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

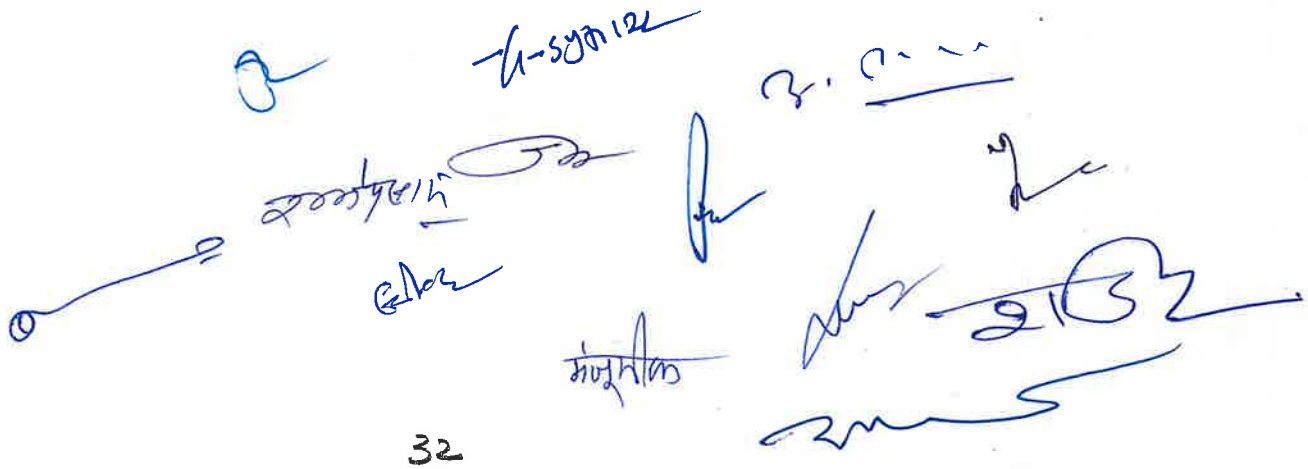
Bacteria	General Characteristics, Classification, Cell structure, endospore formation, Reproduction- asexual and recombination (Conjugation, Transformation and Transduction).	**(10 Lectures)**
Applied Microbiology	Economic importance of viruses, Economic importance of Bacteria with reference to their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

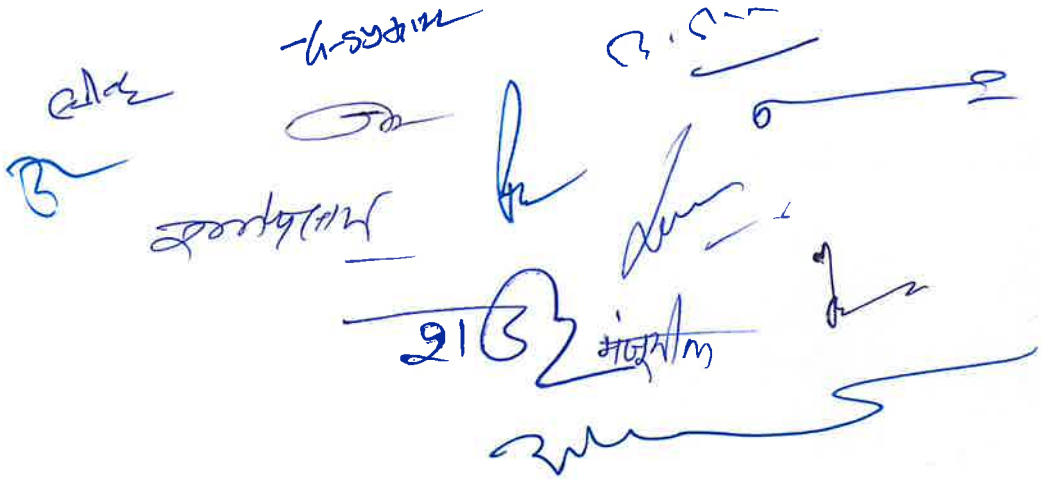
Taxonomic literature	Floras, Monographs, Icons.	**3 lectures**
Modern Trends	Cytotaxonomy, Chemotaxonomy, Palynology, Embryology Anatomy and Numerical taxonomy.	**5 lectures**
Study of Families	Diagnostic characters and economic importance of Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae,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

