclepieadaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae and Poaceae.	**8 lectures**
Economic Botany	Vavilov concept of centre of origin. Primary and secondary centres. **Cereals** (General account): Rice, Wheat, Maize. **Millets** (General account): Ragi (finger millet), Jowar (*Sorghum)*, Sama (Little millet), Bajra (pearl millet), Variga (Porso millet).	**7 lectures**

UNIT-IV

Economic Botany	**Vegetable oil**: Ground nut and Mustard **Spices:** General account of turmeric, asafoetida, Cumin, Coriander & RedChilli. **Beverages:** Tea and Coffee. **Medicinal plants:** General account (Tulsi, Isabgol, Ashwagandha, Neem and Ephedra). **Fibres:** Cotton&Jute.Processing of Rubber &Sugarcane	**15 lectures**



Suggested Books and References –

- Principles of Angiosperm Taxonomy by Davis & Heywood. Publisher: Oliver & Boyd
- Taxonomy of Vascular Plants by Lawrence H M George. Publisher : Scientific Publishers
- Plant Systematics: An Integrated Approach. By Gurcharan Singh. Publisher : CRC Press
- Plant Taxonomy by O. P. Sharma. Publisher : McGraw Hill Education
- Taxonomy of Angiosperms by A.V.S.S. Sambamurty. Publisher :Dreamtech Press
- Modern Plant Taxonomy by N.S. Subrahmanyam. Publisher : S Chand
- Economic Botany by B.P. Pandey. Publisher : S Chand & Company
- Economic botany: a comprehensive study by S.L.Kochhar. Publisher : Cambridge University Press
- Economic Botany by Singh, Pandey & Jain. Publisher -S. Chand Publishing

Suggested E-resources:

1. https:// www.google.co.in/books/edition/The_Flowering_Plants_Handbook/yoLaBAAAQBAJ?hl=en&gbpv=1&dq=james+byng+taxonomy&printsec=frontcover
2. **https://www.pdfdrive.com**
3. RRC E-resources

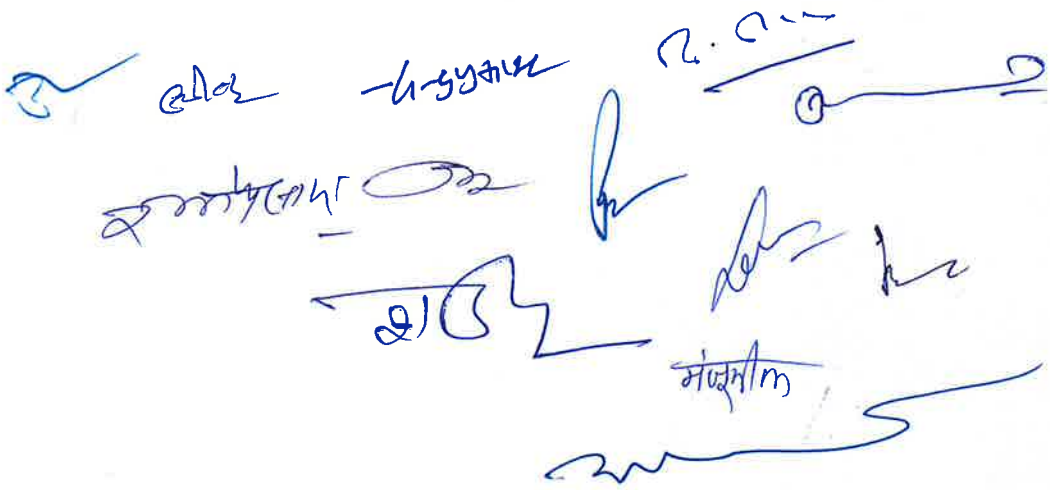
Raj Rishi Govt. (Autonomous) College Alwar (Rajasthan
B.Sc. Semester – IV (2024-25)
BOT-64P-204 Botany Practical-IV

Exercises based on Plant Taxonomy: -

- Plant description and identification of following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae Apocynaceae, Asclepieadaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae and Poaceae
- Exercise based on using taxonomic modern tools
- Preparation of Herbarium sheets
- Campus Flora writing/ Excursion/Field study
- Herbarium tools

Exercises based on Plant Taxonomy

- Biochemical test for Starch, Protein, Oil, Cellulose, ligninand tannin
- Medicinal plant-identification and collection
- Study of specimens with reference to economic use of Cereals, millets, Pulses, Oil, Fibres, Spices, and Beverages (common name, Botanical name, Family, Parts used, Economic uses)
- Collection of specimens of locally available medicinal/ wild plants
- Any other exercise based on theory syllabus



Raj Rishi Govt. (Autonomous) College Alwar

B.Sc. Semester- IV (Bio Group) Botany Practical-IV Scheme of Practical Examination and Distribution of Marks

BOT-64P-204 **Duration: 4Hrs**

Maximum Marks 10*+40 Marks Minimum marks 4*+16 Marks

S.No.	Exercises	Regular	Ex. Students
1.	Identify the family of the given flower and describe floral characters in semi-technical language, draw floral diagram and write floral formula.	7	10
2.	Identify and describe the given herbarium tool	4	6
3.	Perform the biochemical test of given material.	3	4
4.	Identify the given material (economic botany), write botanical characters and economic importance	6	10
5.	Spotting (5)	10	15
6.	Viva voce	5	5
7.	Record	5	-
	TOTAL	**10*+40=50**	**50**
	Regular students' internal marks are based on Viva voce /Group discussion/Project/ Field Study/Herbarium/Chart/Model/Specimen.		
	Regular Candidates must keep a record of all work done in the practical classes and submit the same for inspection at the time of practical examination.		

Course Learning Outcomes:

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

- Learn the types of classifications- artificial, Natural and phylogenetic.
- Gain knowledge about Botanical Survey of India (BSI).
- Briefly study herbarium techniques.
- Learn the taxonomic evidences from molecular, numerical and chemicals.
- Brief study the economic products with special reference to the Botanical name, family, morphology of useful part and the uses
- Acquire an increased awareness and recognition of economical important plants.
- Learn diverse human uses of plants and plant products.
- Apply the knowledge gained in seeking employment to reputed institutions and organizations known in the field of plant taxonomy, diversity, conservation, agro-industry, pharmaceuticals etc.
- Memorize the various classification with the botanical names, distinctions, distribution, habit, characteristics and affinities of various taxon.
- Learn the perspective of origin, history and role of important plants and plant products for the development of human culture.
- Acknowledge the economic uses of plants in modern society.
- Acquire an increased awareness and appreciation of plants & plant products encountered in everyday life.
- Develop scientific insights into the development of many plant products that have shaped our society.
- Appreciate the diversity of plants and the plant products in human us

III– Semester – Chemistry

Syllabus

CHM-63T-211 – **Coordination Chemistry of Transition metal Complexes with kinetic & thermodynamic aspects, UV & IR spectroscopy, Alcohols, Ethers, Phenols and Carbonyl Compounds, Chemical and Ionic Equilibrium, Solutions with Colligative Properties.**

Unit-I

Coordination Compounds:
Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complex.

Metal-ligand bonding in Transition Metal complexes:
Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal-field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Magnetic properties of Transition Metal Complexes:
Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes

Electron Spectra of Transition Metal Complexes:
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Thermodynamic and Kinetic Aspects of Metal Complexes:
A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

15 Lecture

Unit-II

Electromagnetic Spectrum: An Introduction
Absorption Spectroscopy
Ultraviolet (UV) spectroscopy - Absorption laws (Beer-Lambert Law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of solvents on transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Infrared (IR) spectroscopy - Molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristics absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

15 Lecture

Unit-III

Alcohols - Classification and nomenclature.
Monohydric alcohols - Methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, Acidic nature. Reactions of alcohol with mechanism.
Dihydric alcohols - methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement. Trihydric alcohols - methods of formation, chemical reactions of glycerol.

Phenols
Nomenclature, structure and bonding. Preparation of Phenols. Physical properties and acidic character. Comparative acidic strength of alcohols and phenols. Reactions of phenols- electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gattermann synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Ethers and Epoxides
Methods of formation, physical properties. Chemical reactions - cleavage and autooxidation. Ziesel's method.
Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Aldehydes and Ketones
Structure of the carbonyl group. Syntheses of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, syntheses of ketones from nitriles and from carboxylic acids. Physical properties.
Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (Meervein-Pondrof-Verley), Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions, Halogenation of

enolizable ketones. Use of acetals and 1,3-dithiane as protecting group.

15 Lecture

Unit-IV

Chemical Equilibrium:
Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction Isotherm and reaction isochore. Clapeyron equation and Clausius-Clapeyron equation, applications.

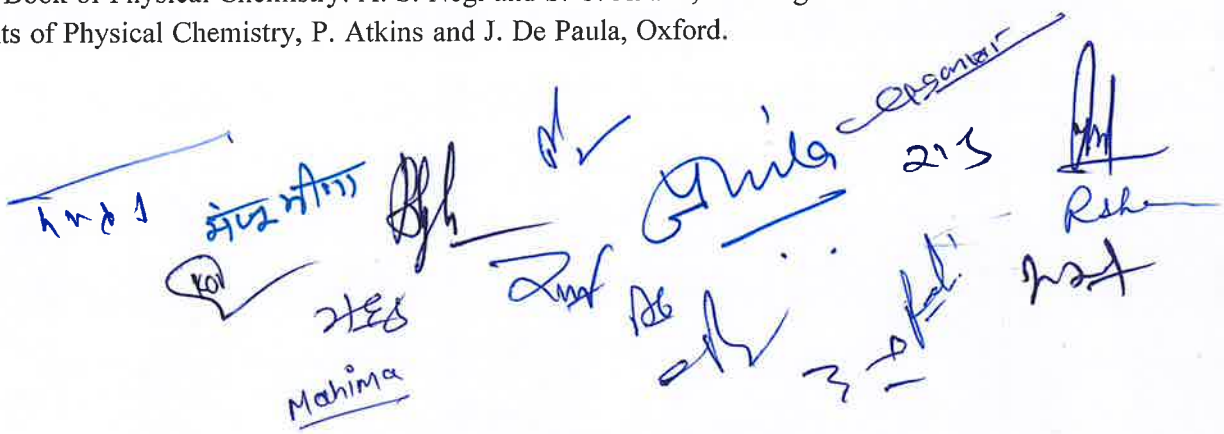
Ionic Equilibrium: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis – calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product.

Solutions, Dilute Solutions and Colligative Properties:
Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.
Dilute solution, colligative properties, Raoult's law, relative lowering of vapor pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weight and elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

15 Lecture

Suggested Books and References:

1. Concise Coordination Chemistry by R. Gopalan and V. Ramalingam, Vikas Publishing House Pvt, Ltd.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P.L Gaus, Willey.
3. Concise Inorganic Chemistry by J. D. Lee, Wiley-India.
4. Inorganic Chemistry by Catherine E. Housecroft, & Alan G Sharpe, Pearson Education Ltd.
5. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Vishal Publishing Co.
6. Concepts and Models of Inorganic Chemistry, B.E. Douglas, D. McDaniel, & J. Alexander, Wiley.
7. Organic Chemistry by R. T. Morrison & R. N. Boyed, Prentice Hall.
8. Reaction Mechanism in Organic Chemistry by S. M. Mukherji & S. P. Singh, TRINITY Press.
9. Organic Chemistry by I. L. Finar, (Vol. I & II) ELBS.
10. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma and M. S. Pathania, Vishal Publishing Co.
11. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand, New Age International Publishers.
12. Elements of Physical Chemistry, P. Atkins and J. De Paula, Oxford.



