

# ***Sunbeam* Women's College Varuna**

**Affiliated to M.G.K. Vidyapith Varanasi**

## **VISION**

Sunbeam College envisions to develop culturally rooted, globally oriented, self reliant women committed to achieve excellence through duty, devotion and discipline.

## **MISSION**

- To reinforce duty, devotion towards the society and the Nation, thereafter keeping with the essence of discipline in one's life.
- To make students sensitive about social concerns, human rights and thus help them being an eco conscious individual.
- To educate the women of tomorrow, through teaching- learning exchange programmes, researches and extension activities.
- To pursue student centric learning for self- development & skill development.
- To equip and empower students with relevant knowledge, competence, value and creativity to face global challenges.
- To facilitate young women to come up with leadership, self-pride and identity in order to become the change makers of the society.
- To inculcate skills and practices that help students become culturally rooted, globally oriented and self reliant.

## **DEPARTMENT OF SCIENCE**

### **VISION**

To achieve overall excellence in education by continuously upgrading the teaching learning methodology and incorporating latest scientific aptitude which are currently happening in the worldwide with ethical responsibility and commitment towards humanity.

### **MISSION**

- To provide excellent environment for faculty and students.
- To impart sound scientific quality education and competency.
- Design and implement curriculum that equips student with professional and life skills.
- Promote and undertake quality work in thrust area of science.
- Collaborate with academia to meet the changing needs of society.
- Foster innovation and cultivate the spirit of scientific aptitude amongst students.
- To realize full potential enabling the students to contribute towards the cause of the society.
- To foster and develop scientific temper among new generation.

### **Program Outcomes (POs):**

The B.Sc. undergraduate programme is designed to intend the following outcomes:

<b>PO1</b>	<b>Critical Thinking</b>	Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
<b>PO2</b>	<b>Effective Communication</b>	Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
<b>PO3</b>	<b>Social Interaction</b>	Elicit views of others, mediate disagreements and help reach conclusions in group settings.
<b>PO4</b>	<b>Effective Citizenship</b>	Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
<b>PO5</b>	<b>Ethics</b>	Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
<b>PO6</b>	<b>Environment and Sustainability</b>	Understand the issue of environmental contexts and sustainable development
<b>PO7</b>	<b>Self-directed and Life-long learning</b>	Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes

**COURSE STRUCTURE FOR  
BACHELOR OF SCIENCE (B.Sc.)**

The students of the B.Sc. shall be examined in the following subjects in accordance with the syllabi prescribed here under:

**SEMESTER- I**

<b>Paper</b>	<b>Name of Paper</b>	<b>Semester Examination Marks</b>	<b>Internal Examination Marks</b>	<b>Credit (Theory +Practical)</b>
Major	Botany	75	25	4+2
Major	Zoology	75	25	4+2
Major	Chemistry	75	25	4+2
Vocational	SPSS/ Voluntary action and NGO management/Business English	75	25	3
Co- Curricular	Food, Nutrition and Hygiene	75	25	2

**SEMESTER- II**

<b>Paper</b>	<b>Name of Paper</b>	<b>Semester Examination Marks</b>	<b>Internal Examination Marks</b>	<b>Credit (Theory +Practical)</b>
Major/Minor	Botany	75	25	4+2
Major/Minor	Zoology	75	25	4+2
Major/Minor	Chemistry	75	25	4+2
Vocational	Data Analytics/ E-Taxation / Gandhian Model of skill development	75	25	3
Co- Curricular	Human Values and Environmental studies	75	25	2

**Academic Calendar for the Session 2025-26**  
Date sheet for **Internal Assessment**

**SEMESTER- I**  
**Mid Term**

<b>Name of Subjects</b>	<b>Date</b>	<b>Shift</b>
<b>Co-Curricular:</b> First Aid & Health	17/11/2025	Shift 1
<b>Vocational:</b> SPSS/ Voluntary action and NGO management/Business English	17/11/2025	Shift 2
<b>Major:</b> Botany – I	18/11/2025	Shift 1
<b>Major:</b> Botany – II	18/11/2025	Shift 2
<b>Major:</b> Zoology –I	19/11/2025	Shift 1
<b>Major:</b> Zoology –II	19/11/2025	Shift 2
<b>Major:</b> Chemistry –I	20/11/2025	Shift 1
<b>Major:</b> Chemistry –II	20/11/2025	Shift 2

**SEMESTER- II**

<b>Name of Subjects</b>	<b>Mid Term I</b>	<b>Shift</b>
<b>Co-Curricular:</b> Human Values and Environmental studies	23/03/2026	Shift 1
<b>Vocational:</b> Data Analytics/ E-Taxation /Gandhian Model of skill development	23/03/2026	Shift 2
<b>Major/Minor:</b> Botany – I	24/03/2026	Shift 1
<b>Major/Minor:</b> Botany – II	24/03/2026	Shift 2
<b>Major/Minor:</b> Zoology –I	25/03/2026	Shift 1
<b>Major/Minor:</b> Zoology –II	25/03/2026	Shift 2
<b>Major/Minor:</b> Chemistry –I	27/03/2026	Shift 1
<b>Major/Minor:</b> Chemistry –II	27/03/2026	Shift 2

**Important Dates**

**SEMESTER- I**

- 17.11.25 to 20.11.25: Mid Term begins.
- 29.11.25: PPM & Report Card Distribution.

**SEMESTER- II**

- 23.03.26 to 27.03.26: Mid Term begins.
- 04.04.26: PPM & Report Card Distribution.

**“All the Best”**

# **SEMESTER- I**

**MAJOR: BOTANY**  
**Course Code: B040101T**  
**Paper I (Theory)**  
**Course Title: Microbiology & Plant Pathology**

**Credits: 4**

**Max. Marks: 75+25**

**Course outcomes:**

After the completion of the course the students will be able to:

1. Develop understanding about the classification and diversity of different microbes including viruses, Algae, Fungi & Lichens & their economic importance.
2. Develop conceptual skill about identifying microbes, pathogens, biofertilizers & lichens.
3. Gain knowledge about developing commercial enterprise of microbial products.
4. Learn host –pathogen relationship and disease management.
5. Learn Presentation skills (oral & writing) in life sciences by usage of computer & multimedia.
6. Gain Knowledge about uses of microbes in various fields.
7. Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens
8. Gain Knowledge about the economic values of this lower group of plant community.

Month	Working Days	Topics to be covered
August'25	24	<p><b>Unit I:</b>  <b>A.</b> Introduction to Indian ancient, Vedic and heritage Botany and contribution of Indian Botanists, in context with the holistic development of modern science and technology, has to be taught, practiced and assessed via class interaction/ assignments / self-study mentioned under Continuous Internal Evaluation (CIE).  <b>B. Microbial Techniques &amp; instrumentation</b>                      Microscopy – Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy, sample preparation for electron microscopy. Common equipment of microbiology lab and principle of their working – autoclave, oven, laminar air flow, centrifuge. Colorimetry and spectrophotometry, immobilization methods, fermentation and fermenters.</p> <p><b>Unit IV: Mycology</b>                      General characteristics, nutrition, life cycle, Economic importance of Fungi, Classification upto class. Distinguishing characters of Myxomycota: General characters of Mastigomycotina, Zygomycota: <i>Rhizopus</i>, <b>Ascomycota:</b> <i>Saccharomyces, Penicillium, Peziza.</i>  <b>Basidiomycotina:</b> <i>Ustilago, Puccinia, Agaricus;</i>  <b>Deuteromycotina:</b> <i>Fusarium, Alternaria.</i> Heterothallism, Physiological specialization, Heterokaryosis &amp; Parasexuality.</p>
September'25	22	<p><b>Unit II: Microbial world</b>                      Cell structure of Eukaryotic and prokaryotic cells, Gram positive and Gram-negative bacteria, Structure of a bacteria; Bacterial Chemotaxis and Quorum sensing, Bacterial Growth curve, factors affecting growth of microbes; measurement of growth; Batch culture, fed batch culture and continuous culture; Synchronous growth of microbes; Sporulation and reproduction and</p>

		<p>recombination in bacteria. Viruses, general characteristics, viral culture, Structure of viruses, Bacteriophages, Structure of T4 &amp; <math>\lambda</math>-phage; Lytic and Lysogenic cycles, viroid, Prions &amp; mycoplasma &amp; phytoplasma, actinomycetes &amp; plasmids and their economic uses.</p> <p><b>Unit V: Mushroom Cultivation, Lichenology &amp; Mycorrhiza</b> Mushroom cultivation. General account of lichens, reproduction and significance; <i>Mycorrhiza: ectomycorrhiza</i> and <i>endomycorrhiza</i> and their significance.</p>
October'25	18	<p><b>Unit III: Phycology</b> Range of thallus organization in Algae, Pigments, Reserve food – Reproduction - Classification and life cycle of – <i>Nostoc</i>, <i>Chlorella</i>, <i>Volvox</i>, <i>Hydrodictyon</i>, <i>Oedogonium</i>, <i>Chara</i>; <i>Sargassum</i>, <i>Ectocarpus</i>, <i>Polysiphonia</i>. Economic importance of algae - Role of algae in soil fertility- biofertilizer – Nitrogen fixation- Symbiosis; Commercial products of algae –biofuel, Agar.</p> <p><b>Unit VI: Plant Pathology</b> Disease concept, Symptoms, Etiology &amp; causal complex, Primary and secondary inoculum, Infection, Pathogenicity and pathogenesis, Koch's Postulates. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Postpenetration), Disease cycle (monocyclic, polycyclic and polyetic). Defense mechanism with special reference to Phytoalexin, Resistance- Systemic acquired and Induced systemic fungicides- Bordeaux mixture, Lime Sulphur, Tobacco decoction, Neem cake &amp; oil</p>
November'25	24	<p><b>Unit VII: Diseases and Control</b> Symptoms, Causal organism, Disease cycle and Control measures of – Early &amp; Late Blight of Potato, False Smut of Rice/ Brown spot of rice, Black Stem Rust of Wheat, <i>Alternaria</i> spot' and 'White rust of Crucifers, Red Rot of Sugarcane, Wilting of Arhar, Mosaic diseases on tobacco and cucumber, yellow vein mosaic of bhindi; Symptoms, Causal organism, Disease cycle and Control measures of –Citrus Canker, Little leaf of brinjal; Damping off of seedlings, Disease management: Quarantine, Chemical, Biological, Integrated pest disease management.</p> <p><b>Unit VIII: Applied Microbiology</b> Food fermentations and food produced by microbes, amino acids, Production of antibiotics, enzymes, vitamins, alcoholic beverages, organic acid &amp; genetic recombinant vaccines. Mass production of bacterial biofertilizers, blue green algae, <i>Azolla</i> and <i>mycorrhiza</i>. Plant growth promoting rhizobacteria &amp; biopesticides— <i>Trichoderma sp.</i> and <i>Pseudomonas</i>, Single cell proteins, Organic farming inputs, Microbiology of water, Biopolymers, Bioindicators, biosensors, Bioremediation, Production of biofuels, biodegradation of pollutants and biodeterioration of materials &amp; Cultural Property.</p> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Activity I:** Project on Mushroom Cultivation. (Unit V)

**Objective:** To develop skills and techniques on Mushroom cultivation.

**Methodology:** Inquiry based learning.

**Activity II:** Class presentation through ppt on topics of Unit VIII.

**Objective:** To develop the concept of application of microbiology.

**Methodology:** Individual learning.

### **Suggested readings:**

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Chopra. G. L. 1984. A text book of Algae, Rastogi publications, Meerut, India.
3. Desikachari, T. V. 1959. Cyanophyta, ICAR, New Delhi.
4. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
5. Fritsch, R. E. 1977. Structure and Reproduction of Algae, Cambridge University Press, London.
6. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
7. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition. Singapore, Singapore: John Wiley & Sons.
8. Sharma, P.D. (2011). Plant Pathology. Meerut, U.P.: Rastogi Publication.
9. Pandey B.P. 2001. College Botany Volume 1, S Chand & Company Pvt.Ltd, New Delhi.
10. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
11. Pelzar, 1963. Microbiology, Tata Mc Graw Hill, New Delhi
12. Sharma, P. D. 2012, Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.
13. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
14. Vashishta, B.R. Sinha, A.K. and Singh, V. P. 1991. Algae, S. Chand and Company, Pvt. Ltd., New Delhi.