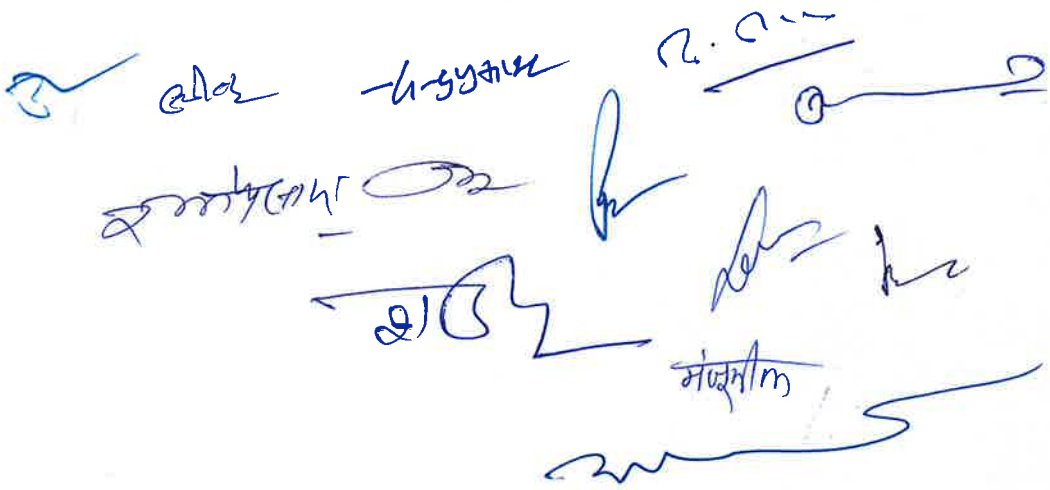
Raj Rishi Govt. (Autonomous) College Alwar (Rajasthan
B.Sc. Semester – IV (2024-25)
BOT-64P-204 Botany Practical-IV

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

Syllabus

CHM-63T-201: Chemistry of s, p-block elements and Noble Gases, Non-aqueous Solvent, Nuclear Chemistry, Hydrocarbons and Alkyl halide, Fundamentals of Thermodynamics, Solutions and their Colligative Properties.

Unit-I

s-Block Elements: Comparative study of properties of alkaline and alkaline earth metals, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

Periodicity of p-block elements: Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energy, electron-affinity, electronegativity, diagonal relationship, catenation.

Some Important Compounds of p-block Elements: Hydrides of boron, diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

Chemistry of Noble Gases: Chemical properties of the noble gases, chemistry of Xenon, structure and bonding in Xenon compounds.

15 Lecture

Unit-II

Oxidation and Reduction:
Uses of Redox Potential data, analysis of redox cycle, redox stability in water. Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

Non-aqueous Solvents:
Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

Nuclear Chemistry: Fundamental particles of nucleus (nucleons), concept of nuclides and its representation, Isotopes, Isobars and Isotones (with specific examples), forces operating between nucleons (n-n, p-p & n-p), Qualitative idea of stability of nucleus (n/p ratio).
Radioactive elements chemistry: Natural and artificial radioactivity, Radioactive disintegration series, Radioactive displacement law, Radioactivity decay rates, Half-life and average life, Nuclear binding energy, mass defect and calculation of defect and binding energy, Nuclear reactions, Spallation, Nuclear fission and fusion. Brief discussion on Atom bomb, Nuclear reactor and Hydrogen bomb.

15 Lecture

Unit-III

Alkanes and Cycloalkanes: Free radical halogenations of Alkanes: mechanism, orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations. Theory of strainless rings.
Alkenes, Cycloalkenes, Dienes and Alkynes: Relative stabilities of alkenes. Chemical reactions of alkenes - hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis and oxidation with $KMnO_4$. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes.
Classification and Nomenclature of isolated, conjugated and cumulated dienes. Structure of allenes and butadiene. Methods of formation, properties and chemical reactions - 1,2- and 1,4-additions, Diels-Alder reaction and polymerization reactions.
Structure and bonding in alkynes. Methods of formation. Chemical reactions - acidity of alkynes: mechanism of electrophilic and nucleophilic addition reactions; hydroboration-oxidation; metal-ammonia reduction, oxidation and polymerization.