Syllabus

CHM-63T-212 – Concepts of Acids & Bases, Lanthanides and Actinides, Carboxylic Acids and its Functional derivatives, N-containing Organic Compounds, Thermodynamics-II, Phase Equilibrium and Electrochemistry-I.

Unit I

Acids and Bases:
Theories: Arrhenius, Bronsted-Lowry, Lux-Flood. Solvent system concept and Lewis's concept of acids and bases.

Hard and Soft Acids and Bases (HSAB):
Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Chemistry of Lanthanide and Actinide Elements:
Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence

and isolation, lanthanide compounds.
General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

15 Lecture

Unit II

Carboxylic Acids
Structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids, mechanism of decarboxylation.
Methods of formation and chemical reactions of halo acids. Hydroxy acids - malic, tartaric and citric acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents (succinic, glutaric and adipic acids).

Carboxylic Acid Derivatives
Structure, nomenclature and synthesis of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.
Preparation of carboxylic acid derivatives, chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic).

Organic Compounds of Nitrogen
Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.
Amines: Structure, nomenclature and preparation of alkyl, and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Physical properties, stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Gabriel-phthalimide reaction and Hoffmann bromamide reaction with mechanism.
Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. diazotisation and mechanism. Synthetic transformations of aryl diazonium salts, azo coupling and its applications.

15 Lecture

Unit III

Thermodynamics –II
Second Law of Thermodynamics: Need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot-Theorem. Thermodynamic scale of temperature.
Concept of Entropy: Entropy as a state function, entropy as a function of V&T, entropy as a function of P&T, entropy change in physical change, Clausius inequality and entropy as a criteria of spontaneity and equilibrium. Entropy changes in ideal gases and mixing of gases.
Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function **(A)** as: thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.
Phase Equilibrium: Statement and meaning of the terms: phase, component and degree of freedom,

derivation of Gibbs phase rule, phase equilibria of one component system - water, CO_2 and Sulphur systems.

Phase equilibria of two component system - solid-liquid equilibria simple eutectic Bi-Cd, Pb-Ag systems, desilverization of lead.

15 Lecture

Unit IV

Electrochemistry – I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye- Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method and moving boundary method.

Applications of conductivity measurements:

Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

15 Lecture

Suggested Books and References:

1. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, & P.L Gaus, Willey.
2. Concise Inorganic Chemistry by J. D. Lee, Wiley-India.
3. Inorganic Chemistry by Catherine E. Housecroft, & Alan G Sharpe, Pearson Education Ltd.
4. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Vishal Publishing Co.
5. Concepts and Models of Inorganic Chemistry, B.E. Douglas, D. McDaniel, & J. Alexander, Wiley.
6. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure by J March, & M. B Smith Wiley.
9. Organic Chemistry by R. T. Morrison & R. N. Boyed, Prentice Hall
10. Reaction Mechanism in Organic Chemistry by S. M. Mukherji & S. P. Singh, TRINITY Press.
11. Organic Chemistry by I. L. Finar, (Vol. I & II) ELBS.
12. Physical Chemistry by R. J. Silbey, R. A. Alberty & M. G. Bawendi, John Wiley & Sons.
13. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma and M. S. Pathania, Vishal Publishing Co.
14. An Introduction to Chemical Thermodynamics by R. P. Rastogi & R. R. Mishra, Vikas Publishing House.
15. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand, New Age International Publishers.
16. Advanced Physical Chemistry by Gurdeep Raj, Goel Publishing House.
17. Elements of Physical Chemistry, P. Atkins and J. De Paula, Oxford.
18. A Textbook of Physical Chemistry, Application of Thermodynamics, by K. L. Kapoor, (Volume-3) McGraw Hill.
19. An Introduction to Electrochemistry by Samuel Glasstone, BSC Publishers.
20. Electrochemistry and its Applications by G. Whitmore, Sarup & Sons.

21. Physical Chemistry by G.M Barrow, Tata McGraw-Hill.
22. Fundamentals of Electrochemistry by Morris Sylvin, Sarup & Sons.
23. Solutions, Phase Equilibrium, Conductance & Electrochemistry by Puri, Sharma, Pathania and Kaur, Vishal Publishing Co.
24. Phase Equilibria, Phase Diagrams and Phase Transformations by Mats Hillert, Cambridge University Press.

Syllabus
Semester-III Chemistry

CHM-63P-213: **Practical I** **4 Hrs./week**

Inorganic Chemistry **20 marks**

Quantitative (Gravimetric) (*any three*)

a) Estimation of Barium (as sulphate)
b) Lead (as chromate)
c) Zinc (as Zinc ammonium phosphate)
d) Magnesium (as Magnesium hydrogen phosphate, $MgHPO_4$)

Inorganic Preparations (*any four*) **of coordination compounds and their characterization:**

(a) Chloropentamminecobalt(III) chloride.
(b) Pyridine complex of copper.
(c) Tetramminecopper(II) sulphate.
(d) Mercury tetrathiocyanatocobaltate.
(e) Prussian blue.
(f) Hexaamminenickel(II) chloride.

Organic Chemistry **20 Marks**

(i) Identification of simple organic compound and preparation of its suitable derivative.

Simple one step organic preparation-

The students are expected to perform at least five of the following preparations:

(a) Preparation of m-dinitrobenzene from nitrobenzene.
(b) Preparation of acetanilide from aniline.
(c) Preparation of aspirin from salicylic acid.
(d) Preparation of o-and p-bromo acetanilide from acetanilide.
(e) Preparation of o-and p-bromo aniline from o-and p-bromoacetanilide.
(f) Partial reduction of m-dinitrobenzene into m-nitro aniline.
(g) Preparation of methyl orange from sulphanilic acid

Physical Chemistry **20 Marks**

Transition temperature:

a) Determination of transition temperature by thermometric and dialometric method.

Molecular weight determination:

a) Determination of molecular weight of non-volatile solute by cryoscopic method and application of technique for determination of the Van't Hoff factor or degree of dissociation of an electrolyte.

Chemical Dynamics experiments:

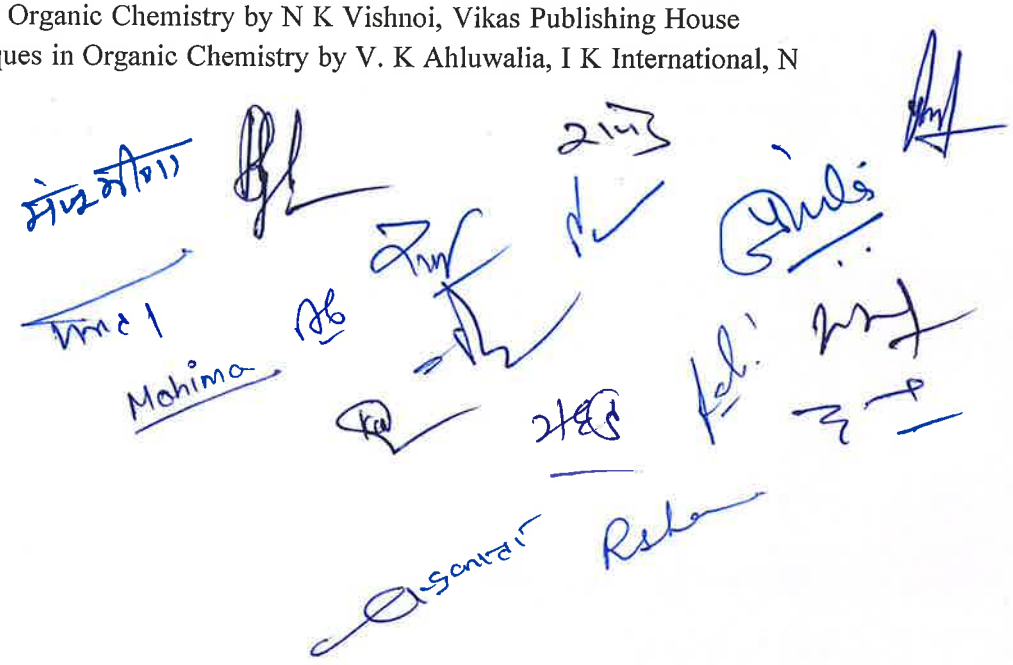
a) To find the velocity constant of the hydrolysis of methyl acetate catalyzed by an acid.
b) To determine the order of saponification of ethyl acetate by NaOH.
c) To find out the rate constant and order of reaction between potassium persulphate and potassium iodide,
d) To study the reaction between acetone and iodine.

Viva voce **10 marks**

Practical Record **10 marks**

Suggested Books and References:

1. Vogel's textbook of practical organic chemistry including **Qualitative** organic Analysis, by A. I. Vogel Longman, London and New York. Prentice Hall.
2. A. I. Vogel, Vogel's **Quantitative** Inorganic Analysis Including Elementary Instrumental Analysis, ELBS.
3. Advance Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House.
4. Advanced Practical Physical Chemistry J. B. Yadav, Goel Publishing House.
5. Practical Physical Chemistry B. D Khosla, S. Chand & Company.
6. Advanced Practical Organic Chemistry by N K Vishnoi, Vikas Publishing House PVT LTD
7. Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis,V. KAhluwalia. Universities Press, Hyderabad.
8. Advanced Practical Organic Chemistry by N K Vishnoi, Vikas Publishing House
9. Laboratory Techniques in Organic Chemistry by V. K Ahluwalia, I K International, N



IV– Semester – Chemistry

Syllabus

CHM-64T-214- Organic Synthesis via Enolates, NMR Spectroscopy, Heterocyclic Compounds, Fundamentals of Molecular Spectroscopy, Electrochemistry-II

Unit-I

Organic Synthesis via Enolates: Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Claisen condensation, Keto-enol tautomerism in ethyl acetoacetate. Synthetic applications of ethyl acetoacetate and malonic ester.

Nuclear Magnetic Resonance (NMR) Spectroscopy:
Proton magnetic resonance (^{1}H-NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals. Interpretation of NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using ^{1}H NMR data.

15 Lecture

Unit-II

Heterocyclic Compounds
Introduction: Molecular orbital diagram and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine and derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.
Introduction to condensed five- and six-membered heterocyles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher-indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis, Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

15 Lecture

Unit-III

Spectroscopy:
Introduction: Electromagnetic radiation, spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom.

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles),

selection rules, spectral intensity, using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect.

Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum: Basic principles and applications, concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank Condon principle. qualitative description of σ, π and n M.O. their energy levels and the respective transitions.

15 Lecture

Unit-IV

Electrochemistry –II

Types of reversible electrodes: Gas–metal- ion, metal-metal ion, metal-insoluble salt anion and redox electrodes, electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cells EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and hydrogen overvoltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells. Valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a, determination of pH using hydrogen quinhydrone and glass electrodes, by potentiometric methods.

15 Lecture

Suggested Books and References:

1. Organic Chemistry by S. S, Gupta, Oxford University Press.
2. Organic Reaction Mechanisms by V. K.Ahluwalia, Narosa Publishing House, New Delhi.
3. Organic Chemistry – Reactions and Reagents Complete Theoretical Organic Chemistry, by O. P Agarwal, Covering Goel Publishing House, Meerut.
4. Organic Chemistry by R.T Morrison. & R. N Boyed., Prentice Hall.
5. Organic Chemistry by I. L Finar, (Vol. I & II) ELBS.
6. Advanced Organic Chemistry by A Bahl. & B. S Bahl., S. Chand.
7. Organic Chemistry by C. N Pillai., Oxford University Press.
8. Modera Organic Chemistry by M. K Jain & S.C. Sharma, Vishal Publishing Co.
9. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure by J March, & M. B Smith Wiley.