### **Suggestive Digital Platforms / Web Links:**

1. <https://indianculture.gov.in/rarebooks/economic-botany-india>
2. <https://www.coursera.org/courses?query=plants>
3. <http://egyankosh.ac.in/handle/123456789/53530>
4. <https://www.classcentral.com/tag/microbiology>
5. <https://www.edx.org/learn/microbiology>
6. <https://www.mooc-list.com/tags/microbiology>
7. <https://www.udemy.com/topic/microbiology/>
8. <https://ucmp.berkeley.edu/bacteria/bacteria.html>
9. <https://www.livescience.com/53272-what-is-a-virus.html>
10. <https://gclambathach.in/lms/Economic%20importance%20of%20Algae.pdf>
11. <https://www.slideshare.net/sardar1109/algae-notes-1>
12. <https://www.onlinebiologynotes.com/algae-general-characteristics-classification/>

**MAJOR: BOTANY**  
**Course Code: B040102P**  
**Paper II (Practical)**

**Credits: 2**

**Course Title: Techniques in Microbiology & Plant Pathology**

**Max. Marks: 75+25**

**Course outcomes:**

After the completion of the course the students will be able:

1. Understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.
2. Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes.
3. Practical skills in the field and laboratory experiments in Microbiology & Pathology.
4. Learn to identify Algae, Lichens and plant pathogens along with their Symbiotic and Parasitic associations.
5. Can initiate his own Plant & Seed Diagnostic Clinic
6. Can start own enterprise on microbial products

Month	W. Days	Topics to be covered
August'25	24	<p><b>Unit I:</b></p> <ol style="list-style-type: none"> <li>1. Laboratory safety and good laboratory practices.</li> <li>2. Principles and application of Laboratory instruments- microscope, incubator, autoclave, centrifuge, LAF, filtration unit, shaker, pH meter.</li> <li>3. Buffer preparation &amp; titration</li> <li>4. Cleaning and Sterilization of glasswares</li> <li>5. Preparation of media- Nutrient Agar and Broth</li> <li>6. Inoculation and culturing of bacteria in Nutrient agar and nutrient broth</li> <li>7. Preparation of agar slant, stab, agar plate</li> </ol> <p><b>Unit II:</b></p> <ol style="list-style-type: none"> <li>1. Isolation of bacteria.</li> <li>2. Identification of bacteria through gram staining.</li> <li>3. Cultural characteristics of bacteria on NA.</li> <li>4. Pure culture techniques (Types of streaking).</li> <li>5. Biochemical characterization: Nitrate reduction test, Catalase test, Starch hydrolysis.</li> </ol>
September'25	22	<p><b>Unit III:</b></p> <ol style="list-style-type: none"> <li>1. Identification of fungi by lactophenol cotton blue method. <i>Rhizopus, Saccharomyces, Penicillium, Peziza, Ustilago, Puccinia; Fusarium, Curvularia, Alternaria, Agaricus.</i></li> <li>2. Specimens of button stage and full grown mushroom; Sectioning of gills of <i>Agaricus</i>.</li> <li>3. Lichens: crustose, foliose and fruticose specimens.</li> </ol> <p><b>Unit IV- PHYCOLOGY:</b></p> <ol style="list-style-type: none"> <li>1. Type study of algae and Cyanobacteria –<i>Spirullina, Nostoc.</i> Chlorophyceae - <i>Chlorella, Volvox, Oedogonium, Cladophora,</i> and <i>Chara</i>; Xanthophyceae – <i>Vaucheria</i>; Bacillariophyceae – <i>Pinnularia</i> Phaeophyceae – <i>Sargassum</i> Rhodophyceae - <i>Polysiphonia</i></li> </ol>
October'25	18	<p><b>Unit V: EXPERIMENTAL PLANT PATHOLOGY</b></p> <ol style="list-style-type: none"> <li>1. Preparation of fungal media (PDA) &amp; Sterilization process.</li> <li>2. Isolation of pathogen from diseased leaf.</li> <li>3. Identification: Pathological specimens of Brown spot of rice,</li> </ol>

		<p>Bacterial blight of rice, Loose smut of wheat, Late blight of potato; Slides of uredial, telial, pycnial &amp; aecial stages of <i>Puccinia</i>, Few viral and bacterial plant diseases.</p> <p><b>Unit VI:</b></p> <ol style="list-style-type: none"> <li>1. Isolation of nitrogen fixing bacteria from root nodules of legumes.</li> <li>2. Enumeration of rhizosphere to non rhizosphere population of bacteria.</li> <li>3. Isolation of phyllosphere microflora.</li> <li>4. Isolation of P solubilizing microorganisms.</li> </ol>
November'25	24	<p><b>Unit VII: PRACTICALS IN APPLIED MICROBIOLOGY-2</b></p> <ol style="list-style-type: none"> <li>1. Wine production.</li> <li>2. Isolation of lactic acid bacteria from curd.</li> <li>3. Isolation of lipolytic organisms from butter or cheese.</li> <li>4. Immobilized bacterial cells for production of hydrolytic enzymes.</li> <li>5. Enzyme production and assay – cellulase, protease and amylase.</li> <li>6. Immobilization of yeast.</li> <li>7. Isolation of cellulolytic and anaerobic sulphate reducing bacteria.</li> <li>8. Isolation and characterization of acidophilic, alkalophilic and halophilic bacteria.</li> </ol> <p><b>Unit VIII</b></p> <ol style="list-style-type: none"> <li>1. Visit to NBAIM, Mau, Varanasi (Kashi)/ IMTECH (Institute of Microbial Technology), Chandigarh for viewing Culture Repository. (Optional)</li> <li>2. Mushroom cultivation for Protein</li> <li>3. Alcohol production from Sugarcane Juice.</li> </ol> <p><b>Revision &amp; Internal Examination</b></p>

**Activity I:** Visit to IIVR/ Central Instrumental facility of Botany Department, BHU, Varanasi.  
Or, Local pond collection of water for Microbial studies

**Objective:** To understand the instruments, techniques, lab etiquettes and good lab practices for working in laboratory and To develop skills and techniques on Mushroom cultivation and to observe plant diseases in crop field as well as algae.

**Methodology:** Expeditionary learning.

**Suggested readings:**

1. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
2. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
3. Pandey. B.P. 2014 Modern Practical Botany, (Vol-I) S. Chand and Company Pvt. Ltd., New Delhi.
4. Singh, R. P. 2007. Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.

**Suggestive Digital Platforms / Web Links:**

1. <https://microbiologysociety.org/publication/education-outreach-resources/basic-practical-microbiology-a-manual.html>
2. <https://microbiologyonline.org/file/7926d7789d8a2f7b2075109f68c3175e.pdf>
3. <https://www.mooc-list.com/tags/microbiology>
4. <https://www.coursera.org/courses?query=plants>
5. <http://egyankosh.ac.in/handle/123456789/53530>

**MAJOR: CHEMISTRY**  
**Paper I (Theory)**  
**Course Code: B020101T**

**Credits: 4**

**Course Title: Fundamentals of Chemistry**

**Max. Marks: 75+25**

**Course outcomes:**

There is nothing more fundamental to chemistry than the chemical bond. Chemical bonding is the language of logic for chemists. Chemical bonding enables scientists to take the 100-plus elements of the periodic table and combine them in myriad ways to form chemical compounds and materials. Periodic trends, arising from the arrangement of the periodic table, provide chemists with an invaluable tool to quickly predict an element's properties. These trends exist because of the similar atomic structure of the elements within their respective group families or periods, and because of the periodic nature of the elements. Reaction mechanism gives the fundamental knowledge of carrying out an organic reaction in a step-by-step manner. This course will provide a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.

Students will gain an understanding of:

1. Molecular geometries, physical and chemical properties of the molecules.
2. Current bonding models for simple inorganic and organic molecules in order to predict structures and important bonding parameters.
3. The chapter Recapitulation of basics of organic chemistry gives the most primary and utmost important knowledge and concepts of organic Chemistry.
4. This course gives a broader theoretical picture in multiple stages in an overall chemical reaction. It describes reactive intermediates, transition states and states of all the bonds broken and formed .It enables to understand the reactants, catalyst, stereochemistry and major and minor products of any organic reaction.
5. It describes the types of reactions and the Kinetic and thermodynamic aspects one should know for carrying out any reaction and the ways how the reaction mechanism can be determined.
6. The chapter stereochemistry gives the clear picture of two-dimensional and three-dimensional structure of the molecules, and their role in reaction mechanism.