Alkyl Halides: Methods of formation of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides S_N2 and S_N1 reactions with energy profile diagrams.

15 Lecture

Unit- IV

Thermodynamics - I
Definition of Thermodynamic Terms: System, surroundings, etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process, concept of heat and work.
First Law of Thermodynamics: Statement, definition of internal energy and enthalpy, heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of Ideal gases under isothermal

and adiabatic conditions for reversible process.

Thermochemistry:

Standard state, standard enthalpy of formation, Hess's law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

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 Inorganic Chemistry by J.D. Lee, Wiley, India.
2. Inorganic Chemistry by Housecroft, E. Catherine & Sharpe, G Alan, Pearson Education Ltd.
3. Advanced Inorganic Chemistry by G. D. Tuli, S. Chand, New Delhi.
4. Advanced Inorganic Chemistry by Satya Prakash, S. Chand, New Delhi.
5. Nuclear and Radiochemistry: Fundamental and Applications, 2 Vols., Jens-Volker Kratz and Karl Heinrich Lieser; 3rd Edn., John Wiley & Sons: UK, 2013.
6. Essentials of Nuclear Chemistry by H. J. Arnikar, Wiley, New York.
7. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Vishal Publishing Co.
8. Organic Chemistry by R. T. Morrison & R. N. Boyed, Prentice Hall
9. Organic Chemistry by I. L. Finar, (Vpl. I & II) ELBS
10. Reaction Mechanism in Organic Chemistry by S. M. Mukherji & S. P. Singh, Reaction Mechanism in Organic Chemistry by S. M. Mukherji & S. P. Singh, TRINITY Press.
11. Physical Chemistry by R. J. Silbey, R. A. Alberty & M. G. Bawendi, John Wiley & Sons.
12. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma and M. S. Pathania, Vishal Publishing Co.
13. An Introduction to Chemical Thermodynamics by R. P. Rastogi & R. R. Mishra, Vikas Publishing House.
14. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand, New Age International Publishers.
15. Advanced Physical Chemistry by Gurdeep Raj, Goel Publishing House.
16. Elements of Physical Chemistry, P. Atkins and J. De Paula, Oxford.
17. A Textbook of Physical Chemistry, Application of Thermodynamics, by K. L. Kapoor, (Volume- 3) McGraw Hill.
18. An Introduction to Chemical Thermodynamics by R. P. Rastogi & R. R. Mishra, Vikas Publishing House.
19. 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: 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.

Syllabus

CHM-63P-202: Chemistry Lab III

(4 Hrs./week)

10 marks

Inorganic Chemistry

Gravimetric estimations: (Any three)

(a) Estimate zinc as zinc ammonium phosphate.
(b) Estimate lead as lead chromate.
(c) Estimate copper as cuprous thiocyanate.
(d) Estimate nickel as nickel dimethyl glyoximate.

10 marks

Organic Chemistry

Qualitative Analysis

(a) Identification of organic compounds (solids or liquids) through element detection (N, S and

halogens) melting /boiling points, functional group analyses with the preparation of suitable derivative. **(Any two)**

(b) One step organic synthesis containing: -

i. Acetylation

(a) Acetanilide from Aniline

(b). Aspirin from salicylic acid

ii. Reduction

(a) *m* -nitro aniline from *m* -dinitrobenzene.

(b) Anthrone by anthraquinone

iii. Electrophilic substitution Reactions

Nitration of nitrobenzene

Physical Chemistry **10 marks**

Distribution law

(a) To determine partition coefficient of iodine between water and $CCl_4/CHCl_3/CS_2$ at room temperature.

(b) To study the distribution of benzoic acid between benzene and water.

Chemical kinetics

(a) Determine the velocity constant and order of reaction for the hydrolysis of ethyl acetate by sodium hydroxide at room temperature (saponification of an ester).

Thermochemistry

(a) To determine heat of neutralization of given acid and base.