10. Stereochemistry of Organic Compounds by V. K. Ahluwalia, Springer.
11. Heterocyclic Chemistry – Third Edition by Thomas L. Gilchrist, Pearson.
12. Fundamentals of Molecular Spectroscopy by C. N. Banwell, Campus Book House.
13. Spectrometric Identification of Organic Compounds by Robert Silverstein, Wiley.
14. Fundamentals of Molecular Spectroscopy by P. S. Sindhu, New Age International.
15. Introduction to Spectroscopy – Fifth Edition by Pavia, Lampman, Kriz & Vyvyan Cengage India Private Limited.
16. Modern Spectroscopy – Fourth Edition by J. Michael Hollas, John Wiley & Sons.\
17. Spectroscopy by B. K. Sharma, Goel Publishing House.
18. An Introduction to Electrochemistry by Samuel Glasstone, BSC Publishers.
19. Electrochemistry and its Applications by G. Whitmore, Sarup & Sons.
20. Physical Chemistry by G.M Barrow, Tata McGraw-Hill.
21. Fundamentals of Electrochemistry by Morris Sylvin, Sarup & Sons.
22. Solutions, Phase Equilibrium, Conductance & Electrochemistry by Puri, Sharma, Pathania and Kaur, Vishal Publishing Co.

Suggested E-resources: All the above suggested books are available as **e- books.**

Online Lecture Notes and Course Materials:

All prescribed syllabus is available digitally in the form of e-books, Adobe Acrobat documents (PDF), web page ,etc.

IV– Semester – Chemistry

Syllabus

CHM-64T-215-4 Hrs./week **Water Analysis, Chromatography, Conductometric, Potentiometric and Spectrophotometric Titrations, Nephelometry, Atomic Absorption spectrometry and Atomic Emission Spectrography.**

Unit-I

Water Analysis

Water pollutants and their analysis: Water analysis, analysis of water for dissolved oxygen, B.O.D. and C.O.D. Biological treatment methods. Prevention of water pollution by treatment of industrial wastes with special reference to cement, fertilizer and dyeing industries.

Air pollution: General consideration types of air pollutants, unit of measurement, sampling monitoring and analysis of CO and SO_2 in atmosphere, effect of air pollutants on plants and human health, method for pollution control, especially for pollution by automobiles.

15 Lecture

Unit-II

Chromatography: Principles of absorption and partition chromatography, techniques and application of column, paper and thin layer chromatography. Electrophoresis and its applications in separation of amino acids.

Ion exchange methods: General discussion, action of ion exchange resins, column operation, experimental techniques, types of ion exchange resins, determination of the following pairs by ion exchange techniques: (a) chloride and bromide (b) nickel and cobalt.

15 Lecture

Unit-III

Conductometric titrations: The basis of conductometric titrations. Apparatus and measurement, application of conductometric titrations. High frequency titrations, advantages of the techniques, some examples of high frequency titrations.

Potentiometric titrations: Introduction, electrodes, instrumentation, potentiometric titrations, differential

Potentiometric titrations, automatic potentiometric titrations, location of end points, determination of some metals through potentiometric titrations.

15 Lecture

Unit-IV

Spectrophotometric titrations: Basic principle. instrumentation experimental techniques, spectrophotometric analysis of Fe (III), Co (I), Ni (II), Fe (II) in presence of Al (III) with EDTA.
Nephelometry & Turbidimetry: General discussion, instrumentation, some nephelometry determination (a) sulphate (b) phosphate

Flame Emission and Atomic Absorption Spectrometry: Basic principle, instrumentation. Nebulization, flames and flame temperatures, interferences, flame spectrometric techniques.
Atomic Emission Spectrography: Spectroscopic sources, instruments for emission spectrographic analysis, qualitative and quantitative spectrographic analysis. Qualitative spectrographic analysis of a non-ferrous alloy and complex organic mixture.

15 Lecture

Suggested Books and References:

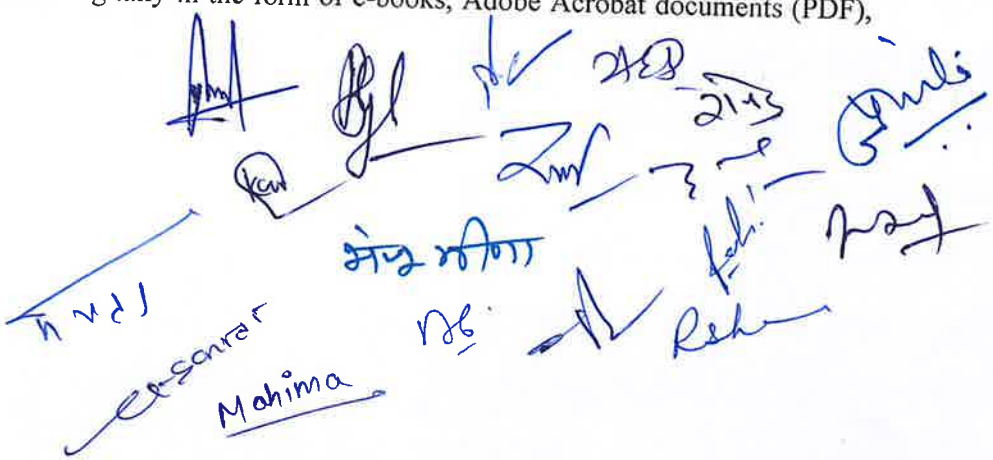
1. Instrumental Methods of Chemical analysis (Analytical Chemistry), Chatwal, R Gurdeep, S Anand, Himalaya Publishing House.
2. Analytical Chemistry Chatwal, R. Gurdeep, Himalaya Publishing House.
3. Skoog and West's Fundamentals of Analytical Chemistry by M. Donald, A Douglas, F. Holler James, F. West et al, 2022, Cengage Learning India Pvt. Ltd.
4. Basic Concepts of Analytical Chemistry – Fourth Edition by S. M. Khopkar, New Age International Publisher.
5. Instrumental Methods of Chemical Analysis (Analytical Chemistry) by B. K. Sharma, Goel Publishing House.
6. Environmental Chemistry by A. K. De, New Age International Publisher.
7. Fundamental Concepts of Environmental Chemistry by G. S. Sodhi, Narosa Publishing House.

Suggested E-resources:

All the above suggested books are available as **e- books.**

Online Lecture Notes and Course Materials:

All prescribed syllabus is available digitally in the form of e-books, Adobe Acrobat documents (PDF), web page ,e



Syllabus

Semester-IV (Chemistry)

CHM-64P-216: **Practical lab** **4 Hrs./week**

Inorganic Chemistry **20 marks**

Ex. 1 **Qualitative analysis** of mixture containing six radicals one of which should be a rare earth metalion. The mixture may contain radicals of any combination including interfering acid radicals and insoluble.

Ex. 2 **Quantitative analysis:** Estimation of *any three* of the following mixtures by volumetric and gravimetric methods.

a) Copper-Zinc
b) Zinc-Nickel
c) Copper-Nickel

Organic Chemistry **20 marks**

Ex. 3. **Quantitative Estimations**

(a) Determination of neutralization equivalent of an organic acid.
(b) Determination of Saponification value of an ester/oil.
(c) Determination of iodine value of an oil to measure unsaturation.
(d) Estimation of glucose by titration with Fehling's solution/ Benedict solution.

Physical Chemistry **20 marks**

A) Conductometry:

a) To find out the strength of strong acid by titrating it against strong alkali.
b) To find out the strength of weak acid by titrating it against a strong alkali.
a) To find out the strength of hydrochloric acid and acetic acid in a mixture of both, by titrating it against sodium hydroxide.
b) Determination of equivalent conductivity of an electrolyte at different dilutions.

B) Spectrophotometery or Colourimetry:

a) Verify Lambert Beer Law & determine the concentration of the given aqueous solution of unknownconcentration of salt ($KMnO_4$, $CuSO_4$, $K_2Cr_2O_7$)

C) pH metric titrations:

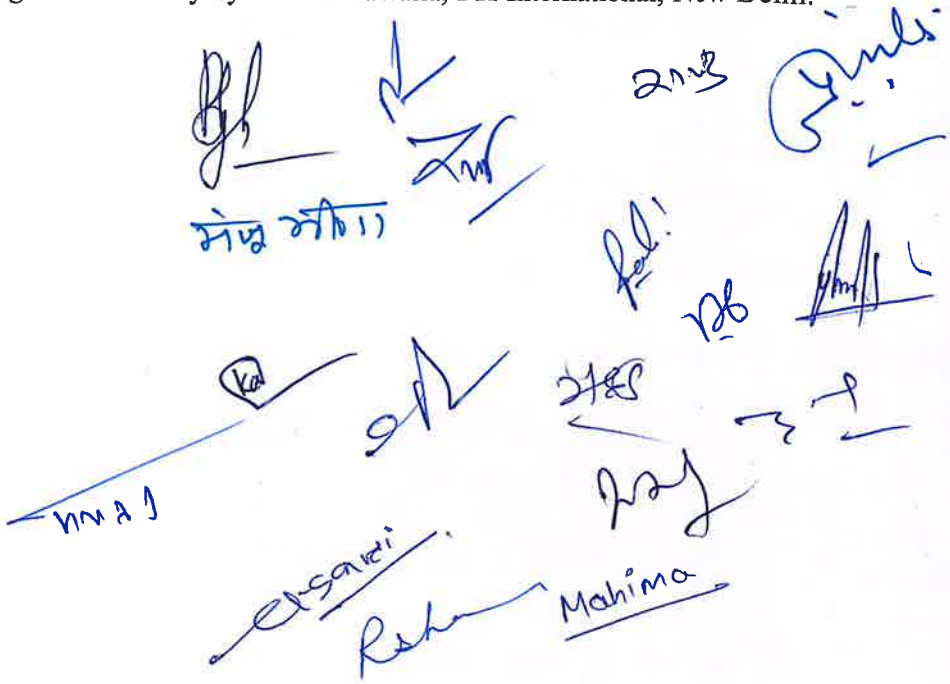
a) To find out the strength of strong acid by titrating it against strong base.
b) To find out the strength of strong acid by titrating it against weak base.
c) To find out the strength of weak acid by titrating it against strong base.
d) Find out the strength of HCl and CH_3COOH in a mixture of both by titrating it against NaOH.

D) Determination of DO, COD and BOD of different water samples.

Viva voce	**10 marks**
Practical Record	**10 marks**

Suggested Books and References:

1. Advanced Practical Physical Chemistry J. B. Yadav, Goel Publishing House.
2. Practical Physical Chemistry B. D Khosla, S. Chand & Company.
3. Advanced Practical Organic Chemistry by N K Vishnoi, Vikas Publishing House PVT LTD
4. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K Ahluwalia. Universities Press, Hyderabad.
5. Advanced Practical Organic Chemistry by N K Vishnoi, Vikas Publishing House PVT LTD
6. Vogel's Qualitative Inorganic Analysis, A. I. Vogel Prentice Hall.
7. Vogel's Textbook of Quantitative Chemical Analysis, A. I. Vogel, Pearson Education Ltd.
8. Laboratory Techniques in Organic Chemistry by V. K Ahluwalia, I K International, New Delhi.