Month	Working Days	Topics to be covered
August'25	24	<b>Unit I:</b> Introduction to Indian ancient Chemistry and contribution of Indian Chemists, in context to the holistic development of modern science and technology, should be included under Continues Evaluation (CIE). <b>Molecular polarity and Weak Chemical Forces :</b> Resonance and resonance energy, formal charge, Van der Waals forces, ion-dipole forces, dipole- dipole interactions, induced dipole interaction, dipole moment and molecular Structure (Diatomic and polyatomic molecules), Percentage ionic character from dipole moment, polarizing power and polarizability. Fajan's rules and consequences of polarization. Hydrogen bonding, van der Waals forces, ion-dipole forces, dipole-dipole interactions,

		<p>induced dipole interaction. Effects of weak chemical forces, melting and boiling points, solubility, energetics of dissolution process. Lattice energy and Born-Haber cycle, solvation energy, and solubility of ionic solids.</p> <p><b>Unit II: Simple Bonding theories of Molecules:</b> Atomic orbitals, Aufbau principle, multiple bonding (<math>\sigma</math> and <math>\pi</math> bond approach) and bond lengths, the valence bond theory (VBT), Concept of hybridization, hybrid orbitals and molecular geometry, Bent's rule, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H<sub>2</sub>O, NH<sub>3</sub>, PCl<sub>5</sub>, SF<sub>6</sub>, SF<sub>4</sub>, ClF<sub>3</sub>, I<sub>3</sub>, ClF<sub>2</sub> and SO<sub>4</sub> and H<sub>3</sub>O<sup>+</sup>. Molecular orbital theory (MOT). Molecular orbital diagrams bond orders of homonuclear and heteronuclear diatomic molecules and ions (N<sub>2</sub>, O<sub>2</sub>, C<sub>2</sub>, B<sub>2</sub>, F<sub>2</sub>, CO, NO, and their ions)</p>
September'25	24	<p><b>Unit III: Periodic properties of Atoms (with reference to s &amp; p-block):</b> Brief discussion, factors affecting and variation trends of following properties in groups and periods. Effective nuclear charge, shielding or screening effect, Slater rules, Atomic and ionic radii, Electronegativity, Pauling's/ Allred Rochow's scales, Ionization enthalpy, Electron gain enthalpy</p> <p><b>Unit IV: Recapitulation of basics of Organic Chemistry:</b> Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, Van der Waals interactions, inclusion compounds, Clathrates, Charge transfer complexes, hyperconjugation, Dipole moment; Electronic Displacements: Inductive, electromeric, resonance mesomeric effects and their applications</p>
October'25	18	<p><b>Unit V: Mechanism of Organic Reactions:</b> Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations. Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).</p> <p><b>Unit VI: Stereochemistry</b>-Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomer, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D &amp; L and R &amp; S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E &amp; Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane,</p>

		axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation
November'25	24	<p><b>Unit VII: Basic Computer system (in brief)</b>-Hardware and Software; Input devices, Storage devices, Output devices, Central Processing Unit (Control Unit and Arithmetic Logic Unit); Number system (Binary, Octal and Hexadecimal Operating System); Computer Codes (BCD and ASCII); Numeric/String constants and variables. Operating Systems (DOS, WINDOWS, and Linux); Software languages: Low level and High Level languages (Machine language, Assembly language; QBASIC, FORTRAN and C++); Software Products (Office, chemsketch, scilab, matlab, hyperchem, etc.), internet application.</p> <p><b>Unit VIII: Mathematical Concepts for Chemistry:</b> Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like <math>Kx</math>, <math>ex</math>, <math>Xn</math>, <math>\sin x</math>, <math>\log x</math>; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations, Factorials, Probability</p> <p><b>Revision &amp; Internal Examination</b></p>

**Activity:** Power point presentation on stereochemistry of molecule and chemical bonding so that they can visualize 3 D structure and arrangement of molecule in space. (Unit VI)

**Objective:** Student can able to understand about stereochemistry and 3d structure of molecule

**Methodology:** Individual learning.

**Suggested Readings:**

1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010
2. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.
3. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
4. Shriver, D.D. & P. Atkins, *Inorganic Chemistry 2nd Ed.*, Oxford University Press, 1994.
5. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.
6. Singh J., Yadav L.D.S., Advanced Organic Chemistry, Pragati Edition
7. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Carey, F. A., Giuliano, R. M. *Organic Chemistry*, Eighth edition, McGraw Hill Education, 2012.
9. Loudon, G. M. *Organic Chemistry*, Fourth edition, Oxford University Press, 2008.
10. Sykes, P. *A guidebook to Mechanism in Organic Chemistry*, Pearson Education, 2003
11. Francis, P. G. Mathematics for Chemists, Springer, 1984

**Suggestive Digital Platforms / Web Links:**

1. <http://heecontent.upsdc.gov.in/Home.aspx>
2. <https://nptel.ac.in/courses/104/106/104106096/>
3. <http://heecontent.upsdc.gov.in/Home.asp>

**MAJOR: CHEMISTRY****Paper II (Practical)****Course code: B020102P****Credits: 2****Course Title: Quantitative Analysis****Max. Marks: 75+25****Course Outcomes:**

Upon completion of this course the students will have the knowledge and skills to understand the laboratory methods and tests related to estimation of metals ions and estimation of acids and alkali contents in commercial products. The students will be able to accomplish following objectives:

1. Potability tests of water samples.
2. Estimation of metal ions in samples.
3. Estimation of alkali and acid contents in samples.
4. Estimation of inorganic salts and hydrated water in samples.

Month	Working Days	Topics to be covered
August'24	25	<b><u>Unit I: Water Quality analysis</u></b> 1. Estimation of hardness of water by EDTA. 2. Determination of chemical oxygen demand (COD). 3. Determination of Biological oxygen demand (BOD).
September'24	23	<b><u>Unit II: Estimation of Metals ions</u></b> 1. Estimation of ferrous and ferric by dichromate method. 2. Estimation of copper using thiosulphate.
October'24	17	<b><u>Unit III: Estimation of acids and alkali contents</u></b> 1. Determination of acetic acid in commercial vinegar using NaOH. 2. Determination of alkali content – antacid tablet using HCl. 3. Estimation of oxalic acid by titrating it with KMnO <sub>4</sub> .
November'24	23	<b><u>Unit IV: Estimation of inorganic salts and hydrated water</u></b> 1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of calcium content in chalk as calcium oxalate by permanganometry. 3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO <sub>4</sub> <b>Revision &amp; Internal Examination</b>

**Activity:** Visit to Department of Biomedical Engineering, IIT, BHU for Hands on training for the determination of BOD and COD.

**Objective:** To understand the instruments, techniques and lab etiquettes for working in laboratory and practical demonstration of above practical.

**Methodology:** Expeditionary learning.

**Suggested Readings:**

1. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
2. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
3. Skoog, D.A. Holler F.J. and Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Edition

**Suggestive digital platforms / web links:**

1. <https://www.labster.com/chemistry-virtual-labs/>
2. <https://www.vlab.co.in/broad-area-chemical-sciences>

**MAJOR: ZOOLOGY**  
**Paper I (Theory)**  
**Course Code: B050101T**

**Credits: 4**

**Course Title: Cytology, Genetics and Infectious Diseases**

**Max. Marks: 75 +25**

**Min. Marks: 25+10**

**Course outcomes:**

The student at the completion of the course will be able to:

1. Understand the structure and function of all the cell organelles.
2. Know about the chromatin structure and its location.
3. To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
4. How one cell communicates with its neighboring cells?
5. Understand the basic principles of genetics and how genes (earlier called factors) are inherited from one generation to another.
6. Understand the Mendel's laws and the deviations from conventional patterns of inheritance.
7. Comprehend how environment plays an important role by interacting with genetic factors.
8. How to detect chromosomal aberrations in humans and study the pattern of inheritance by pedigree analysis in families.

Month	W. Days	Topics to be covered
August'25	24	<p><b>Unit I: Structure and Function of Cell Organelles I</b></p> <ul style="list-style-type: none"> <li>• Plasma membrane: chemical structure—lipids and proteins</li> <li>• Cell-cell interaction: cell adhesion molecules, cellular junctions</li> <li>• Endomembrane system: protein targeting and sorting, endocytosis, exocytosis</li> </ul> <p><b>Unit II: Structure and Function of Cell Organelles II</b></p> <ul style="list-style-type: none"> <li>• Cytoskeleton: microtubules, microfilaments, intermediate filaments</li> <li>• Mitochondria: Structure, oxidative phosphorylation</li> <li>• Peroxisome and ribosome: structure and function</li> </ul>
September'25	22	<p><b>Unit III: Nucleus and Chromatin Structure</b></p> <ul style="list-style-type: none"> <li>• Structure and function of nucleus in eukaryotes</li> <li>• Chemical structure and base composition of DNA and RNA</li> <li>• DNA super-coiling, chromatin organization, structure of chromosomes</li> <li>• Types of DNA and RNA</li> </ul> <p><b>Unit IV: Cell cycle, Cell Division and Cell Signaling</b></p> <ul style="list-style-type: none"> <li>• Cell division: mitosis and meiosis</li> <li>• Cell cycle and its regulation, apoptosis</li> <li>• Signal transduction: intracellular signaling and cell surface receptors, via G-protein linked receptors, JAK-STAT pathway</li> </ul>

<p>October'25</p>	<p>18</p>	<p><b>Unit V: Mendelism and Sex Determination</b></p> <ul style="list-style-type: none"> <li>• Basic principles of heredity: Mendel's laws, monohybrid and dihybrid crosses</li> <li>• Complete and Incomplete Dominance</li> <li>• Penetrance and expressivity</li> <li>• Genetic Sex-Determining Systems, Environmental Sex Determination, Sex Determination in <i>Drosophila</i>, Sex Determination in Humans</li> <li>• Sex-linked characteristics and Dosage compensation</li> </ul> <p><b>Unit VI: Extensions of Mendelism, Genes and Environment</b></p> <ul style="list-style-type: none"> <li>• Extensions of Mendelism: Multiple Alleles, Gene Interaction</li> <li>• The Interaction Between Sex and Heredity: Sex-Influenced and Sex- Limited Characteristics</li> <li>• Cytoplasmic Inheritance, Genetic Maternal Effects</li> <li>• Genomic Imprinting, Anticipation</li> <li>• Interaction between Genes and Environment: Environmental Effects on Gene Expression, Inheritance of Continuous Characteristics.</li> </ul>
<p>November'25</p>	<p>24</p>	<p><b>Unit VII: Human Chromosomes and Patterns of Inheritance</b></p> <ul style="list-style-type: none"> <li>• Human karyotype</li> <li>• Chromosomal anomalies: Structural and numerical aberrations with examples</li> <li>• Pedigree analysis</li> <li>• Patterns of inheritance: autosomal dominant, autosomal recessive, X-linked recessive, X-linked dominant</li> </ul> <p><b>Unit VIII: Infectious Diseases</b></p> <ul style="list-style-type: none"> <li>• Introduction to pathogenic organisms: viruses, bacteria, fungi, protozoa, and worms.</li> <li>• Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of common parasites: <i>Trypanosoma</i>, <i>Giardia</i> and <i>Wuchereria</i>.</li> </ul> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

*Activity I: PowerPoint Presentation on Cell structure and Cell division.*

*Objective: To understand function of Cell organelles and Concept of Cell division.*

*Methodology: Individual learning.*

*Activity II: Group discussion on parasites and associated diseases.*

*Objective: To understand about parasitic diseases.*

*Methodology: Group learning.*

**Suggested Readings:**

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).

**MAJOR: ZOOLOGY**  
**Paper II (Practical)**  
**Course Code: B050102P**

**Credits: 2**

**Course Title: Cell Biology & Cytogenetics Lab**

**Max. Marks: 75 +25**

**Course outcomes:**

1. To use simple and compound microscopes.
2. To prepare slides and stain them to see the cell organelles.
3. To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
4. The chromosomal aberrations by preparing karyotypes.
5. How chromosomal aberrations are inherited in humans by pedigree analysis in families.
6. The antigen-antibody reaction.