(b) To determine the dissociation energy of given weak acid.

Solution

(a) To determine the molecular mass of given non-volatile substance cryscopically.

Viva-voce **5 marks**

Practical Record **5 marks**

Suggested Books and References:

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

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.

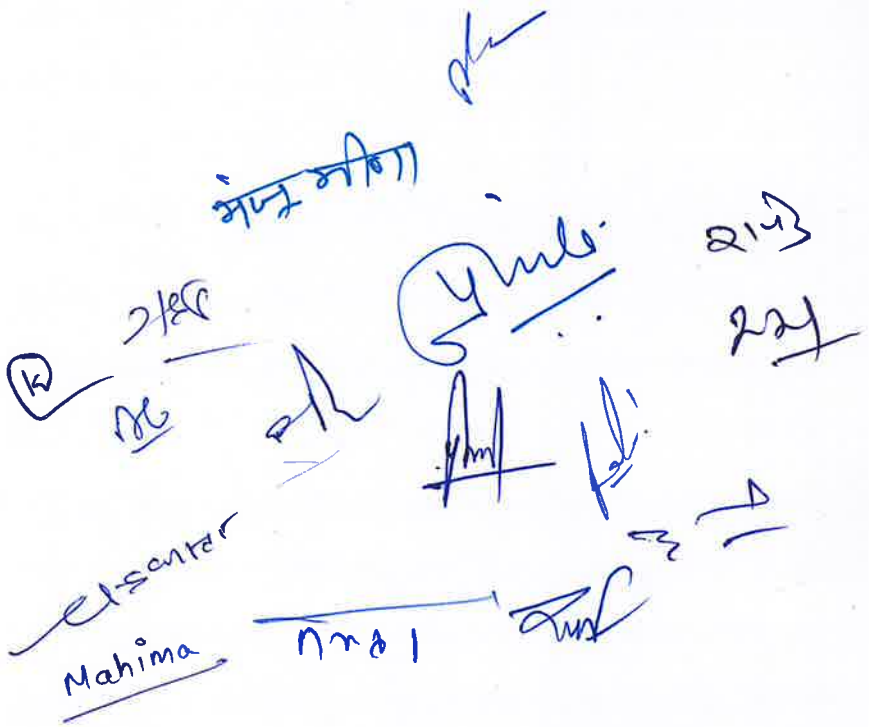
Course Learning Outcomes:

With the completion of this course, students will be able to understand concepts related to periodic trends of s and p-block elements their properties, applications along with noble gases. Student will gain knowledge about the uses of non-aqueous aprotic solvents in chemical research and the essentials of nuclear chemistry with their uses range from agricultural to medical and space exploration to water desalination. Moreover, the organic reactions of saturated and unsaturated hydrocarbons and their uses are incorporated to gain clear understanding in this field. Concepts related to the field of basic and applied thermodynamics and solutions with their colligative properties are also incorporated to enrich the knowledge in these fields,

By the end of this degree programme, student would have achieved the essential conceptual knowledge in the field of chemical sciences and will be able to conduct experiments and demonstrate efficiency with appropriate lab skills, techniques and instrumentations.

Syllabus
IV – Semester

CHM-64T-203- **Chemistry of d & f block elements, Chemistry of Oxygen/Nitrogen-Containing Functional Groups and Chemical and Ionic Equilibrium,**



Thermodynamics-II.

Unit-I

Chemistry of Elements of First Transition Series:
Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation-states, coordination number and geometry.
Chemistry of Elements of Second and Third Transition Series:
General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.
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

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-III

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- IV

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.

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.