Syllabus

[UG0102-Three/Four Year Bachelor of Science (Maths Group)] - [UG0102-MAT-63T-201] - [Real Analysis-I & Differential Equations-I]

III-Semester - [Mathematics]

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0102-MAT-63T-201 Real Analysis-I & Differential Equations-I	1 Hrs-CA 3 Hrs-EoSE	20 Marks-CA 80 Marks-EoSE	08 Marks-CA 32 Marks-EoSE

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	UG0102-MAT-63T-201	Real Analysis-I & Differential Equations-I			6	4
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	UG	4	0	4	Lecture, Sixty Lectures	
List of Programme Codes in which Offered as Minor Discipline						
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The primary objective of this course is to introduce the real line with algebraic, order,completeness properties, and convergence/ divergence of sequences. The course also provides the types of ordinary differential equations and their solution strategies.				

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04/10

Sita Meena

04/10/2024

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Detailed Syllabus

[UG0102-MAT-63T-201] - [Real Analysis-I & Differential Equations-I]

Unit - I

Bounded set, Neighbourhood, Limit point, Bolzano-Weierstrass theorem, closed and Open sets. Concept of compactness and connectedness. Heine-Borel theorem.

(15 Lectures)

Unit - II

Real sequences- Limit and Convergence of a sequence, Monotonic sequences. Cauchy's sequences, Subsequences, Cauchy's general principle of convergence. Continuous functions: Properties of continuous functions on closed intervals.

(15 Lectures)

Unit -III

Exact differential equations and equations which can be made exact. First order but higher degree differential equations solvable for x,y and p. Linear differential equations with constant coefficients, Complementary function and Particular integral.

(15 Lectures)

Unit-IV

Homogeneous linear differential equations, Linear differential equations of second order. Solution by transformation of the equation by changing the dependent variable/the independent variable, Method of variation of parameters, Method of undetermined coefficients.

(15 Lectures)

Suggested Books and References –

1. Royden H, Fitzpatrick PM. Real analysis. China Machine Press; 2010.
2. Rudin W. Principles of mathematical analysis. New York: McGraw-hill; 1964.
3. Bartle RG, Sherbert DR. Introduction to real analysis. New York: Wiley; 2000.
4. Mapa SK. Introduction to Real Analysis. Sarat Book Distributors; 2014.
5. Malik SC, Arora S. Mathematical analysis. New Age International; 1992.
6. Ross SL, Differential Equation-Jhon Wiley & Sons. Inc. New York. 1984.
7. Raisinghania MD, Ordinary and partial differential equations. S. Chand Publishing; 2013.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Apply Bolzano-Weierstrass and Heine-Borel theorems to real number sets.
2. Test sequence convergence using Cauchy's principle and analyse continuous functions on closed intervals.
3. Solve first-order and higher-degree differential equations and linear differential equations with constant coefficients.
4. Solve second-order linear differential equations using transformation techniques and assess linear independence of solutions.

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Syllabus

[UG0102-Three/Four Year Bachelor of Science (Maths Group)] - [UG0102-MAT-63P-202] - [Introduction to Scilab: A Mathematical Tool]

III-Semester - [Mathematics]

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Practical	UG0102-MAT-63P-202 Introduction to Scilab: A Mathematical Tool	2 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	04 Marks-CA 16 Marks-EoSE

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	UG0102-MAT-63P-202	Introduction to Scilab: A Mathematical Tool			6	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	UG	0	2	2	Practical, Sixty Hours of Practical	
List of Programme Codes in which Offered as Minor Discipline						
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objective of the course is to equip students with skills to create, analyze, and understand graphs. To teach the use of computational and programming functions within Scilab. To understand and apply methods for solving linear equations and other mathematical problems.				

साक्षी गुप्ता

04/10

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4/10/2024

Detailed Syllabus

[UG0102-MAT-63P-202] - [Introduction to Scilab: A Mathematical Tool]

Group-A

1. Plotting the graphs of the following functions : ax, $\sqrt{(ax+b)}$, $|ax+b|$, $c \pm |ax+b|$, $x^{\pm n}$, e^{ax+b}, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|\sin(ax+b)|$, $|\cos(ax+b)|$. explaining the effects of change in the real constant a, b and c on graphs. Plotting graphs of hyperbolic functions and inverse trigonometric functions, plotting and analyzing the graphs of polynomials and their derivatives.
2. Complex numbers: Operations like addition, subtraction, multiplication, division, Modulus and inbuilt functions conj., imag, imult, isreal, real.

(20 Hours)

Group-B

1. Matrix operations: addition, multiplication, inverse, transpose, determinant, rank and inbuilt functions eye, ones, zeros. olving the system of linear equations by using Matrix Division (\ Operator), using 'linsolve' function, using 'inv' function, using 'mldivide' function.
2. Finding Roots of equations by using 'fsolve' function, using 'roots' function, using 'mnewton' function.

(20 Hours)

Group-C

1. Solving linear programming problems by using inbuilt functions of Scilab.
2. Solving Ordinary Differential Equations (ODEs) by using the 'ode' function.

(20 Hours)

Suggested Books and References –

1. Sandeep Nagar, Introduction to Scilab: For Engineers and Scientists, APress; 1st ed. Edition.
2. Claude Gomez, Engineering and Scientific Computing with Scilab, Birkhauser Boston Inc; 1999th edition.
3. Tejas Sheth, Scilab: A Practical Introduction to Programming and Problem Solving, Createspace Independent Pub.

Suggested E-resources:

1. Online Lecture Notes and Course Materials

Course Learning Outcomes: By the end of the course, students should be able to:

1. Students should be prepared to utilize various mathematical techniques to solve different mathematical problems.
2. Students should gain practical expertise in solving problems involving graphs, matrices, and equations.
3. Understand graphical and numerical techniques and be able to apply them using Scilab.

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04/10

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4/10/2024

Syllabus

[UG0102-Three/Four Year Bachelor of Science (Maths Group)] - [UG0102-MAT-64T-203] - [Real Analysis-II & Numerical Analysis]

IV-Semester - [Mathematics]

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Theory	UG0102-MAT-64T-203 Real Analysis-II & Numerical Analysis	1 Hrs-CA 3 Hrs-EoSE	20 Marks-CA 80 Marks-EoSE	08 Marks-CA 32 Marks-EoSE

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	UG0102-MAT-64T-203	Real Analysis-II & Numerical Analysis			6	4
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	UG	4	0	4	Lecture, Sixty Lectures	
List of Programme Codes in which Offered as Minor Discipline						
Prerequisites		UG0102-MAT-63T-201 Real Analysis-I & Differential Equations-I				
Objectives of the Course:		The primary objective of this course is to enable students to understand fundamental concepts of differentiable functions, apply Darboux's, Rolle's theorems, Riemann integration, mean value theorems, and to learn numerical techniques viz. Interpolation, Numerical integration, roots of equation, solution of initial value problem.				

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Detailed Syllabus

[UG0102-MAT-64T-203] - [Real Analysis-II & Numerical Analysis]

Unit - I

Properties of derivable functions, Darboux's and Rolle's theorem. Notion of limit, continuity and differentiability for functions of two variables. Directional derivative, total derivative, expression of total derivative in terms of partial derivatives.

(15 Lectures)

Unit - II

Riemann integration – Lower and Upper Riemann integrals, Riemann integrability, Mean value theorems of integral calculus, Fundamental theorem of integral calculus. Functions of bounded variations.

(15 Lectures)

Unit -III

Differences. Relation between differences and derivatives. Differences of a polynomial. Newton's formulae for forward and backward interpolation. Divided differences. Newton's divided difference, Lagrange's interpolation formula. Numerical Differentiation. Derivatives from interpolation formulae.

(15 Lectures)

Unit-IV

Numerical integration, Derivations of general quadrature formulas, Trapezoidal rule. Simpson's one-third, Simpson's three-eighth and Gauss's quadrature formulae. Numerical solution of Algebraic and Transcendental equations: Bisection method, secant method, Regula-Falsi method, Iteration method, Newton- Raphson Method. Numerical solutions of ordinary differential equations of first order with initial conditions using Euler and modified Euler's method.

(15 Lectures)

Suggested Books and References –

1. Royden H, Fitzpatrick PM. Real analysis. China Machine Press; 2010.
2. Rudin W. Principles of mathematical analysis. New York: McGraw-hill; 1964.
3. Bartle RG, Sherbert DR. Introduction to real analysis. New York: Wiley; 2000.
4. Mapa SK. Introduction to Real Analysis. Sarat Book Distributors; 2014.
5. Malik SC, Arora S. Mathematical analysis. New Age International; 1992.
6. Burden RL, Faires JD. Numerical analysis, brooks;1997.
7. Iyengar SR, Jain RK. Numerical Methods. New Age International; 2009.
8. Sastry SS. Introductory methods of numerical analysis. PHI Learning Pvt. Ltd.; 2012.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Analyse multivariable functions using differentiability and partial derivatives.
2. Solve problems using Riemann integrability and integral calculus theorems.
3. Use interpolation formulas for data approximation and numerical differentiation.
4. Apply numerical methods to solve equations and differential equations.

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Syllabus

[UG0102-Three/Four Year Bachelor of Science (Maths Group)] - [UG0102-MAT-64P-204] - [Introduction to C Programming: As Mathematical Tool]

IV-Semester - [Mathematics]

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Passing Marks (CA + EoSE)
Practical	UG0102-MAT-64P-204 Introduction to C Programming: As Mathematical Tool	2 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	04 Marks-CA 16 Marks-EoSE

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	UG0102-MAT-64P-204	Introduction to C Programming: As Mathematical Tool			6	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	UG	0	2	2	Practical, Sixty Hours of Practical	
List of Programme Codes in which Offered as Minor Discipline						
Prerequisites		Mathematics course of XII std. of Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objective of the course is to enable students learn the basic knowledge of developing algorithms for various Mathematical problems and preparing codes for these algorithms in C language.				

04/10

Sita Meena

साक्षी गुप्ता

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4/10/2024

Detailed Syllabus

[UG0102-MAT-64P-204] - [Introduction to C Programming: As Mathematical Tool]

Programming languages and problem solving on computers, Algorithm, Flow chart, Programming in C-Constants, Variables, Arithmetic and logical expressions, Input-Output, Conditional statements, Implementing loops in Programs, Defining and manipulating arrays and functions.

Group-A

1. Printing n terms of Fibonacci sequence and finding factorial n, summation n, summation of square of n etc.
2. Defining a function and finding sum of n terms of a series/sequence whose general term is given.
3. Finding gcd and lcm of two numbers by Euclid's algorithm.
4. Checking prime/composite numbers and finding the number of primes less than n, where n is a positive integer.
5. Finding mean, standard deviation and Permutation, Combination.

(20 Hours)

Group-B

6. Numerical integration using Trapezoidal rule.
7. Numerical integration using Simpson's ⅓ rule.
8. Numerical integration using Simpson's 3/8 rule.
9. Numerical integration using Waddle rules.
10. Preparing forward and backward difference tables.

(20 Hours)

Group-C

11. Solution of algebraic and transcendental equations by Bisection method.
12. Solution of algebraic and transcendental equations by Regula-falsi method.
13. Solution of algebraic and transcendental equations by Newton-Raphson method.
14. Solution of Initial value problems by Euler's method.
15. Solution of Initial value problems by Runga-Kutta fourth order method.