Month	W. Days	Topics to be covered
August'25	24	<b>Unit I:</b> 1. To study different cell types such as buccal epithelial cells, neurons, striated muscle cells using Methylene blue. 2. To study the different stages of Mitosis in root tip of onion. 3. To study the different stages of Meiosis in grasshopper testis.
September'25	22	<b>Unit I:</b> 1. To prepare molecular models of nucleotides, amino acids, dipeptides using bead and stick method. 2. To check the permeability of cells using salt solution of different concentrations. <b>Unit II:</b> 1. Study of parasites (eg. Protozoans, helminth <i>etc.</i> ) from permanent slides. 3. To learn the procedures for preparation of temporary and permanent stained/unstained slides.
October'25	18	<b>Unit III:</b> 1. Study of mutant phenotypes of <i>Drosophila</i> . 2. Preparation of polytene chromosomes. 3. Study of sex chromatin (Barr bodies) in buccal smear and hair bud cells (Human). 4. Preparation of human karyotype and study the chromosomal aberrations with respect to number, translocation, deletion etc. from the pictures provided. 5. To prepare family pedigrees.
November'25	24	<b>Unit IV:</b> <b>Virtual Labs (Suggestive sites)</b> <a href="https://www.vlab.co.in">https://www.vlab.co.in</a> <a href="https://zoologysan.blogspot.com">https://zoologysan.blogspot.com</a> <a href="http://www.vlab.iitb.ac.in/vlab">www.vlab.iitb.ac.in/vlab</a> <a href="http://www.onlinelabs.in">www.onlinelabs.in</a> <a href="http://www.powershow.com">www.powershow.com</a> <a href="https://vlab.amrita.edu">https://vlab.amrita.edu</a> <a href="https://sites.dartmouth.edu">https://sites.dartmouth.edu</a> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Suggested Readings:**

1. Yadav and Varshney: Modern Practical Zoology Vol.I. Kedar Nath Ram Nath Publication (2021).

## VOCATIONAL / SKILL DEVELOPMENT

### Any one Subject:

1. Voluntary Actions and NGO Management
2. Data Analysis through SPSS
3. Business English

### VOLUNTARY ACTION & NGO MANAGEMENT

**Credits: 3**

**Max. Marks:25+75**

#### Course Outcomes:

- To understand the concept and historical evolution of voluntary action in India.
- To understand the concept, characteristics and types of voluntary organizations/NGOS.
- To acquire skills of registration, management of NGOs and writing proposals.

Month	W. Days	Topics to be covered
August' 25	24	<p><b>Unit I</b></p> <p><b>Historical Review of voluntary action in India:</b> voluntary action in the 19<sup>th</sup> century, British period, the early post-independence period. Structure of voluntary action, nature and concept of voluntary action, rationale behind voluntary action, dimensions of voluntary action, motivation and inspiration for voluntary work.</p> <p><i>Activity: PPT Presentation by the students on the topic voluntary action in the 19<sup>th</sup> century</i></p> <p><i>Objective: To develop the interest about the concept of voluntary action</i></p> <p><i>Methodology: PPT Presentation</i></p>
September' 25	22	<p><b>Unit II</b></p> <p><b>Non-Governmental Organizations (NGOs):</b> Meaning, characteristics, types and objectives- relief, charity, developmental activism for mainstreaming of women, s/c and s/t mobilization, lobbying, collaboration and networking.</p> <p><b>Classification of organizations:</b> Non-Governmental Developmental Organization (NGDO), Voluntary Organization (VO), Voluntary Agency (VA), International Non-Governmental Organization (INGO), Business oriented International Non-Governmental Organization (INGO), Business oriented International Nongovernmental Organization (BINGO), Religious International Non-Governmental Organization (RINGO), Government Operated Non-Governmental Organization (GONGO), Environmental Non-Governmental Organization (ENGO), Quasi-autonomous Non-Governmental Organization (QUANGO).</p>
October' 25	18	<p><b>Unit III</b></p> <p><b>Management of NGOs:</b> Objectives of association, understanding an organization, Registration as a legal form, memorandum of Association, By- Laws, Registration process and renewal by Registrar, Powers of Registrar, duties and rights of members, Management Committee, Election and other provisions under (section 20) of SR Act 1860. NGOs relation with administration, Documents of NGO, Acts and provisions: Societies Registration Act 1860. Indian Trust Act 1882. The Indian Companies Act 1956</p>

		(Section 25), Trade Union Act 1926. Registration on Darpan portal, 12 A, 80 G., F.C.R.A.
		<b>Activity:</b> Visit to an NGO <b>Objective:</b> To acquaint the students with the working of an NGO <b>Methodology:</b> Educational Visit
November' 25	24	<b>Unit IV</b> <b>Project Proposal writing for resource mobilizing:</b> local community resources, Government resources, national and international sources, Resource Utilization, Capital budgeting, income and expenditure statements, accounts and book banks, bank reconciliation statement, inventory, cash and receivable management. Taxation and Assessment of Trust and Society. Transparency and credibility building (social audit) Vouching and verification of accounts. <b>Unit V</b> <b>Project work/Internship/Field work (Non Lecture Mode) -</b> Understand grass roots issues and grass roots actions being taken by community based organizations (CBOs), writing of reports, identification of gap: implementation, generation of ideas and collaboration with local leaders administration. Presentation of reports in writing and/or in audio-visual mode. <b>Revision &amp; Internal Examination</b>

**Suggested Readings:**

- <https://egyankosh.ac.in/bitstream/123456789/17111/1/Unit-4.pdf>
- [https://pria-academy.org/pdf/ngom/NGOM\\_1.pdf](https://pria-academy.org/pdf/ngom/NGOM_1.pdf)
- [https://ir.nbu.ac.in/bitstream/123456789/1393/9/09\\_chapter\\_02.pdf](https://ir.nbu.ac.in/bitstream/123456789/1393/9/09_chapter_02.pdf)
- [https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004131505182050sandhya\\_yadav\\_sw\\_Non\\_Governmental\\_Organizations.pdf](https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004131505182050sandhya_yadav_sw_Non_Governmental_Organizations.pdf)
- <https://mpbou.edu.in/slm/bswc14.pdf>

**Note- Latest edition of the text books should be used.**

## STATISTICAL ANALYSIS THROUGH SPSS

**Credits: 3**

**Max. Marks:25+75**

**Course Outcomes:**

The objective of this paper is to give basic knowledge about Data Analytics and SPSS.

<b>Month</b>	<b>W. Days</b>	<b>Topics to be covered</b>
August' 25	24	<b>Unit I</b> Data inputs: Entering data in Excel. Creating new variables, Recoding variables, and renaming variables.
September' 25	22	<b>Unit II</b> SPSS Environment entering data in SPSS, Data Preparation, Data Transformation, # representation of data. Descriptive Statistics (measures of central tendency, variability, skewness, and kurtosis.
		<i>Activity: Extract the data from web sources and TRANSFORM it through SPSS.</i> <i>Objective: To Understand basic knowledge of ANALYTICS through SPSS</i> <i>Methodology: Practical learning</i>
October' 25	18	<b>Unit III</b> Inferential Statistics-Parametric test: Test for Normality, t-test for single mean, t-test for difference between means, paired t-test.
November' 25	24	<b>Unit IV</b> Analysis of Variance (One-way & Two-way). The correlation coefficient, Linear Regression <b>Revision &amp; Internal Examination</b>
		<i>Activity: Presentation and Implementation of all data analytics calculations through SPSS.</i> <i>Objective: To help the students to understand the importance of ANALYTICAL CALCULATION in this Business Era.</i> <i>Methodology: PPT Presentation</i>

**Suggested Readings:**

1. Morgan C A: SPSS for Introductory Statistics; Uses and Interpretation.
2. Robert H. Carver: Data Analysis with SPSS (Version 16).
3. Kiran Pandya, Smruti Bulsari and Sanjay Sinha: SPSS in Simple Steps

**Note- Latest edition of the text books should be used.**

**Course Outcomes:**

After completing this course, the students will be able to:

CO1: Develop written expression of thought and get opportunities to explore ideas and to build connections among different content writing areas.

CO2: Comprehend public speaking abilities through informal and formal conversations.

CO3: Increase their reading speed and understanding through comprehension passages and enlarge their vocabulary through reading synonyms, antonyms, Idioms and phrases.

<b>Month</b>	<b>Working Days</b>	<b>Topic</b>
August'25	24	<b>Unit I:</b> Application and Business Letter Format and Style Enquiries and Replies Business Profile and Proposal
September' 25	22	<b>Unit II:</b> Office Communication and Notification Circular and Memo-Writing Personal Writing: Designing Visiting Cards, Letter pads, Formal and Informal greetings, Postcards, Invitation, Acceptance, and Refusal.
October'25	18	<b>Unit III:</b> Advanced Resume Writing, Reading Comprehension Synonyms, Antonyms Idiom and Phrases
November'25	24	Revision & Internal Examination

*Activity:* Group presentation and small play on effective advertisement.

*Objective:* To enhance their presentation and communication skill.

*Methodology:* Presentation method, Skit

**Books Recommended:**

- R. K. Khanna, Kaushik Sinha: *English for students of Commerce*, OPU
- Krishna Mohan, Meera Banerjee: *Developing Communication Skills*, Macmillan
- Wren & Martin: *English For Competitive Examinations*, S Chand Publishing

## CO-CURRICULAR

**Course Title: First Aid & Health**

**Credits: 2**

**Max. Marks: 100**

**Course outcomes:**

1. Learn the skills to provide CPR to infants, children and adults.
2. Learn the skills to handle emergency child birth
3. Learn the Basic sex education help young people navigate thorny questions responsibly and with confidence.
4. Learn the Basic sex education help youth to understand Sex is normal. It's a deep, powerful
5. Instinct at the core of our survival as a species. Sexual desire is a healthy drive.
6. Help to understand natural changes of adolescence
7. Learn the skill to identify Mental Health status and Psychological First Aid

Month	W. Days	Topics to be covered
August' 25	24	<p><b>Unit I:</b></p> <p>A. Basic First Aid</p> <ol style="list-style-type: none"> <li>1. Aims of first aid &amp; First aid and the law.</li> <li>2. Dealing with an emergency, Resuscitation (basic CPR).</li> <li>3. Recovery position, Initial top to toe assessment.</li> <li>4. Hand washing and Hygiene</li> <li>5. Types and Content of a First aid Kit First AID Technique</li> </ol> <p>1. Dressings and Bandages.</p> <p>2. Fast evacuation techniques (single rescuer).</p> <p>3. Transport techniques.</p> <p>C. First aid related with respiratory system</p> <ol style="list-style-type: none"> <li>1. Basics of Respiration.</li> <li>2. No breathing or difficult breathing, Drowning, Choking, Strangulation and hanging,</li> <li>3. Swelling within the throat, Suffocation by smoke or gases and Asthma.</li> </ol> <p>D. First aid related with Heart, Blood and Circulation</p> <ol style="list-style-type: none"> <li>1. Basics of The heart and the blood circulation.</li> <li>2. Chest discomfort, bleeding.</li> </ol> <p>D. First aid related with Wounds and Injuries</p> <ol style="list-style-type: none"> <li>1. Type of wounds, Small cuts and abrasions</li> <li>2. Head, Chest, Abdominal injuries</li> <li>3. Amputation, Crush injuries, Shock</li> </ol> <p>E. First aid related with Bones, Joints Muscle related injuries</p> <ol style="list-style-type: none"> <li>1. Basics of The skeleton, Joints and Muscles.</li> </ol> <p>Fractures (injuries to bones).</p>
September' 25	22	<p><b>Unit II:</b></p> <p>F. First aid related with Nervous system and Unconsciousness</p> <ol style="list-style-type: none"> <li>1. Basics of the nervous system.</li> <li>2. Unconsciousness, Stroke, Fits – convulsions – seizures, Epilepsy.</li> </ol> <p>G. First aid related with Gastrointestinal Tract</p> <ol style="list-style-type: none"> <li>1. Basics of The gastrointestinal system.</li> <li>2. Diarrhea, Food poisoning.</li> </ol>