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. Concise Coordination Chemistry by R. Gopalan and V. Ramalingam, Vikas Publishing House Pvt, Ltd.
6. Concepts and Models of Inorganic Chemistry, B.E. Douglas, D. McDaniel, & J. Alexander, Wiley.
7. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure by J March, & M. B Smith Wiley.
8. Organic Chemistry by R. T. Morrison & R. N. Boyed, Prentice Hall
9. Reaction Mechanism in Organic Chemistry by S. M. Mukherji & S. P. Singh, TRINITY Press.
10. Organic Chemistry by I. L. Finar, (Vol. I & II) ELBS.
11. Physical Chemistry by R. J. Silbey, R. A. Alberty & M. G. Bawendi, John Wiley & Sons.
12. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma and M. S. Pathania, Vishal Publishing Co.
13. An Introduction to Chemical Thermodynamics by R. P. Rastogi & R. R. Mishra, Vikas Publishing House.
14. A Text Book of Physical Chemistry: A. S. Negi and S. C. Anand, New Age International Publishers.
15. Advanced Physical Chemistry by Gurdeep Raj, Goel Publishing House.
16. Elements of Physical Chemistry, P. Atkins and J. De Paula, Oxford.
17. A Textbook of Physical Chemistry, Application of Thermodynamics, by K. L. Kapoor, (Volume-3) McGraw Hill.
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.
23. Phase Equilibria, Phase Diagrams and Phase Transformations by Mats Hillert, Cambridge University Press
24. Textbook of Physical Chemistry, (Volume 5) by Kapoor, K. L Macmillan India Ltd.

Suggested E-resources:

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

Online Lecture Notes and Course Materials: Suggested E-resources:

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

Syllabus

CHM-64P-204: Chemistry Lab IV — 4 Hrs./week

Inorganic Chemistry — **10 marks**

Inorganic Preparations

(a) Preparation of tetraamminecopper(II) sulphate
(b) Preparation of cis and trans-potassium diaquadioxalatochromate(III).
(c) Synthesis of sodium trioxalatoferrate(III).
(d) Preparation of bis(glyoxamato)nickel (II).

Organic Chemistry — **10 marks**

Organic Syntheses

(a) Synthesis of iodoform from ethanol and acetone (Aliphatic Electrophilic Substitution).
(b) Synthesis of aspirin from salicylic acid (Acetylation).
(c) Synthesis of phthalimide from phthalic anhydride.
(d) Synthesis of succinic anhydride.

Physical Chemistry — **10 marks**

Transition Temperature

(a) Determination of transition temperature of the given substance ($Na_2SO_4.10H_2O$, $MnCl_2.4H_2O$ or $SrBr_2.6H_2O$) by thermometric method.

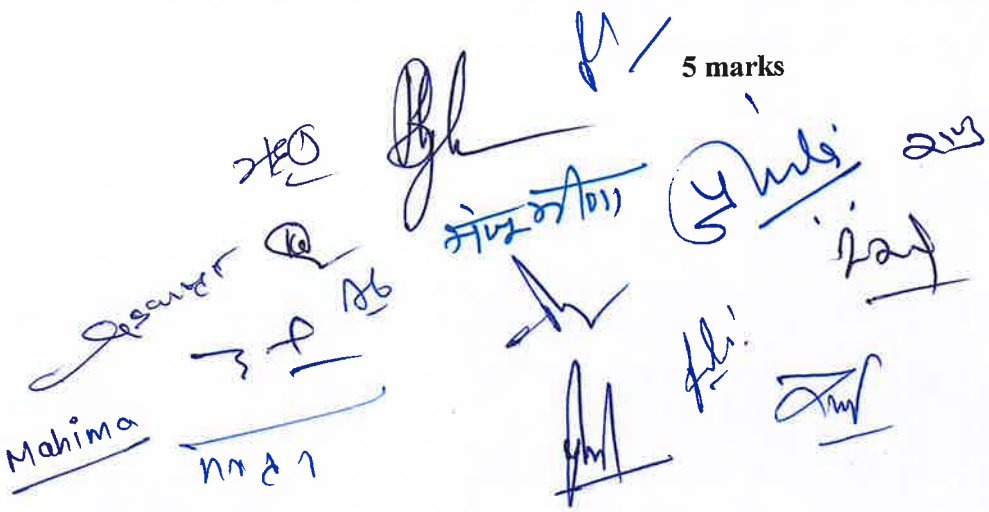
Phase Equilibrium

(a) To construct the phase diagram of two component system like phenol-H_2O system and determine the CST (critical solution temperature) and composition of the solution at CST.
(b) To study the effect of solute $NaCl$ and succinic acid etc. on the CST (critical solution temperature) of two partially miscible liquids (phenol-H_2O system) and determine the concentration of that solute in the given partially miscible liquid system.