(20 Hours)

Suggested Books and References –

1. B. W. Kernighan and D. M. Ritchi : The C-Programming Language, 2nd Edi.(ANSI Refresher), Prentice Hall, 1977.
2. E. Balagurnsamy : Programming in ANSI C, Tata McGraw Hill, 2004.
3. Y. Kanetkar : Let Us C ; BPB Publication, 1999.
4. C. Xavier : C-Language and Numerical Methods, New Age International, 2007.
5. V. Rajaraman : Computer Oriented Numerical Methods, Prentice Hall of India, 1980.

Suggested E-resources:

1. **Online Lecture Notes and Course Materials:**

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Syllabus

Semester-III

Optics

Semester	Code of the Course	Title of the Course/Paper	NHEQF Level	Credits
III	UG0102, PHY-63T-201	Optics	6	4
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	Major/Minor	Lecture, Sixty Lectures (4 hours in week) including diagnostic and formative assessments during lecture Hours.		
Prerequisites	Physics and Mathematics courses of Central Board of Secondary Education or Equivalent.			
Objectives of the Course:	The student will get an introduction to the discipline of optics and its role in daily life. They will learn basic knowledge of interference, diffraction, polarization, LASER, HOLOGRAPHY and FIBRE OPTICS for future research purposes.			

Unit I

Interference: Concept of Spatial and temporal coherence, coherence length, coherence time, Definition and propagation of wave front, Huygens principle of secondary wavelets, Young's Double Slit Experiment, Types of fringes, Interference by division of wave front: Fresnel's Bi-Prism, Measurement of wavelength and thickness of a thin transparent sheet. Interference by division of amplitude– Thin films (parallel and wedge-shaped films), Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer, the shape of fringes, the Measurement of wavelength, the difference between two spectral lines, and the thickness of a thin transparent sheet. **(15 Lectures)**

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Unit II

Diffraction: Fraunhofer diffraction: Single slit; double slit. Multiple slits, missing order, Diffraction grating, Resolving power of grating, Rayleigh's criterion of resolution.

Fresnel Diffraction: Half-period zones. Zone plate. Multiple Foci of zone plate, comparison between zone plate and convex lens, Fresnel Diffraction pattern at a circular aperture, straight edge, and a rectangular slit using half-period zone analysis. **(15 Lectures)**

Unit III

Polarization: Polarization (i) Plane polarized light (ii) Circularly polarized light (iii) Elliptically polarized light, Production of plane-polarized light (i) by reflection (ii) by refraction (iii) by double refraction, and (iv) by dichroism (Polaroid), Brewster's law, Law of Malus, Huygens' wave theory of double refraction, Analysis of Polarized light: Nicol prism, Quarter wave plate, and half-wave plate, Optical activity, Laws of optical activity, and Fresnel's explanation of optical activity; Specific rotation, Polarimeters: Laurent's half shade Polarimeter and Biquartz Polarimeter. **(15 Lectures)**

Unit IV

Quantum Optics and photonics

(i) **Laser:** Spontaneous and stimulated emission, Einstein's A & B coefficients, population inversion, methods of optical pumping. Ruby, He-Ne, and Semiconductor laser (Principle and working).

(ii) **Holography:** Principle of holography, Theory of construction and reconstruction of image, applications of holography.

(iii) **Fiber Optics:** Introduction to optical fiber, types of optical fiber, Total internal reflection, Explanation of propagation of light through an optical fiber

(15 Lectures)

REFERENCES:

1. F.A. Jenkins and H.E. White, Fundamentals of Optics, Tata McGraw Hill.
2. Brij Lal and N. Subrahmaniyam, Optics, S. Chand.
3. E.Hecht, Optics, Pearson.
4. A.K.Ghatak, Optics, Tata Mc Graw Hill.

Course outcomes:

1. The student will get an introduction to the discipline of optics and its role in daily life.
2. The optics course will give the student a basic knowledge of interference, diffraction, and polarization.
3. The student will be able to analyze and calculate interference between light waves and application of the theory to various interferometers along with their practical applications.
4. The student would know the conditions for near and far-field diffraction and be able to calculate the far-field diffraction from gratings and simple aperture functions.
5. The student would understand how the polarization of light changes at reflection and transmission at interfaces.
6. The students are able to understand theory of LASER, HOLOGRAPHY and FIBRE OPTICS for future research purpose.

Syllabus

Physics Lab-III

Semester	Code of the Course	Title of the Course/Paper	NHEQF Level	Credits
III	UG0102,PHY-63P-202	Physics Lab-III	6	2
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	Major/Minor	Practical, Sixty hours of practical including diagnostic and formative assessment during practical hours.		
Prerequisites	Physics and Mathematics courses of Central Board of Secondary Education or Equivalent.			
Objectives of the Course:	1. Ability to find the formation of Newton ring and calculate the wavelength of monochromatic source. 2. Develop an understanding of light dispersion through prisms 3. Proficiency in analyzing and calculating the wavelength of light by grating. 4. Learn to determine the thermal conductivity of band teeth. 5. Develop skills in designing and analyzing the value of inductance by Anderson Bridge. 6. Understand the principle of wavefront division and also learn how to determine the wavelength of sodium light by biprism. 7. Students learn about the sensitivity ballistic galvanometer and determine the value of ballistic constant			

Exam Scheme-

Students will have to perform one practical in the exam. The duration of practical exam will be 4 hours.

Marks distribution

Student category	Experiments	Viva-voice	Record	Maximum marks

Regular Student	20	10	10	40

Marking distribution in practical

Student category	Theory/formula	Figure/circuit	Observation	Calculation	Results/Error	Precautions
Regular	3	2	6	5	3	1

Practical lists-

1. Find the wavelength of the monochromatic source using the Newton ring method and find the refractive index of the liquid.
2. Determine the dispersive power of prism.
3. Determine the wavelength of sodium light using grating.
4. Study the light properties using a fiber optics trainer kit.
5. Measure the induction by the Anderson bridge coil.
6. Determine the wavelength of sodium light using bi-prism.
7. Calculate the ballistic constant of the ballistic galvanometer.
8. Find high resistance by the leakage method.
9. Study the coherent source and coherent time using a diode laser.
10. To study the preparation of air film using the air wedge method.
11. To study the resolving power of prism.
12. To study the resolving power of grating.
13. To study the Rydberg constant by using grating.

Suggested Books and References –

1. Practical Optics, by S. Naftali Men. First Edition (ISBN 13:978-0124909519)

Suggested e-Resources:

http://msbahae.um.edu, University of New Mexico.

Course Learning Outcomes

1. Ability to find the formation of Newton ring and calculate the wavelength of monochromatic source.
2. Develop an understanding of light dispersion through prisms.
3. Proficiency in analyzing and calculating the wavelength of light by grating.
4. Develop skills in designing and analyzing the value of inductance by Anderson Bridge.
5. Understand the principle of wave front division and also learn how to determine the wavelength of sodium light by biprism.
6. Students learn about the sensitivity ballistic galvanometer and determine the value of a ballistic constant.

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Syllabus

Semester-IV

Thermodynamics & Statistical Physics

Semester	Code of the Course	Title of the Course/Paper	NHEQF Level	Credits
IV	UG0102,PHY-64T-203	Thermodynamics & Statistical Physics	6	4
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	Major/Minor	Lecture, Sixty Lectures including diagnostic and Formative assessments during lecture hours.		
Prerequisites	Physics and Mathematics courses of Central Board of Secondary Education or Equivalent.			
Objectives of the Course:	By this course, students will have developed a strong understanding of thermal and statistical physics. They will be able to apply the principles and concepts learned to analyze and solve problems related to thermodynamic systems, phase transitions, transport phenomena, low-temperature production, and quantum statistics. Additionally, they will be able to interpret and explain various phenomena and behaviors of macroscopic and microscopic systems using the principles of thermodynamics and statistical mechanics.			

Unit I

Thermal and adiabatic interactions: Thermal interaction, Zeroth law of thermodynamics, systems in thermal contact with a heat reservoir (canonical distribution), Energy Fluctuations, Entropy of a system, Helmholtz free energy, Adiabatic interaction and enthalpy, General interaction and first of thermodynamics, Infinitesimal general interaction, Gibb's free energy, Phase transitions, Triple point, First and second-order phase transition, Clausius-Clapeyron equation, Vapour-pressure curve, transformation of disorder into order, Heat engine and efficiency of engine, Carnot's Cycle; Thermodynamic scale as an absolute scale, Maxwell relations and their applications. **(15 Lectures)**

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Unit II

Kinetic Theory: Derivation of Maxwell's law of distribution of velocities and its experimental verification, most probable, average and RMS velocities, Diffusion, Equipartition Theorem, Classical theory of Specific heat capacity, the specific heat of solid (Explanation on the basis of Einstein and Debye Theory.

Transport Phenomenon: Mean free path, Distribution of free path, Coefficients of viscosity, thermal conductivity and diffusion, Brownian motion, Langevin's and Einstein's theories, Experimental determination of Avogadro number. **(15 Lectures)**

Unit III

Production of low temperatures: Cooling by Adiabatic expansion, Coefficient of performance, Joule Thomson effect, J-T coefficient for ideal as well as-Vander Waal's gases, porous plug experiment, Temperature of inversion, Regenerative cooling, Air Liquefiers. Adiabatic demagnetization of paramagnetic substances: Nuclear Para-magnetism, Liquid He I and He II, Superfluidity, Quest for absolute zero, Third law of thermodynamics and Nernst Heat Theorem. **(15 Lectures)**

Unit IV

Quantum Statistics: Introduction to Phase space, Micro and Macro states, Thermodynamic probability, Entropy and probability, Bose-Einstein and Fermi-Dirac distribution laws, Calculation of the thermodynamic functions of weak degenerate gas, Strong degeneration, Calculation of the thermodynamic functions of an ideal Bose gas, Derivation of Plank law, Flux of radiation energy, radiation pressure, thermodynamic functions of an ideal Fermi electron gas, Free electron model for metals, Spectra of metals, Richardson's equation of thermionic emission, Relativistic fermi gas, White dwarf stars, Chandrasekhar mass limit.

(15 Lectures)

Suggested Books and References -

1. Kittle-Thermal Physics.
2. Berkeley Series, Vol. V, Statistical Physics
3. Reif-Thermodynamics and Statistical Physics.
4. Lokanathan and Khandelwal Thermodynamics and Statistical Physics.
5. Sears Thermodynamics, Kinetic Theory of Gases and Statistical Physics.

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Suggested E-sources:

1. MIT Open Course Ware: Statistical Mechanics 1: Statistical Mechanics of Particles- This resource offers lecture notes, assignments, and exams for a complete course on Statistical Mechanics-I,https://ocw.mit.edu/courses/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/pages/syllabus/

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand the concepts of thermal interactions and the law of thermodynamics.
2. Calculation of the entropy of a system and analyze the Helmholtz free energy.
3. Study infinitesimal general interactions and Gibb's free energy.
4. Explore phase transitions, including first and second-order phase transitions. Understand the Clausius-Clapeyron equation and the vapour pressure curve.
5. Learn about the thermodynamic scale as an absolute scale and apply Maxwell relations.
6. Explore the classical theory of specific heat capacity and analyze the specific heat of solids.
7. Study the production of low temperatures and cooling by adiabatic expansion.
8. Explore regenerative cooling and air liquefiers.
9. Understand adiabatic demagnetization of paramagnetic substances and the properties of liquid He 1 and He II, including super-fluidity.
10. Study phase space, microstates, macrostates, thermodynamic probability, and entropy. Learn about quantum statistics, including Bose-Einstein and Fermi-Dirac distribution laws.
11. Analyze the behavior of an ideal Bose gas.
12. Understand the free electron model for metals, the spectrum of metals, relativistic Fermi gas, and the Chandrasekhar mass limit for white dwarf stars.