		<p>H. First aid related with Skin, Burns</p> <ol style="list-style-type: none"> <li>1. Basics of The skin.</li> <li>2. Burn wounds, Dry burns and scalds (burns from fire, heat and steam).</li> <li>3. Electrical and Chemical burns, Sun burns, heat exhaustion and heatstroke.</li> <li>4. Frost bites (cold burns), Prevention of burns, Fever and Hypothermia.</li> </ol> <p>I. First aid related with Poisoning</p> <ol style="list-style-type: none"> <li>1. Poisoning by swallowing, Gases, Injection, Skin</li> </ol> <p>J. First aid related with Bites and Stings</p> <ol style="list-style-type: none"> <li>1. Animal bites, Snake bites, Insect stings and bites</li> </ol> <p>K. First aid related with Sense organs</p> <ol style="list-style-type: none"> <li>1. Basic of Sense organ.</li> <li>2. Foreign objects in the eye, ear, nose or skin.</li> <li>3. Swallowed foreign objects.</li> </ol> <p>L. Specific emergency satiation and disaster management</p> <ol style="list-style-type: none"> <li>1. Emergencies at educational institutes and work</li> <li>2. Road and traffic accidents.</li> <li>3. Emergencies in rural areas.</li> <li>4. Disasters and multiple casualty accidents.</li> <li>5. Triage.</li> </ol> <p>M. Emergency Child birth</p>
October' 25	18	<p><b>Unit III</b></p> <p>Basic Sex Education</p> <ol style="list-style-type: none"> <li>1. Overview, ground rules, and a pre-test</li> <li>2. Basics of Urinary system and Reproductive system.</li> <li>3. Male puberty — physical and emotional changes</li> <li>4. Female puberty — physical and emotional changes</li> <li>5. Male-female similarities and differences</li> <li>6. Sexual intercourse, pregnancy, and childbirth</li> <li>7. Facts, attitudes, and myths about LGBTQ+ issues and identities</li> <li>8. Birth control and abortion</li> <li>9. Sex without love — harassment, sexual abuse, and rape</li> <li>10. Prevention of sexually transmitted diseases.</li> </ol>
November' 25	24	<p><b>Unit IV:</b></p> <p>Mental Health and Psychological First Aid</p> <ol style="list-style-type: none"> <li>1. What is Mental Health First Aid?</li> <li>2. Mental Health Problems in the India</li> <li>3. The Mental Health First Aid Action Plan</li> <li>4. Understanding Depression and Anxiety Disorders</li> <li>5. Crisis First Aid for Suicidal Behavior &amp; Depressive symptoms</li> <li>6. What is Non-Suicidal Self-Injury?</li> <li>7. Non-crisis First Aid for Depression and Anxiety</li> <li>8. Crisis First Aid for Panic Attacks, Traumatic events</li> <li>9. Understanding Disorders in Which Psychosis may Occur</li> </ol> <p>Crisis First Aid for Acute Psychosis</p> <ol style="list-style-type: none"> <li>1. Understanding Substance Use Disorder</li> <li>2. Crisis First Aid for Overdose, Withdrawal Using Mental Health First Aid</li> </ol>

**Activity I:** Assignment on the topic “Mental Health and Cures”.

**Objective:** Student will be able to understand about Protein.

**Methodology:** Writing skills.

**Activity II:** Class presentation on the topic “First Health Methods”.

**Objective:** To make students aware about common health issues in the society.

**Methodology:** PPT presentation.

**Suggested Readings:**

1. Singh, Anita, “Food and Nutrition”, Star Publication, Agra, India, 2018.
2. 1000Days-Nutrition\_Brief\_Brain-Think\_Babies\_FINAL.pdf.
3. <https://pediatrics.aappublications.org/content/141/2/e20173716>.
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909>.

**Latest edition of the text books should be used.**

# SEMESTER- II

**MAJOR/MINOR: BOTANY**  
**Course Code: B040201T**  
**Paper I (Theory)**  
**Course Title: Archegoniates and Plant Architecture**

**Credits: 4**

**Max. Marks: 75+25**

**Course outcomes:**

After the completion of the course the students will be able to:

1. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms
2. Understanding of plant evolution and their transition to land habitat.
3. Understand morphology, anatomy, reproduction and developmental changes therein through. typological study and create a knowledge base in understanding the basis of plant diversity, economic values & taxonomy of plants
4. Understand the details of external and internal structures of flowering plants.

Month	Working Days	Topics to be covered
January' 26	19	<p><b>Unit I- Introduction to Archegoniates &amp; Bryophytes</b>            Unique features of archegoniates, Bryophytes: General characteristics, adaptations to land habit, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of <i>Riccia</i>, <i>Marchantia</i>, <i>Anthoceros</i> and <i>Sphagnum</i>. (Developmental details not to be included). economic importance of bryophytes .</p> <p><b>Unit V- Angiosperm Morphology (Stem, Roots, Leaves &amp; Flowers, Inflorescence)</b>            Morphology and modifications of roots; Stem, leaf and bud. Types of inflorescences; flowers, flower parts, fruits and types of placentation; Definition and types of seeds.</p>
February'26	23	<p><b>Unit II- Pteridophytes</b>            General characteristics, Early land plants (<i>Rhynia</i>). Classification (up to family) with examples, Heterospory and seed habit, stelar evolution, economic importance of Pteridophytes.</p> <p><b>Unit VI-Plant Anatomy:</b> Meristematic and permanent tissues, Organs (root, stem and leaf). Apical meristems &amp; theories on apical organization - Apical cell theory, Histogen theory, Tunica - Corpus theory. Secondary growth - Root and stem- cambium (structure and function) annular rings, Anomalous secondary growth - <i>Bignonia</i>, <i>Boerhaavia</i>, <i>Dracaena</i>, <i>Nyctanthes</i></p>
March' 26	20	<p><b>Unit III- Gymnosperms</b>            Classification and distribution of gymnosperms; Salient features of Cycadales, Ginkgoales, Coniferales and Gnetales, their examples, structure and reproduction; economic importance</p> <p><b>Unit VII-Reproductive Botany</b>            Plant Embryology, Structure of microsporangium,</p>

		microsporogenesis, , Structure of megasporangium and its types, megasporogenesis, Structure and types of female gametophyte, types of pollination, Methods of pollination, Germination of pollen grain, structure of male gametophyte, Fertilization, structure of dicot and monocot embryo, Endosperm, Double fertilization, Apomixis and polyembryony.
April' 26	24	<p><b>Unit IV- Palaeobotany</b>            General account of Cycadofilicales, Bennettitales and Cordaitales; Geological time scale; Brief account of process of fossilization &amp; types of fossils and study techniques ;            Contribution of Birbal Sahni</p> <p><b>Unit VIII- Palynology:</b> Pollen structure, pollen morphology, pollen allergy, Applied Palynology: Basic concepts, Palaeopalynology, Aeropalynology, Forensic palynology, Role in taxonomic evidences.</p> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Activity I:** Assignment on Angiosperm morphology.

**Objective:** To understand the morphological characters of angiosperms and their use in taxonomic identification.

**Methodology:** Inquiry-based learning.

**Activity II:** Class presentation through ppt on topics of Unit VII.

**Objective:** To develop the concept of plant reproduction and embryological behavior.

**Methodology:** Individual learning.

**Suggested readings:**

1. Gangulee H. S. and K. Kar 1992. College Botany Vol. I and II. (New Central Book Agency)
2. Sharma OP (1990) Textbook of Pteridophyta. MacMillan India Ltd. Delhi.
3. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Pteridophyta, S. Chand and Company.
4. 4. Vashishtha BR, Sinha AK and Kumar A (2010) Botany for Degree Students – Gymnosperms, S. Chand and company.
5. Pandey BP (2010) College Botany Vol II S. Chand and Company, New Delhi
6. Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London
7. Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.
8. Bhojwani, S.S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House,.

**Suggested equivalent online courses:**

1. <https://www.anbg.gov.au/bryophyte/what-is-bryophyte.html>
2. <https://pteridoportal.org/portal/index.php>  
<https://www.conifers.org/zz/gymnosperms.php>
3. <http://www.mobot.org/MOBOT/research/APweb/>  
<https://milneorchid.weebly.com/plant-id-for-beginners.html>
4. <https://www.botany.org/PlantImages/PlantAnatomy.php>
5. <http://webapp1.dlib.indiana.edu/inauthors/view?docId=VAC0868&doc.view=print>
6. <https://palynology.org/>
7. <https://www.sciencelearn.org.nz/resources/100-plant-reproduction>  
<https://palaeobotany.org/>

**MAJOR/MINOR: BOTANY****Course code: B040202P****Paper II (Practical)****Credits: 2****Course Title: Land Plants Architecture****Max. Marks: 75 +25****Course outcomes:**

1. The students will be made aware of the group of plants that have given rise to land habit and the flowering plants. Through field study they will be able to see these plants grow in nature and become familiar with the biodiversity.
2. Students would learn to create their small digital reports where they can capture the zoomed in and zoomed out pictures as well as videos in case they are able to find some rare structure or phenomenon related to these plants.
3. Develop an understanding by observation and table study of representative members of phylogenetically important groups to learn the process of evolution in a broad sense.
4. Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding plant diversity, economic values & taxonomy of lower group of plants.
5. Understand the composition, modifications, internal structure & architecture of flowering plants for becoming a Botanist.