Ionic Equilibrium

Preparation of different types of buffer solutions and determination of pH using pH meter.

Viva voce — **5 marks**



Practical Record **5 marks**

Suggested Books and References:

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

Suggested E-resources:

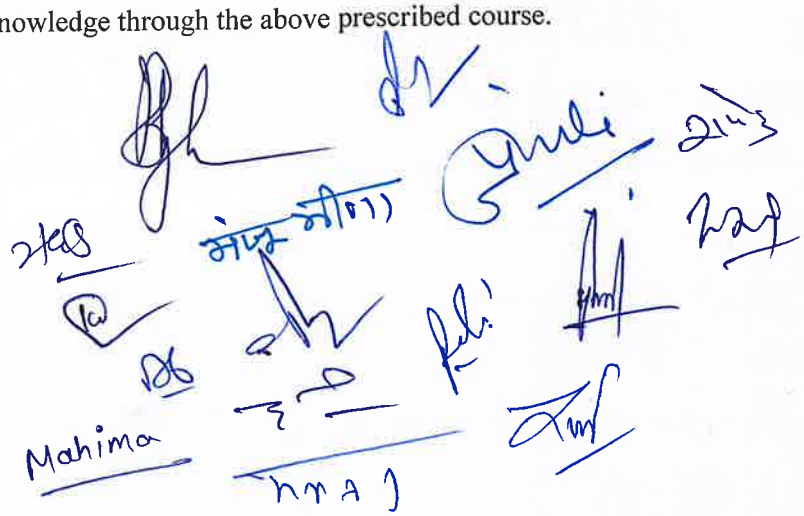
All the above suggested books are available as **e- books.**

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.

Course Learning Outcomes:

With the completion of this degree programme, student will achieve the essential conceptual knowledge in the field of chemical sciences and will be able to conduct experiments and demonstrate efficiency with appropriate lab skills, techniques and instrumentations.

Student will be able to understand the theoretical knowledge about first, second and third series of transition metals, lanthanides and actinides chemistry with their periodic trends, properties and applications in various fields. In addition to the above, student will acquire knowledge about the characteristic organic reactions associated with O/ N-elements containing functional groups and their interconversion with their uses in synthetic organic chemistry. Moreover, chemical and ionic equilibrium and applied thermodynamics are incorporated to enrich student's conceptual knowledge through the above prescribed course.



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

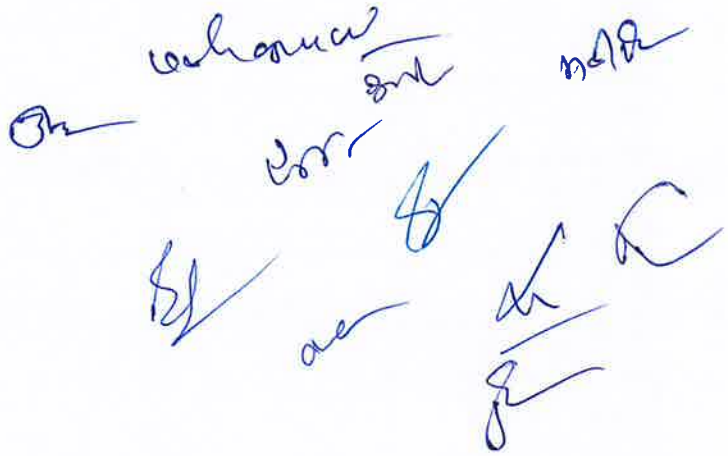
UG0101 -ZOO-64T-203- Cell Biology, Genetics & Biotechnology

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.

B.Sc. (Math & Bio Group, chemistry & Mathematics) Semester I & III

ENGLISH - I

The Question paper shall be of one & half hours 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) 05 Marks

Transformation of sentences.

- 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) 05 Marks

- Modal Auxiliaries.
- 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.

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

(Bhagirath Parsad Meena)
27/9/23

27/07/2023

C.B. Meena
27-9-23

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

C.B. Meena 27-9-23

Dr. Richa Meena

Bhagirath Board Meena 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 Khanna,