    By the end of this course, students will have developed a strong understanding of thermal and statistical physics. They will be able to apply the principles and concepts learned to analyze and solve problems related to thermodynamic systems, phase transitions, transport phenomena, low- temperature production, and quantum statistics. Additionally, they will be able to interpret and explain various phenomena and behaviors of macroscopic and microscopic systems using the principles of thermodynamics and statistical mechanics.

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Syllabus

Physics Lab-IV

Semester	Code of the Course	Title of the Course / Paper	NHEQF Level	Credits
IV	**UG0102,PHY-64P-204**	**Physics Lab –IV**	**6**	**2**
Level of Course	Type of Course	Delivery of the Course		
Introductory	Major	Lecture, Sixty Lectures(4 hour in a week) including diagnostic and formative assessment during lecture hours.		
Prerequisites	Practical, sixty hours (4 hours in a week) of practical including diagnostic and formative assessment during practical hours			
Objectives of the Course	To provide hands-on experience in conducting experiments related to Thermal and statistical Physics. To develop practical skills in using various experimental components and instruments. To reinforce theoretical concepts learned in the corresponding lecture course through practical applications. To enhance problem-solving and analytical skills by analyzing experimental data and interpreting results. To promote scientific inquiry, critical thinking, and the ability to design and execute experiments. To foster teamwork and collaboration in conducting experiments and analyzing results. To develop skills in accurately measuring and recording Experimental data.			

The colleges are free to set new experiments of equivalent standards. This should be intimated and approved by the Convener, Board of Studies before the start of the academic session. It is

binding on the college to have an experimental set-up of at least ten experiments listed below. In case the number of experiments performed by the student is less than eight, his marks shall be scaled down in the final examination on a pro-rata basis. Laboratory examination paper will be set by the external examiner out of eight or more experiments available at the centre

Exam Scheme-

Students will have to perform one practical in the exam. The duration of practical exam will be 4 hours.

Marks distribution

Student category	Experiments	Viva-voice	Record	Maximum marks
Regular Student	20	10	10	40

Marking distribution in practical

Student category	Theory/formula	Figure/circuit	Observation	Calculation	Results/Error	Precautions
Regular	3	2	6	5	3	1

List of Experiments -

1. To find out the melting-point of a given substance using platinum resistance thermometer.
2. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer
3. To determine the Specific Heat of a Liquid using a Calorimeter.
4. Determination of Specific Heat Capacity of a Liquid using the Method of Cooling.
5. To Study the Variation of Thermo-emf with Temperature.
6. Determination of the Coefficient of Thermal Conductivity of a Bad Conductor by Lee and Charlton's Disc Method.
7. Determination of the Coefficient of Thermal Conductivity of Copper by Searle's Apparatus.

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8. Determination of Stefan's Constant using Black Body Radiation.
9. Determination of Planck's constant.
10. To Study the Linear expansion of different solid samples.
11. Determination of Thermal conductivity by Armstrong method.
12. Study of Phase Transitions and Interpretation of Cooling Curves.
13. To study the blackbody spectrum of light intensity for a light bulb.
14. Experimental Determination of γ using Clement and Desormes Method
15. Study of variation of total thermal radiation with temperature.
16. To investigate the rate of thermal conduction through some common materials.
17. Determine the specific heat capacity of the given solid by Ice Calorimetry
18. Plot thermo emf versus temperature graph and find the neutral temperature (Use sand bath).

Suggested Books and Reference-

Suggested E-resources:

http://egyankosh.ac.in//handle/123456789/67451

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Demonstrate proficiency in using various thermodynamically components and instruments required for conducting experiments.
2. Apply theoretical concepts of thermodynamics and statistical dynamics to design and execute experiments.
3. Analyze experimental data using appropriate mathematical and statistical techniques.
4. Interpret experimental results and draw conclusions based on data analysis.
5. Develop skills in accurately measuring physical quantities and recording experimental observations.
6. Communicate experimental procedures, results, and conclusions effectively in written reports.

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Syllabus

UG0101 -ZOO-63T-201- Economic Zoology & Ethology

UG0101 -ZOO-63P-202- Practicals based on Economic Zoology & Ethology

III SEMESTER -Zoology

Objectives of theCourse:

- Gain knowledge about silkworms rearing and their products; Bee keeping equipment and apiary management.
- Acquaint knowledge on dairy animal management, the breeds, and diseases of cattle and learn the testing milk quality.
- Acquaint knowledge about the culture techniques of fish, prawn and poultry
- Acquaint the knowledge about basic procedure and methodology of Vermiculture. Learn various concepts of lac cultivation.
- Learn the various pests and diseases and their management strategies
- Students can start their own business i.e. self- employments. and Get employment in different applied sectors
- To equip learners with a sound knowledge of how animals interact with one another and their environment.
- To enable the learners to understand different behavioral patterns.

Detailed Syllabus Semester III

ZOO-63T-201: Economic Zoology & EthologyUNIT I

Sericulture: Silkworm species, host plants, types of silk, economic importance ofsilk, Moriculture: life cycle of mulberry silkworm, silk production, processing of silk, associated enemies, diseases and their management. **4 Hrs**

Lac culture: Life cycle of lac insect, general practices and management of lac cultivation, processing of lac, composition, properties and products of lac, associated enemies, diseases and their management. **4 Hrs**

Apiculture: Species of domesticated honey bee, life cycle of honeybees, indigenous and artificial bee hives, management of beekeeping, by-products, associated enemies, diseases and their management, apiculture and apiary in India. **4 Hrs**

Prawn culture: Culturable species, prawn hatcheries, culture practices, products and maintenance of culture, associated diseases and their management. **3 Hrs**

UNIT II

Vermiculture and Vermicomposting: Suitable and non-suitable species, conventional and commercial vermiculture (small- and large-scale vermicomposting), harvesting, processing, problems related to vermicomposting **4 Hrs**

Pearl culture and industry: Pearl producing molluscs, pearl formation, harvesting,properties and composition of pearls. **3 Hrs**

Pisciculture: Culturable species, edible fishes, seed production, hatcheries, feeding offishes, by-products of fish culture, associated diseases and their management. **4 Hrs**

Poultry keeping: Indigenous and exotic breeds of poultry, housing system of poultry,common poultry management practices, associated diseases and their management. **4 Hrs**

UNIT III

Protozoan diseases: Malaria, African sleeping sickness, amoebic dysentery, Leishmaniasis **3 Hrs**

Helminth diseases: Outline of diseases caused by Platyhelminthes and Aschelminthes **3 Hrs**

Arthropod-borne diseases: Tick-borne diseases, Mite infestation, Insect-bornediseases. **4 Hrs**

Pest and their management: agricultural pests, stored grain pests, household pests,Integrated pest management **5 Hrs**

UNIT IV

Ethology: Introduction and history of Ethology Brain and behaviour, Limbic system and Hypothalamus. **3 Hrs**

Concepts of ethology: Fixed action pattern, sign stimulus, innate releasing mechanism, action specific energy,motivation, imprinting and learning. **4 Hrs**

Communication: auditory, tactile, visual and chemical; Societies: Characteristics and advantage with special reference to honey bee and monkeys. **4 Hrs**

Biological clocks and animal behaviour: Biological rhythms and biological clocks.Methods of studying animal behaviour. **4 Hrs**

Suggested Books and References:

1. Economic Zoology, Biostatistics and Animal behaviour, S. Mathur, 2009, Deepand Deep Publicatons.
2. Economic Zoology, Shukla G.S. & Upadhyay V.B., 2017, Rastogi Publications.
3. Vermicomposting for sustainable agriculture, Gupta P. K, 2003, Agrobios India
4. A hand book of economic zoology, Ashan J. and Sinha S.P, 2010, S. Chand andCompany
5. Perspectives in Indian Apiculture, Mishra R. C., 1999, Allied scientific publ.Bikaner India
6. A Textbook of Applied Entomology, Srivastava, K. P., 1988., Publ. KalyaniPublishers, New Delhi.
7. Animal Behavior: An Evolutionary Approach, Alcock J., 2013, SinauerAssociates.
8. Animal Societies and Evolution: Reading from Scientific America, 1981, TophoffH.R., W.H. Freedman and Co Ltd.
9. Animal Behavior, Breed M.D. and Moore J., 2015, Academic Press.
10. Animal Behavior, Mathur R, 2010, Rastogi Publications.
11. The ecology & Evolution of Animal Behavior, Werlace R.A., 1979, Good YearPublishing Co., Inc.
12. Biological Rhythms, Kumar V., 2002, Narosa Publishing House, Delhi/ Springer-Verlag.

Suggested E-Resources:

1. https://vidyamitra.inflibnet.ac.in/content/index/6018e55f8007bec1c22166b0/ET
2. https://vidyamitra.inflibnet.ac.in/content/index/6018e69d8007be8bc42166af/ET
3. https://vidyamitra.inflibnet.ac.in/index.php/content/index/5fd9f1678007bef4453de 567
4. https://vidyamitra.inflibnet.ac.in/index.php/content/index/6018dbb48007be63c12166ae

Course Learning Outcome: Upon completion of the course, students will be able to:

- Understand the economic importance of non-chordates and chordates and their significance in the ecosystem.
- Comprehend the life cycle of specific parasites, the symptoms of the disease andits treatment and apply simple preventive measures for the same.
- Gain knowledge on animals useful to mankind and the means to make the most ofit.
- Learn the modern techniques in various industries of beneficial animals.
- Pursuing entrepreneurship as careers
- Understand the main historical ideas that underpin animal behaviour theory.
- Critically review hypotheses to explain animal behaviour.
- Gain an insight into different types of animal behaviour and their role inbiological adaptations.

Practical Syllabus Semester III

UG0101 -ZOO-63P-202- Practicals based on Economic Zoology & Ethology

1. Study of Microscopic Slides/models/ photographs of the following: *Plasmodium, Giardia, Toxoplasma, Trypanosoma,* Bedbugs, mosquito (any), *Pediculus humanus capitis, Xenopsyllacheopis*, aphid, *Tribolium, Tenia solium, Fasciola hepatica, Ascaris, Waucheria,*

2. Study of Museum Specimens/ photographs/ Models of following: silk moth species, earthworm species, Prawn, Pearl oyster, poisonous spiders, scorpion, ants, Centipede, ear wig, types of honey bees, cockroach, crickets, grasshopper, ediblefishes, fur, feathers, corals, cowrie.

3. To study life cycle of silk worm and different types of silk yarns available in the market.

4. To study the qualitative analysis of honey.

5. To study the construction of vermicomposting bins and devices used forvermicomposting.

6. Study to differentiate between original and artificial pearls.

7. To study the food preference and response to light in any of the stored insect pest

8. To study the antennal grooming in cockroach.

9. Study of chemical communication behaviour in Ants/earthworm.

10. Educational tour: Visit to any sericulture research and training Institute/ Apiary/ Poultry farm/ Aquaculture and report submission (Candidates are expected to submit a detailed report of such visit)

Scheme of Practical Examination and Distribution of Marks

S.No.	Practical Exercises	Regular Students	Ex. /N.C. Students
1.	Exercise based on sericulture, apiculture, lac culture.	6	12
2.	Exercise based on vermiculture, pearl culture, aquaculture.	4	6
3.	Exercise based on ethology	4	6
4.	Identification and comments on Spots (1 to 8)	16	16
5.	Viva Voce	5	10
6.	Class Record and report	5	
		10*+40=50	50

Note:

***Internal marks for regular students only.**

1. With reference to microscopic slides, in case of non-availability, the exerciseshould be substituted with diagrams / photographs.
2. Candidates must keep a record of all work done in the practical class and submitthe same for inspection at the time of the practical examination.
3. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.