Month	Working Days	Topics to be covered
January' 26	19	<p><b>Unit I- Bryophytes:</b>            Marchantia- morphology of thallus, W.M. rhizoids and scales, V.S. thallus through Gemma cup, W.M. gemmae (all temporary slides), V.S. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides). <i>Sphagnum</i>- morphology, W.M. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads. L.S. capsule and protonema.</p> <p><b>Unit II-Pteridophytes:</b>  <i>Lycopodium</i>: Habit, stem T. S. stobilus V. S., <i>Selaginella</i>: Habit, rhizophore T. S, stem T. S, axis with stobilus, V.S. of stobilus, Megasporophyll and microsporophyll.  <i>Equisetum</i> - Habit, rhizome and stem T.S. and V. S. of stobilus. <i>Azolla</i> – Habitat &amp; its structure</p>
February'26	23	<p><b>Unit III-Gymnosperms</b></p> <ol style="list-style-type: none"> <li>1. <i>Cycas</i> – seedling, coralloid root and coralloid root T. S., T.S. of leaflet and Rachis, micro and megasporophyll, male cone V. S., microsporophyll T. S. entire and V. S. of ovule. <i>Pinus</i> - Branch of indefinite growth, spur shoot, T. S of old stem and needle R.L.S and T. L. S. of stem, male and female cone, V.S. of male and female cone.</li> </ol> <p><i>Ephedra</i> &amp; <i>Thuja</i>: Habit, stem T. S (young and mature), leaf T. S, male and female stobilus, V. S. of male and female cone, ovule V. S. and seed.</p> <p><b>Unit IV-Palaeobotany &amp; Palynology</b></p> <ol style="list-style-type: none"> <li>1. Morphology of <i>Rhynia</i> and fossils gymnosperms &amp; other groups.</li> <li>2. Visit Birbal Sahni Institute of Palaeosciences or virtual conference with their scientists to learn fossilization.</li> </ol>

		3. Mark and know about Indian geographical sites rich in plant fossils.
<b>March' 26</b>	<b>20</b>	<p><b>Unit V-Angiosperm Morphology</b></p> <ol style="list-style-type: none"> <li>1. To study diversity in leaf shape, size and other foliar features.</li> <li>2. To study monopodial and sympodial branching.</li> <li>3. Morphology of Fruits</li> <li>4. Inflorescence types- study from fresh/ preserved specimens</li> <li>5. Flowers- study of different types from fresh/ preserved specimens</li> <li>6. Fruits- study from different types from fresh/preserved specimens</li> <li>7. Study of ovules (permanent slides/ specimens photographs) - types (anatropous, orthotropous, amphitropous and campylotropous)</li> <li>8. Modifications in Roots, stems, leaves and inflorescences</li> </ol> <p><b>Unit VI-Plant Anatomy:</b></p> <p>Normal &amp; Anomalous secondary thickening - <i>Bignonia</i>, <i>Dracaena</i>, <i>Boerhaavia diffusa</i>, <i>Nyctanthes</i> Study of primary and secondary growth in the root and stem of monocots and dicots by section cutting and permanent slides.</p> <p>Study of internal structure of dicot and monocot leaves.</p> <p>Study of structure of stomata.</p>
<b>April' 26</b>	<b>24</b>	<p><b>Unit VII-Reproductive Botany</b></p> <ol style="list-style-type: none"> <li>1. Structure of anther, microsporogenesis and pollen grains</li> <li>2. Structure of ovule and embryo sac development</li> <li>3. (through slides).</li> <li>4. Study of embryo development in monocots and dicots.</li> <li>5. Vegetative propagation by means of cutting, budding and grafting exercises.</li> <li>6. Study of seed germination.</li> <li>7. Study of pollen morphology of the following plants – <i>Hibiscus</i>, <i>Vinca</i>, <i>Balsam</i>, <i>Ixora</i>, <i>Crotalaria</i>, <i>Bougainvillea</i> by microscopic observation.</li> <li>8. Calculation of pollen viability percentage using in vitro pollen germination techniques.</li> </ol> <p><b>Unit VIII-Commercial Uses and Production technology</b></p> <ol style="list-style-type: none"> <li>1. <i>Azolla</i> production</li> <li>2. Production technology of Resins</li> <li>3. Production and propagation of Ornamental <i>Pteris</i>, Cycadales, Coniferales for landscaping.</li> <li>4. Lab method for qualitative testing/ extraction of Ephedrine, Taxol and <i>Thuja</i> oil.</li> </ol> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Activity I:** Visit to Birbal Sahni Institute of Palaeosciences, Lucknow.

**Objective:** To understand about the different types of fossils and interaction with the concerned scientist.

**Methodology:** Expeditionary learning.

**Suggested readings:**

1. Pandey, BP and Trivedi, P.S. 1997. Botany Vol. I, II and III (10th edition). Vikas Publishing House.
2. Santra, SC and Chatterjee. 2005. College Botany Practical Vol. I. New Central Book Agency (P) Ltd.
3. Bendre and Kumar A text book of Practical Botany. Vol I,II., Rastogi Pub. Meerut.
4. Suresh Kumar, Amar Singh Kashyap Manual of Practical Algae. Campus Books Internet, New Delhi

**Suggested equivalent online courses:**

1. <https://www.easybiologyclass.com/topic-botany>
2. <http://www3.botany.ubc.ca/bryophyte/index.html>
3. [http://ecflora.cavehill.uwi.edu/bio\\_courses/bl14apl/practical\\_3.1.htm](http://ecflora.cavehill.uwi.edu/bio_courses/bl14apl/practical_3.1.htm)
4. <http://mydunotes.blogspot.com/p/botany.html>
5. <http://www.fao.org/3/a-v9236e.pdf>
6. <https://iinrg.icar.gov.in/library/nrg/nrg.pdf>
7. [https://agritech.tnau.ac.in/banking/nabard\\_pdf/Azolla%20Cultivation/Model\\_project\\_on\\_Azolla\\_cultivation.pdf](https://agritech.tnau.ac.in/banking/nabard_pdf/Azolla%20Cultivation/Model_project_on_Azolla_cultivation.pdf)
8. <http://arnoldia.arboretum.harvard.edu/pdf/articles/1977-37-1-propagation-manual-of-selected-gymnosperms.pdf>
9. [https://www.fs.fed.us/rm/pubs\\_other/wo\\_AgricHandbook730/wo\\_AgricHandbook727\\_153\\_175.pdf](https://www.fs.fed.us/rm/pubs_other/wo_AgricHandbook730/wo_AgricHandbook727_153_175.pdf)

**MAJOR/MINOR: CHEMISTRY****Course Code: B020201T****Paper I (Theory)****Course Title: Bioinorganic and Medicinal Chemistry****Credit: 4****Max. Marks: 75 +25****Course outcomes:**

Biomolecules are important for the functioning of living organisms. These molecules perform or trigger important biochemical reactions in living organisms. When studying biomolecules, one can understand

1. The physiological function that regulates the proper growth and development of a human body.
2. Basic experiments of carbohydrates, amino acids, proteins, nucleic acids and medicinal chemistry.
3. The available job opportunities in food, beverage and pharmaceutical industries.

Month	Working Days	Topics to be covered
January' 26	19	<p><b>Unit I: Chemistry of Carbohydrates:</b> Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Mechanism of mutarotation Determination of configuration of Glucose (Fischer's proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Inter conversions of sugars (ascending and descending of sugar series, conversion of aldoses to ketoses). Lobry de Bruyn-van Ekenstein rearrangement; stepping-up (Kiliani- Fischer method) and stepping-down (Ruff's &amp; Wohl's methods) of aldoses; end-group interchange of aldoses Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.</p> <p><b>Unit II: Chemistry of Proteins:</b> Classification of <i>amino acids</i>, zwitter ion structure and Isoelectric point. Overview of primary, secondary, tertiary and quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection &amp; C-activating groups and Merrifield solid phase synthesis. Protein denaturation/ renaturation Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action(Including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Noncompetitive inhibition including allosteric inhibition).</p>
February'26	23	<p><b>Unit III: Chemistry of Nucleic Acids:</b> Constituents of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), Nucleosides and nucleotides (<b>nomenclature</b>), Synthesis of nucleic acids, Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (<b>types of RNA</b>), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation</p> <p><b>Unit IV: Introductory Medicinal Chemistry:</b> Drug discovery,</p>

		design and development; Basic Retrosynthetic approach. Drug action-receptor theory. Structure –activity relationships of drug molecules, binding role of –OH group, –NH <sub>2</sub> group, double bond and aromatic ring. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), HIV-AIDS related drugs (AZT- Zidovudine)
March' 26	20	<p><b>Unit V: Solid State:</b> Definition of space lattice, unit cell. Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices and (iii) Symmetry elements in crystals and law of symmetry. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).</p> <p><b>Unit VI: Introduction to Polymer</b> Monomers, Oligomers, Polymers and their characteristics, Classification of polymers: Natural synthetic, linear, cross linked and network; plastics, elastomers, fibres, Homopolymers and Copolymers, Bonding in polymers: Primary and secondary bond forces in polymers; cohesive energy, and decomposition of polymers. Determination of Molecular mass of polymers: Number Average molecular mass (M<sub>n</sub>) and Weight average molecular mass (M<sub>w</sub>) of polymers and determination by (i) Viscosity (ii) Light scattering method (iii) Gel permeation chromatography (iv) Osmometry and Ultracentrifuging.</p> <p><b>Silicones and Phosphazenes</b> –Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.</p>
April' 26	24	<p><b>Unit VII: Kinetics and Mechanism of Polymerization</b> Polymerization techniques, Mechanism and kinetics of copolymerization, Addition or chain growth polymerization, Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers, Condensation or step growth-polymerization, Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes, Natural and synthetic rubbers, Elementary idea of organic conducting polymers.</p> <p><b>Unit VIII: Synthetic Dyes:</b> Colour and constitution (electronic Concept), Classification of dyes, Chemistry and synthesis of Methyl orange, Congo red, Malachite green, crystal violet, phenolphthalein, fluorescein, Alizarin and Indigo.</p> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Activity:** To make an assignment on polymers. (Unit VI)

**Objective:** To practice formula and mechanism of polymerization.

**Methodology:** Inquiry based learning.

**Suggested Readings:**

1. Davis, B. G., Fairbanks, A. J., *Carbohydrate Chemistry*, Oxford Chemistry Primer, Oxford University Press.
2. Finar, I. L. *Organic Chemistry (Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry 7th Ed.*, W. H. Freeman.

4. Berg, J. M., Tymoczko, J. L. & Stryer, L. *Biochemistry 7th Ed.*, W. H. Freeman.
5. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Patrick, G. L. *Introduction to Medicinal Chemistry*, Oxford University Press, UK, 2013.
7. Singh, H. & Kapoor, V.K. *Medicinal and Pharmaceutical Chemistry*, Vallabh Prakashan, Pitampura, New Delhi, 2012.
8. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry Ed.*, Oxford University Press 13(2006).
9. Ball, D. W. *Physical Chemistry Thomson Press, India*(2007).
10. Castellan, G. W. *Physical Chemistry 4th Ed. Narosa*(2004).
11. R.B. Seymour & C.E. Carraher: *Polymer Chemistry: An Introduction*, Marcel Dekker, Inc. New York, 1981.
12. G.Odian: *Principles of Polymerization*, 4<sup>th</sup>Ed. Wiley, 2004.
13. F.W. Billmeyer: *Textbook of Polymer Science*, 2<sup>nd</sup> Ed. Wiley Interscience, 1971.
14. P. Ghosh: *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991

**Suggested online links:**

1. <http://heecontent.upsdc.gov.in/Home.aspx>
2. <https://nptel.ac.in/courses/104/105/104105124/>
3. <https://nptel.ac.in/courses/103/106/105106204/>
4. <https://nptel.ac.in/courses/104/105/104105034/>
5. <https://nptel.ac.in/courses/104/103/104103121/>
6. <https://nptel.ac.in/courses/104/102/104102016/>
7. <https://nptel.ac.in/courses/104/106/104106106/>
8. <https://nptel.ac.in/courses/104/105/104105120/>

**MAJOR/MINOR: CHEMISTRY****Course Code: B020202P****Paper II (Practical)****Credit: 2****Course Title: Biochemical Analysis****Max. Marks: 75 +25****Course outcomes:**

Upon successful completion of the course:

1. Students will have basic qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids drug molecules.
2. Students may get job opportunities in food, beverage and pharmaceutical industries.