Syllabus

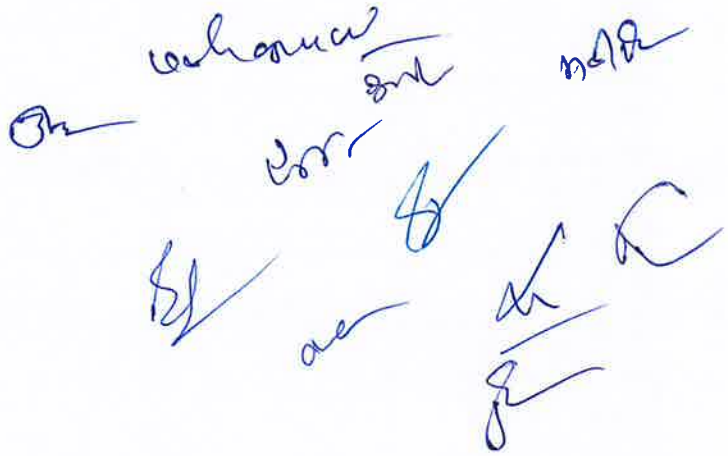
UG0101 -ZOO-64T-203- Cell Biology, Genetics & Biotechnology

UG0101 -ZOO-64P-204- Practicals based on Cell Biology, Genetics & Biotechnology

IV Semester-Zoology

Objectives of theCourse:

- This course will provide with a deep knowledge of Cell Biology, Genetics and Biotechnology.
- Understand the role of different cell organelles in the maintenance of life activities, the history and basic concepts of heredity, variations and gene interaction, the application of biotechnology in the fields of industry and agriculture.
- In addition to this, the course is aimed at nurturing skills of conducting scientific inquiry and experimentation in the field of recent advancements, recent trends and technologies.
- Students can start their own business i.e. self- employments and get employment in different applied sectors.



Detailed syllabus Semester IV

UG0101 -ZOO-64T-203- Cell Biology, Genetics & Biotechnology

UNIT I

Introduction to cell: Morphology, size, shape, characteristics and structure of prokaryotic and eukaryotic animal cells; basic idea of virus and cell theory.

3 Hrs

Plasma membrane: Composition, Fluid mosaic model; Transport across the membrane: active and passive transport, facilitated transport, diffusion, osmosis.

4 Hrs

Cell Organelles: Structure and functions of nucleus, mitochondria, endoplasmic reticulum, ribosome (prokaryotic and eukaryotic), Golgi complex, lysosome, microbodies and centrioles. Structure and functions of cilia, flagella, and microvilli. **8 Hrs**

UNIT II

Cell Division: Mitosis, Meiosis, cell cycle. **4 Hrs**

Prokaryotic chromosomes and eukaryotic chromosomes: Morphology, telomeres, primary and secondary constrictions, chromatids; Giant chromosome types: Polytene and Lampbrush.

4Hrs

Chromosomal organization: Euchromatin, heterochromatin, folded fiber model and nucleosome concept.

4 Hrs

Cell-Cell Junctions: Structure and Functions- Tight junctions, Desmosomes, Gap junctions.

3 Hrs

UNIT III

Mendel's law of Inheritance: Principle of segregation, independent assortment, dominance, Mendelian genetics in humans, Variety of gene expression- modifiers, suppressors, pleiotropic gene, multiple alleles, Interaction of gene epistasis, complimentary gene, duplicate gene. **4 Hrs**

Linkage: Definition, coupling and repulsion hypothesis, linkage groups, Crossing over- mechanism and theory; structure of chromosomes, extrachromosomal inheritance- mitochondrial and plastids.

4 Hrs

Mutation: Definition, basic concept, also include types (spontaneous and induced); mechanism of mutagenesis; base analogues, nitrous acid, hydroxyl amine, alkylating agent, Acridine dyes, U.V. light.

4 Hrs

Genetic disorders: Down's, Turner's and Klinefelter's syndromes, color blindness,Hemophilia and Phenylketonuria. **3 Hrs**

UNIT IV

Concept and scope of Animal Biotechnology: Cloning methods (Cell, Animal and Gene cloning). Vectors- Plasmids, Cosmids, Lambda bacteriophages and Yeast artificial chromosomes (YAC).

5 Hrs

Animal cell culture: Equipment and materials for animal cell culture; applications ofcell culture techniques; Recombinant DNA technology and its applications. **4 Hrs**

Transgenesis: Methods of Transgenesis, Production of transgenic animals and theirapplication in Biotechnology; Stem cells: Types and their applications. **4Hrs**

Dairy biotechnology: Food, drink and dairy biotechnology (outline idea only).Fermented food production: dairy products, wine, beer, vinegar and food preservation.

3Hrs

Suggested Books and References:

1. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and James Darnell, J. Molecular Cell Biology, Freeman, 7th edition 2013.
2. Cell Biology, Genetics, Molecular biology, Evolution and Ecology (2022) P.S. Verma, V.K. Agarwal.
3. Cross A.E. and Nagle R.B. (2006). Cell Adhesion and Cytoskeletal Molecules in Metastasis. Vol. XII, Springer Publication.
4. Karp G. John. (2013). Cell and Molecular Biology. Concepts and Experiments.7th Edition, Wiley & Sons Inc., New York.
5. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M.(2009). An Introduction to Genetic Analysis. □ Edition. Freeman and Co., N.Y., USA.
6. Brown, T.A. (2015). Gene Cloning and DNA Analysis.7thEdition, Academic Press, California, USA.
7. Gardner E.J. (2008). Principles of Genetics. VIII Edition, Simmons M.J. and Snustad D.P. Willey, India.
8. Pierce B.A. (2008). Genetics-A Conceptual Approach. W.H. Freeman & Co., New York.
9. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. □ Edition, Freeman and Co., N.Y., USA.
10. Biotechnology by U. Satyanarayan. (2010).
11. B.D. Singh. (2004). Biotechnology-Expanding Horizons. Kalyani Publishers, New Delhi. India.
12. Current Frontiers and Perspectives in Cell Biology (2012). Stevo Najman.
13. Cooper, G. M., and Hausman, R. E. (2013). The Cell: A Molecular Approach (6th Ed.). Washington: ASM; Sunderland.
14. Principles of Genetics by Gardner (2008) (8th Edition).
15. Genetics (2009) P.K. Gupta, Rastogi Publications.
16. Primrose S. B. and Twyman R. M: Principles of Gene Manipulation andGenomics. John Wiley & Sons, 2013.

Suggested E-Resources:

1. The Cell: A Molecular Approach (2013) Geoffrey M. Cooper and Robert E.Hausman. Sixth Edition. Sinauer Associates.
2. Principles of Molecular Biology (2023) Veer Bala Rastogi. Second Edition.Medtech.
3. Genetics and Molecular Biology (Volume 1) Kohji Hasanuma. Encyclopedia ofLife Support Systems. UNESCO-EOLSS.
4. https://egyankosh.ac.in/handle/123456789/5504

Course Learning Outcome: Upon completion of the course, students will be able to:

- Students will be able to explain the basic concepts of Cell Biology.
- Have an understanding of classical genetics.
- To impart knowledge and practical training in various techniques to develop research in commercial and scientific application.

Learn about biotechnology and its concepts as well as various scopes in Biotechnology

Practical Syllabus Semester IV

UG0101 -ZOO-64P-204- Practicals based on Cell Biology, Genetics & Biotechnology

Exercises in Cell Biology:

1. Principle and uses of Microscopy.
2. Squash preparation for the study of mitosis in the onion root tip, permanent slidesof mitosis (all stages).
3. Squash preparation for the study of meiosis in grasshopper or cockroach testes,permanent slides of meiosis (all stages).
4. Study of giant chromosomes in salivary glands of *Chironomus* or *Drosophila* larva.
5. Preparation of blood smear and differential staining of blood cells.

Exercises in Genetics:

6. Life cycle of *Drosophila* and an idea about its culture.
7. Identification of male and female *Drosophila.*
8. Identification of wild and mutant (yellow body, ebony, vestigial wing and whiteeye).
9. Study of permanent prepared slides: Sex comb and salivary gland chromosomes.
10. Numerical exercises on Monohybrid and dihybrid cross.

Exercises in Biotechnology:

11. Study of Lab instruments: Centrifuge, Autoclave, pH meter.
12. Isolation of DNA from cheek cells.
13. Separation of DNA by Agarose gel electrophoresis.
14. Chromatography: Paper/TLC chromatography for separation of dyes/Amino acids.

Scheme of Practical Examination and Distribution of Marks

S.No.	Practical Exercises	Regular Students	Ex. /N.C. Students
1.	Exercise in Cell Biology	**6**	**12**
2.	Exercise in Genetics	**4**	**6**
3.	Exercise in Biotechnology	**4**	**6**
4.	Identification and comments on Spots (1 to 8)	**16**	**16**
5.	Viva Voce	**5**	**10**
6.	Class Record and report	**5**	
		10*+ 40 =50	**50**

Notes:

***Internal marks for regular students only**

1. With reference to microscopic slides, in case of non-availability, the exercise should be substituted with diagrams / photographs.

2. Candidates must keep a record of all work done in the practical class and submit the same for inspection at the time of the practical examination.
   Mounting material for permanent preparations would be as per the syllabus or as available through collection and culture methods.

ENGLISH - I

The Question paper shall be of one & half hour duration.

MM: 40

Objectives:

- Reinforcing selected components of grammar and usages.
- Facilitating comprehension of a prosepassage.

Unit – I(Vocabulary) 05 Marks

- Antonyms and Synonyms
- Word formation: Prefix and suffix.

Unit – II(Grammar and Usage – I)

Transformation of sentences. 05 Marks

- Direct and Indirect Narration.
- Active and Passive Voice.
- Interchange of Degrees of Comparison.

Unit – III(Grammar and Usage – II) 05 Marks

- Sequence of Tenses.
- Prepositions.

Unit – IV(Grammar and Usage – III)

- Modal Auxiliaries. 05 Marks
- Articles.

Unit – V(Comprehension)20 Marks

- Comprehension of a passage from the prescribed book(Essential Language Skills by Macmillan)

  Following essays and Stories in Essential Language Skills revised edition compiled by Macmillan for General English B.A./B.Com./B.Sc.

Richa Meena 27-9-23
Dr. Richa Meena

27-9-23

Bhagirath 27/09/2023

William Blake	The Little Black Boy
Sujata Bhatt	Voice of the Unwanted Girl
Ruskin Bond	Night Train at Deoli
M.K. Gandhi	The Birth of Khadi
J.L.NehruA Tryst with Destiny	
A.P.J.AbdulKalam	Vision for 2020

Five Questions to be answered from the texts mentioned.

Suggested Reading:

1. A University Grammar of English by Quirk and Greenbaum.
2. A Foundation English Course for Undergraduates. Ed. Gunashekhar
3. Prose for Pleasure and Comprehension by H G SuryanarayanRao.
4. A Guide to Patterns and Usage by AS Hornby.

27-9-23
Dr. Richa Meena

C.B. Meena
27-9-23

(Bhagirath Prasad Meena)
27/9/23

27/07/2023

B.Sc. (Math & Bio Group, chemistry & Mathematics) Semester II & IV

ENGLISH - II

The Question paper shall be of One & Half hour duration.