Month	Working Days	Topics to be covered
January' 26	19	<b>Unit I: Qualitative and quantitative analysis of Carbohydrates:</b> <ol style="list-style-type: none"><li>1. Separation of a mixture of two sugars by ascending paper chromatography</li><li>2. Differentiate between a reducing/ non reducing sugar</li><li>3. Synthesis of Osazones.</li></ol>
February'26	23	<b>Unit II: Qualitative and quantitative analysis of Proteins, amino acids and Fats</b> <ol style="list-style-type: none"><li>1. Isolation of protein.</li><li>2. Determination of protein by the Biuret reaction.</li><li>3. TLC separation of a mixture containing 2/3 amino acids</li><li>4. Paper chromatographic separation of a mixture containing 2/3 amino acids</li><li>5. Action of salivary amylase on starch</li><li>6. To determine the concentration of glycine solution by formylation method.</li></ol>
March' 26	20	<ol style="list-style-type: none"><li>1. To determine the saponification value of an oil/fat.</li><li>2. To determine the iodine value of an oil/fat</li></ol> <b>Unit III: Determination and identification of Nucleic Acids</b> <ol style="list-style-type: none"><li>1. Determination of nucleic acids</li><li>2. Extraction of DNA from onion/cauliflower</li></ol>
April' 26	24	<b>Unit IV:</b> <b>Synthesis of Simple drug molecules</b> <ol style="list-style-type: none"><li>1. To synthesize aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC.</li><li>2. Synthesis of barbituric acid</li><li>3. Synthesis of propranolol</li></ol> <b>Revision &amp; Internal Examination</b>

**Activity:** Visit to Department of Chemistry for hands on training on TLC. (Unit IV)

**Objective:** To understand concept of chromatography and practical demonstration of it by experts.

**Methodology:** Expeditionary learning.

### **Suggested Readings:**

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012).
2. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education.
3. *Vogel's Qualitative Inorganic Analysis*, Revised by G.Svehla.
4. Vogel, A.I. *A Textbook of Quantitative Analysis*, ELBS.1986
5. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, ELBS.
6. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry*, Universities Pres
7. Cooper, T.G. *Tool of Biochemistry*. Wiley-Blackwell (1977).
8. Wilson, K. & Walker, J. *Practical Biochemistry*. Cambridge University Press (2009).
9. Varley, H., Gowenlock, A.H & Bell, M.: *Practical Clinical Biochemistry*, Heinemann,

### **Suggestive digital platforms web links:**

1. <https://www.labster.com/chemistry-virtual-labs/>
2. <https://www.vlab.co.in/broad-area-chemical-sciences>
3. <http://chemcollective.org/vlabs>

**MAJOR/MINOR: ZOOLOGY****Course Code: B050201T****Paper I (Theory)****Credits: 4****Course Title: Biochemistry and Physiology****Max. Marks: 75 +25****Course outcomes:**

The student at the completion of the course will learn:

1. To develop a deep understanding of structure of biomolecules like proteins, lipids and carbohydrates
2. How simple molecules together form complex macromolecules.
3. To understand the thermodynamics of enzyme catalyzed reactions.
4. Mechanisms of energy production at cellular and molecular levels.
5. To understand systems biology and various functional components of an organism.
6. To explore the complex network of these functional components.
7. To comprehend the regulatory mechanisms for maintenance of function in the body.

<b>Month</b>	<b>Working Days</b>	<b>Topics to be covered</b>
<b>January' 26</b>	<b>19</b>	<p><b>Unit I: Structure and Function of Biomolecules</b></p> <ol style="list-style-type: none"> <li>1. Structure and Biological importance of carbohydrates (Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates)</li> <li>2. Lipids (saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Glycolipids, Steroids)</li> <li>3. Structure, Classification and General properties of <math>\alpha</math>-amino acids; Essential and non-essential <math>\alpha</math>-amino acids, Levels of organization in proteins; Simple and conjugate proteins.</li> </ol> <p><b>Unit II: Enzyme Action and Regulation</b></p> <ol style="list-style-type: none"> <li>1. Nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action</li> <li>2. Isozymes; Mechanism of enzyme action.</li> <li>3. Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of <math>K_m</math> and <math>V_{max}</math>, Lineweaver-Burk plot; Enzyme inhibition;</li> <li>4. Allosteric enzymes and their kinetics; Regulation of enzyme action</li> </ol>
<b>February'26</b>	<b>23</b>	<p><b>Unit III: Metabolism of Carbohydrates and Lipids</b></p> <ol style="list-style-type: none"> <li>1. Metabolism of Carbohydrates: glycolysis, citric acid cycle, gluconeogenesis, phosphate pentose pathway</li> <li>2. Glycogenolysis and Glycogenesis</li> <li>3. Lipids --- Biosynthesis of palmitic acid; Ketogenesis.</li> <li>4. <math>\beta</math>-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms</li> </ol> <p><b>Unit IV: Metabolism of Proteins and Nucleotides</b></p> <ol style="list-style-type: none"> <li>1. Catabolism of amino acids: Transamination, Deamination, Urea cycle</li> <li>2. Nucleotides and vitamins</li> <li>3. Review of mitochondrial respiratory chain, Oxidative phosphorylation, and its regulation.</li> </ol>

<p><b>March' 26</b></p>	<p><b>20</b></p>	<p><b>Unit V: Digestion and Respiration</b></p> <ol style="list-style-type: none"> <li>1. Structural organization and functions of gastrointestinal tract and associated glands</li> <li>2. Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Histology of trachea and lung</li> <li>3. Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood Respiratory pigments, Dissociation curves and the factors influencing it; Control of respiration.</li> </ol> <p><b>Unit VI: Circulation and Excretion</b></p> <ol style="list-style-type: none"> <li>1. Components of blood and their functions</li> <li>2. Haemostasis: Blood clotting system, Blood groups: Rh factor, AB and MN</li> <li>3. Structure of mammalian heart</li> <li>4. Cardiac cycle; Cardiac output and its regulation, Electrocardiogram, Blood pressure and its regulation</li> <li>5. Structure of kidney and its functional unit; Mechanism of urine formation</li> </ol>
<p><b>April' 26</b></p>	<p><b>24</b></p>	<p><b>Unit VII: Nervous System and Endocrinology</b></p> <ol style="list-style-type: none"> <li>1. Structure of neuron, resting membrane potential</li> <li>2. Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers</li> <li>3. Types of synapse</li> <li>4. Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them</li> <li>5. Classification of hormones; Mechanism of Hormone action</li> </ol> <p><b>Unit VIII: Muscular System</b></p> <p>Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus.</p> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Suggested Readings:**

1. Nelson & Cox: Lehninger's Principles of Biochemistry: McMillan (2000)
2. Zubayet al: Principles of Biochemistry: WCB (1995)
3. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology. XI Edition. Hercourt Asia
4. PTE Ltd. /W.B. Saunders Company. (2006).
5. Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).

**MAJOR/MINOR: ZOOLOGY****Course Code: B050202P/R****Paper II (Practical)****Course Title: Physiological, Biochemical & Hematology Lab****Credits: 2****Max. Marks: 75 +25****Course outcomes:**

The student at the completion of the course will be able to:

1. Understand the structure of biomolecules like proteins, lipids and carbohydrates
2. Perform basic hematological laboratory testing,
3. Distinguish normal and abnormal hematological laboratory findings to predict the diagnosis of hematological disorders and diseases.

Month	Working Days	Topics to be covered
January' 26	19	<b>Unit I:</b> <ol style="list-style-type: none"> <li>1. Estimation of haemoglobin using Sahli's haemoglobinometer</li> <li>2. Preparation of haemin and haemochromogen crystals</li> <li>3. Counting of RBCs and WBCs using Haemocytometer</li> <li>4. To study different mammalian blood cell types using Leishman stain.</li> <li>5. Recording of blood pressure using a sphygmomanometer</li> <li>6. Recording of blood glucose level by using glucometer</li> </ol>
February'26	23	<b>Unit II:</b> <ol style="list-style-type: none"> <li>1. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid</li> <li>2. Recording of simple muscle twitch with electrical stimulation (or Virtual)</li> <li>3. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)</li> </ol>
March' 26	20	<b>Unit III:</b> <ol style="list-style-type: none"> <li>1. Ninhydrin test for amino acids.</li> <li>2. Benedict's test for reducing sugar and iodine test for starch.</li> <li>3. Test for sugar and acetone in urine.</li> <li>4. Qualitative tests of functional groups in carbohydrates, proteins and lipids.</li> <li>5. Action of salivary amylase under optimum conditions.</li> </ol>
April' 26	24	<b>Unit IV:</b> <b>Virtual Labs (Suggestive sites)</b> <ol style="list-style-type: none"> <li>1. <a href="https://www.vlab.co.in">https://www.vlab.co.in</a></li> <li>2. <a href="https://zoologysan.blogspot.com">https://zoologysan.blogspot.com</a></li> <li>3. <a href="http://www.vlab.iitb.ac.in/vlab">www.vlab.iitb.ac.in/vlab</a></li> <li>4. <a href="http://www.onlinelabs.in">www.onlinelabs.in</a></li> <li>5. <a href="http://www.powershow.com">www.powershow.com</a></li> <li>6. <a href="https://vlab.amrita.edu">https://vlab.amrita.edu</a></li> <li>7. <a href="https://sites.dartmouth.edu">https://sites.dartmouth.edu</a></li> </ol> <p style="text-align: center;"><b>Revision &amp; Internal Examination</b></p>

**Any One Subject:**

1. E-taxation
2. Data Analytics
3. Gandhian Model of Skill Development

**E-TAXATION**

**Credits: 3**

**Max. Marks: 25+75**

**Course Outcomes:**

After completing this course, Students will be able to:

CO1: learn the concepts of filing of income tax return and submit tax documents by using internet.

CO2: learn about the availability of different types of tax returns under various heads of income.

CO3: learn to differentiate between different types of income tax returns.

CO4: acquire knowledge about the payment facilities of tax liability.