MM: 40

Objectives:

- Introducing students to Phonetics, correct their pronunciation and word stress.
- Strengthening compositional skills.
- Introducing students to writing of notices

Unit – I(Phonetics) 10 Marks

- Transcription of Phonetic symbols.
- Word stress.
- Translation of 5 sentences from Hindi to English
- Translation of 10 words from Hindi to English

Unit – II(Writing Skills) 10 Marks

- CV"s and Job Applications.
- Precis Writing.

Unit – III(Compositional Skills) 10 Marks

- Letter Writing (Formal and Informal)
- Paragraph Writing.

Unit – IV(Writing Skills) 10 Marks

- Notice Writing.

Suggested Reading:

1. CVs and Job Applications by Judith Leigh.
2. English at Workplace. Eds: Panja, Sawhney&Verma.
3. Professional Communication by R P Singh.
4. English made simple by Arthur Waldhorn and Arthur Zeiger.
5. The Written Word by Vandana R Singh.
6. Technical Writing by Sunder Rajan.

Richa Meena 27-9-23 Dr. Richa Meena

C.B. Meena 27-9-23

Board of Studies Meeting 27/9/23

27/09/2023.

SEC- Logical and Critical Thinking

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III & IV	SEC-	Logical and Critical Thinking			5	2
Level of Course	Type of the Course	Credit Distribution		Offered to NC Student	Delivery Type of the Course	
		Theory	Practical			
Introductory	Skill Enhancement	2	-	Yes	30 Hours Lecture	
Prerequisites	XII Pass					
Objectives of the Course:	Objectives of the Course - This course aims to equip students with a comprehensive understanding of various logical reasoning concepts and critical thinking techniques. Through a diverse range of topics and exercises, the course seeks to enhance students' ability to analyze information, evaluate arguments. solve complex problems, and make informed decisions. By the end of the course, students should have a solid foundation in logical reasoning and critical thinking. empowering them to excel in various academic, professional. and everyday scenarios.					

Examination Scheme

Type	Paper code and Nomenclature	Duration of Examination	M:,:1.imum Marks (Midterm + EoSE)	Minimum Marks (Midterm + EoSE)
Theory	SEC-004- Logical and Critical **Thinking**	I Hrs.-MT I **Hrs.-EoSE**	**10 Marks-MT** 40 **Marks-EoSE**	4 Marks-MT I6 **Marks-EoSE**

Syllabus

SEC-

Logical and Critical Thinking

Unit - I

Alphabet test, Alphanumeric series, Analogy, Analytical and Decision Making, Arithmetic Reasoning, Artificial Language,

(7 Lectures)

Unit - II

Blood Relations, Calendars, Cause and Effect, Classification, Clocks, Code lnequalities, Coded equations, Coding and Decoding, Course of Action, Critical path, Critical Reasoning, Cubes and cuboids,

(8 Lectures)

Unit - III

Data Sufficiency, Decision Making, Deductive Reasoning/Statement Analysis, Dices. Direction questions, Embedded images, Figure Matrix, Input-Output, Mirror and Water Images, Odd One Out, Ordering and Ranking, Paper folding; unfolding questions **(8 Lectures)**

Unit- IV

Picture Series and Sequences, Puzzles, Reasoning Analogies, Seating Arrangements. Shape Construction, Statement and Assumptions, Statement and Conclusions, Syllogism, Venn Diagram. Verbal Reasoning, Visual Reasoning **(7 Lectures)**

Suggested Books and References-

1. A Modern Approach to Logical Reasoning by R.S. Aggarwal
2. Logical and Analytical Reasoning by A.K. Gupta
3. How to Prepare for Logical Reasoning for CAT by Arun Sharma
4. Verbal and Non-Verbal Reasoning by R.S. Aggarwal
5. Analytical Reasoning by M.K. Pandey
6. Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
7. The Power Score LSAT Logical Reasoning Bible by David M. Killoran
8. Critical Thinking: A Student's Introduction by Gregory Bassham, William lrwin, and Henry Nardone
9. Thinking, Fast and Slow by Daniel Kahneman
10. I 0. The Art of Thinking Clearly by Rolf Dobell

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Demonstrate Proficiency in Various Logical Reasoning Techniques: Students ill grasp the fundamental principles of logical reasoning and apply techniques such as analogy, class1ficatwn, coding-decoding, statement analysis, syllogism and more.
2. Enhance critical thinking skills, student will develop the ability to critically evaluate the information. Identifying assumptions and analyses arguments to make well reason decisions.
3. Solve Complex Problems: Student, will be adept at solving intricate problems involving arithmetic reasoning, puzzles, sequencing, and other logical challenges.
4. Interpret Visual and Verbal Data: Students will effectively interpret visual information, such **as figure matrices and comprehend verbal reasoning exercises to arrive at accurate conclusions,**
5. Navigate Various Question Types: Students will become proficient in handling a wide range of logical reasoning question formats, including seating arrangements, blood relations, **calendars, and more.**
6. Strengthen Decision-Making Abilities: Students will sharpen their decision-making skills by considering cause and effect relationships, identifying critical paths, and applying course of action principles.
7. Enhance Test-Taking Abilities: Students will be well-prepared for competitive exams and assessments that include logical reasoning sections, as they will have practiced a diverse set of reasoning challenges.
8. Apply Logical Thinking in Real-Life Contexts: Students will be able to apply logical and critical thinking techniques to real-life situations, improving their problem-solving abilities **in various domains.**

Syllabus

SEC- Quantitative Aptitude and Data Interpretation

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III & IV	SEC	Quantitative Aptitude and Data Interpretation			5	2
Level of Course	Type of the Course	Credit Distribution		Offered to NC Student	Delivery Type of the Course	
		Theory	Practical			
Introductory	Skill Enhancement	2	-	Yes	30 Hours Lecture	
Prerequisites	XII Pass					
Objectives of the Course:	Objectives of the Course - • To provide a strong foundation in the number system and basic arithmetic concepts. • To understand divisibility rules, decimal fractions, greatest common divisor (GCD), least common multiple (LCM), surds, indices, and simplifying square and cube roots. • To solve problems related to averages, ages, allegations, and percentages.					

Examination Scheme

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (Midterm + EoSE)	Minimum Marks (Midterm + EoSE)
Theory	SEC- Quantitative Aptitude and Data Interpretation	1 Hrs.-MT 1 Hrs.-EoSE	10 Marks-MT 40 Marks-EoSE	4 Marks-MT 16 Marks-EoSE

Detailed Syllabus

SEC- Quantitative Aptitude and Data Interpretation

Unit-I

Number system. divisibility, decimal fractions. GCD & LCM. surds and indices. Squares and Cubes, square roots and cube roots, problerns on averages and ages, allegations, percentage.

(08 Lectures)

Unit-II

Profit & loss, partnership, discount, simple & compound interest, ratio & proportion and variation.

(06 Lectures)

Unit -III

Time and work, time, speed and distance. geometry and mensuration, coordinate geometry, functions, inequalities, quadratic and other equat10ns, logarithms. Permutations and combinations, probability, set theory.

(08 Lectures)

Unit-IV

Basic modes of data Interpretation. Data. Nature of Data, Data represents variable. types of variable need for capturing data. Data interpretation -definition, organization and presentation. Tabular presentation. Tables, bar Charts- Simple, Stacked, Composite. representation of percentage, show deviation, XY Charts, Pie Charts. Cases. Challenges of data interpretation. Data Sufficiency.

(08 Lectures)

Suggested Books and References -

I. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand, 2018.
1. Arun Sharma, Teach Yourself Quantitative Aptitude. McGraw Hill, 20!9.
2. P.A. Anand. Wiley Quantitative Aptitude For Competitive Exams, Wiley India Pvt.Ltd, 2015,
3. Rajesh Verma, Fast Track Objective Arithmetic. Arihant Publications, 2018.
4. Nishit K. Sinha - The Pearson Guide to Quantitative Aptitude and Data Interpretation fur the CAT-Pearson Education (2012)

Course Learning Outcomes:

By the end of the course students will be proficient in solving a range of mathematical problems. interpreting data. and making informed decisions in various contexts. They will have developed quantitative reasoning skills that can be applied both academically and in practical situations.

NUTRITION FOR HEALTH AND FITNESS

Programme Objective:

The course has been planned to provide the student about basic concept of health, wellness and fitness. The course shall create awareness about the importance of correct dietary and physical activity practices for positive health and wellness. The student shall understand balanced diet and impact of processed foods on health. An understanding of the current health scenario in the country and globally will be imported.

Course content

UNIT-I

Health & Fitness: Concept of positive Health and Wellness as per WHO Guideline, Physical Fitness – definition, Role of Nutrition for Health and Fitness.

UNIT-II

Nutritional Guidelines: Balanced Diets and Food Pyramid. How to plan balanced diets for various age groups. Dietary Goals and Guidelines for Indians (Reference man &woman).

UNIT-III

Processed Foods: Concept of Processed Foods, Impact of Packaged, Ultra-processed and Convenience Foods on Health.

UNIT-IV

Physical Activity & Nutrition: Effects on health of Physical Activity and Dietary Habits, Dual Burden of Malnutrition.

Suggested Books/References/Web-links:

(l) M.Swaminathan (201SJ: Advanced Text Book of Food and Nutrition. Volume J & II. The Bangalore Press, India.

(2) Ravindra Chadhha &Pulkit Mathur (201S) : Nutrition and Life Cycle Approach. The Orient Blackswan; First Ed.

(3) Dietary Guidelines for Indians -A Manual (201 l) ,NIN, Hyderabad

(4) h\tr>s://cdn.who.int/rnedia/docsldefault-source/health-gromotionlfrarnework4wellbeing 1 6dec22.gdf?sfvrsn=32a0e228 4&download=true.

(5) hws://www.researchgate.net/12ublication/S1711287 Consensus Physical Activity.

Programme Outcome

1. Enhancing the basic under standing of nutrition and physical fitness
2. Developing a healthy attitude to wards physical well being
3. Inculcating values of conscious and correct eating habits
4. Awareness generation regarding processed foods and their effects on health & wellness
5. Understanding importance of physical activity and its effect on health &wellness.

NATIONAL SERVICE SCHEME

Programme Objective:

Understanding the community in which the volunteers works, relation to their community, identifying the needs and problems of the community and involve them in problem-solving exercises and utilising their knowledge in finding practical solutions to individual and community problems. Mobilising community participation and acquire leadership qualities and democratic attitudes. To practice national integration and social harmony.

Course content

UNIT-I

Introduction to NSS: History, philosophy, aims & objectives of NSS. Emblem, flag, motto, song and badge. Organizational structure, roles and responsibilities of various NSS functionaries.

UNIT-II

NSS Programmes and Activities: Concept of regular activities, One day camps and seven day camp. Basis of adoption of slum/village. Youth development programmes/ schemes of Govt. of India. Collaboration with different agencies.

UNIT-III

Awareness programmes: First aid training, Traffic awareness programme, Self defence.

UNIT-IV

Importance and role of youth leadership in society: Volunteerism and leadership, Gender and society, Fundamental rights, Consumer rights

Suggested Books/References/Web-links:

1. NSS manual
2. https://nss.gov.in
3. yas.nic.in

Programme Outcome

1. Understanding role of volunteership.
2. Activation in the community participation.
3. Promoting leadership skills and social awareness.
4. Youth integration and understanding culture.
5. Better connect with society and building harmony.

(Dr. C. P. Mahendra) Dr. Ram Nath Kohli