Month	W. Days	Topics to be covered
January' 26	19	<b>Unit I</b> <b>Taxation E – Taxation</b> – Definition, Purpose, Importance and Types. <b>Direct Taxes</b> – Types of Direct Taxes <b>Indirect Taxes</b> – Types of Indirect Taxes Difference between Direct and Indirect Taxes, Tax Management, Tax Planning, Tax Evasion & Tax Avoidance
		<i>Activity: Power Point Presentation on “Impact of Taxation on Indian Economy”</i> <i>Objective: To understand the impact of taxation in Indian Economy</i> <i>Methodology: PPT Presentation</i>
February' 26	23	<b>Unit II</b> Fundamental Principle of Taxation. An evolution of Taxation, issues related to E-Commerce
March' 26	20	<b>Unit III</b> Table of contents about Income Tax basics in India Relevant ITR form at the time of e-filing Income Tax
		<i>Activity: Project on “Process of E-Filing of ITR and E-Tax Payment of Direct Tax”</i> <i>Objective: To understand the process of filing the ITR.</i> <i>Methodology: Written Assignment</i>
April'26	24	<b>Unit IV</b> E-Tax payment facilities, Payment of direct taxes online by tax payers. To avail of this facility – Net Banking/Debit Card/Credit Card Facility is required. <b>Revision &amp; Internal Examination</b>

**Suggested Readings:**

- *Dr. Vinod Kumar Singhania :Direct Taxes Ready Reckoner-Taxman Publication.*
- *Tasman Publication: Digital Taxation A Holistic View.*
- *Nina Verma: E-Commerce-Taxation-Prospects & Challenges- Global Vision Publishing House.*
- *IBED: E-Commerce and Source-Based Income Taxation.*
- *Flipkart: Global Perspective on E-Commerce Taxation law.*

## DATA ANALYTICS

Credits: 3

Max. Marks:25+75

### Course Outcomes:

Introduction to Data Analytics course will give students insights into applying data and analytics principles in the social science research. Students will gain an understanding of the complete different large unit-level data sets such as, National Sample Survey (NSS), Periodic Labour Force Surveys (PLFS), Annual Survey of Industry (ASI), India Human Development Survey (IHDS), and National Family Health Survey (NFHS). Through various social science specific examples and case studies, students will learn how analytics, data visualization, and data science methodologies can be used to drive better social science research.

Month	W. Days	Topics to be covered
January' 26	19	<b>Unit I</b> Data Analytics Overview: Introduction of large unit-level data sets such as, National Sample Survey (NSS), Periodic Labour Force Surveys (PLFS), Annual Survey of Industry (ASI), India Human Development Survey (IHDS), and National Family Health Survey (NFHS). Explanation of how to access these data sets and data extraction of unit-level data.
		<b>Activity:</b> Real time data implementation of organized and unorganized data with the visualisation <b>Objective:</b> Through various data analytics techniques, students will learn how to analyze, data visualize and data science methodologies which can be used for better research process <b>Methodology:</b> Presentation and data software
February' 26	23	<b>Unit II</b> Dealing with Different Types of Data: Estimation of different social science indicators such as, Poverty, Workforce Participation Rate (WFPR), Labour force Participation Rate (LFPR), Unemployment Rate (UR) from Consumption Expenditure Survey, Employment & Unemployment Survey, and Periodic Labour Force Surveys. An analysis of division of organized & unorganized sector and formal & informal workers from Periodic Labour Force Surveys.
March' 26	20	<b>Unit III</b> Analytics Framework and Latest Trends: Introduction of Annual Survey of Industry (ASI) database. Uses of deflators (Wholesale Price Index & Consumer Price Index) and National Industry Classification (NIC).
		<b>Activity:</b> Extraction, Transformation and Load Activity of data from ASI <b>Objective:</b> By this real time data experience student will understand the procedure and analytical structure of official organization that how data flow and transformation taken under the software
April'26	24	<b>Unit IV</b> Practical Analysis: Some case studies task will be given to students based on above data sets. <b>Revision &amp; Internal Examination</b>

### Suggested Readings:

- Ministry of Statistics and Programme Implementation (MosPI)
- <http://mospi.nic.in/download-tables-data>.

- *National Data Archive*
- <http://microdata.gov.in/nada43/index.php/catalog/central/about>
- *Indian Council of Social Science Research Data Service (ICSSR)*  
<http://www.icssrdataservice.in/>
- *National Family Health Survey (NFHS)*  
<https://dhsprogram.com/methodology/survey/survey-display-355.cfm>
- *India Human Development Survey (IHDS)*  
<https://ihds.umd.edu/>
- *NCEUS (National Commission for Enterprises in the Unorganised Sector) Report on Definitional and Statistical Issues Relating to the Informal Economy. New Delhi: Government of India, November.*
- *NCEUS (National Commission for Enterprises in the Unorganised Sector), Conditions of Work and Promotion of Livelihood in the Unorganised Sector, National Commission for Enterprises in the Unorganised Sector, Government of India, New Delhi.*
- *NSC (National Statistical Commission, Government of India). Report of the*
- *Srivastava, Ravi S. and Ajaya Kumar Naik "Growth and Informality in the Indian Economy" in K. P. Kannan, R. P. Mangain and Preet Rustagi (eds.) Development from the Perspective of Labour: Essays in honour of Prof. T. S. Papola. New Delhi: Academic Foundation.*

**Note- Latest edition of the text books should be used.**

## GANDHIAN MODEL OF SKILL DEVELOPMENT

**Credits: 3**

**Max. Marks:25+75**

### Course Objectives

- **Understand and Apply Gandhian Principles:** Students will explore the Gandhian vision of social issues while examining the relevance of Gandhian thought in contemporary issues like health, wellness, and financial equality.
- **Develop Practical Skills in Community Engagement:** Students will learn to identify foundational issues within communities, prioritize social concerns, and engage with local and national resources to support community development.
- **Promote Cultural and Social Awareness:** Students will gain an understanding of the importance of regional and national languages, craftsmanship, arts, literature, and communication skills within the framework of Gandhian thought, recognizing their roles in enhancing social cohesion and empowering marginalized groups.
- **Enhance Financial Literacy and Resource Management:** Students will acquire the knowledge to manage income and expenditures, conduct revenue and tax assessments, and understand the audit processes within trusts and societies, focusing on the ethical utilization of resources and the implementation of decentralized and sustainable economic practices in line with Gandhian values.

Month	W. Days	Topics to be covered
January' 26	19	<b>Unit I</b> <u>Creative Programs</u> Communal unity, Eradication of Untouchability, Prohibition of Liquor, Khadi, Other Cottage Industries, Cleanliness and Sanitation in Villages, New and Elementary Learning and Teaching, Teaching and Learning from Elders and Women, Health and Wellness Awareness, Regional Languages, National Language, Financial Equality, Farmers, Labourers, Tribals, Leprosy Patients, and Students.
		<b>Activity 1:</b> Quiz on Mahatma Gandhi's Life, Work, and Legacy <b>Objective:</b> To ensure awareness about Mahatma Gandhi and his role in the freedom struggle as well as his vision about India's future generations.
February' 26	23	<b>Unit II</b> Importance of Labour and Work, Decentralization, Small Scale Industries and the Principles of Gandhian Thought <ul style="list-style-type: none"> <li>• Gandhian Vision of Craftsmanship</li> <li>• Gandhian Vision of Arts</li> <li>• Gandhian Vision of Literature</li> <li>• Gandhian Vision of Communication and Oratory Skills</li> </ul>
March' 26	20	<b>Unit III</b> Identification and Utility of Resources, Local Community Resources, Governmental Resources, National and International Resources, Utilization of Resources, Income and Expenditure, Revenue and Tax Assessment of Trusts and Societies, Audit and Social Audit.
		<b>Activity 2:</b> PPT Presentation on Indian Martyrs who are celebrated along with Gandhiji on his death anniversary, also known as Martyr's Day (30 January) <b>Objective:</b> To appreciate the legacy of Gandhiji by

		remembering and knowing closely the martyrs who are gone but not forgotten, whose sacrifices have ensured the comfort we enjoy today.
April'26	24	<p><b>Unit IV</b>  <u>Practical Program/ Skill Program –</u></p> <p>Identity of Gandhian Institutions, Identifying Foundational Issues, Prioritization, Intervention of Community Organizations, Report Article, Application of Information and Communication Technology.</p> <p><b>Revision &amp; Internal Examination</b></p>

**Credits: 2**

**Max. Marks: 100**

**Course outcomes:**

The mission of the course on Human Values and Environmental Studies is to create morally articulate solutions to be truthful and just and to become responsible towards humanity. The course seeks to establish a continuous interest in the learners to improve their thought process with intent to develop a new generation of responsible citizens capable of addressing complex challenges faced by the society due to disruptions in human interactions effecting human values. This course works towards :

- Building fundamental knowledge of the interplay of markets, ethics, and law.
- Look at various challenges faced by individual to counter unethical issues.
- Look at core concepts for business ethics.
- Look at core concepts of anti-corruption.
- Look at core concepts for a morally articulate solution evolver to management issues in general.
- Issues of sustainable development for a better environment.
- To know how environmental degradation has taken place.
- Be aware of negotiations and international efforts to save environment.
- How to develop sustainably?
- Efforts taken up by UN in Sustainable Development. Department of Higher Education U.P. Government, Lucknow.
- Efforts taken by India in Sustainable Development.
- The course intends to create a sense of how to be more responsible towards the environment. Upon finishing of the course students will be able to come up with using ethical reasoning for decision making and frame ethical issues as well as operationalize ethical choices. The course integrates various facets of human values and environment.

<b>Month</b>	<b>W. Days</b>	<b>Topics to be covered</b>
January' 26	<b>19</b>	<p><b>Unit I</b>  <b>Human Values-</b> Introduction- Values, Characteristics, Types , Developing Value system in Indian Organisation , Values in Business Management , value based Organisation , Trans –cultural Human values in Management. Swami Vivekananda's philosophy of Character Building, Gandhi's concept of Seven Sins, APJ Abdul Kalam view on role of parents and Teachers.  <b>Human Values and Present Practices</b> – Issues: Corruption and Bribe, Privacy Policy in Web and Social Media, Cyber threats, Online Shopping etc. Remedies UK Bribery Act, Introduction to sustainable policies and practices in Indian Economy. Principles of Ethics Secular and Spiritual Values in Management- Introduction- Secular and Spiritual values, features, Levels of value Implementation. Features of spiritual Values, Corporate Social Responsibility- Nature, Levels, Phases and Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Premji and Bill Gates.</p>
February' 26	23	<p><b>Unit II</b>  <b>Holistic Approach in Decision making-</b> Decision making, the decision-making process, The Bhagavad Gita: Techniques in Management, Dharma and Holistic Management.</p>

		<p><b>Discussion through Dilemmas</b> – Dilemmas in Marketing and Pharma Organisations, moving from Public to Private – monopoly context, Dilemma of privatisation, Dilemma on liberalization, Dilemma on social media and cyber security, Dilemma on Organic food , Dilemma on standardization ,Dilemma on Quality standards.</p> <p><b>Case Studies</b></p>
March' 26	20	<p><b>Unit III</b></p> <p>Ecosystem: Concept, structure &amp; functions of ecosystem : producer, consumer, decomposer, foodweb, food chain, energy flow, Ecological pyramids Conservation of Biodiversity- In-situ &amp; Ex- situ conservation of biodiversity, Role of individual in Pollution control Human Population &amp; Environment Sustainable Development India and UN Sustainable Development Goals Concept of circular economy and entrepreneurship</p>
April' 26	24	<p><b>Unit IV</b></p> <p>Environmental Laws? International Advancements in Environmental Conservation Role of National Green Tribunal Air Quality Index 8 Importance of Indian Traditional knowledge on environment Bio assessment of Environmental Quality Environmental Management System Environmental Impact Assessment and Environmental</p> <p><b>Revision &amp; Internal Examination</b></p>
		<p><i>Activity: Power point presentation on Biodiversity conservation</i></p> <p><i>Objective: To understand about the biodiversity and different type of conservation</i></p> <p><i>Methodology: PPT Presentation</i></p>

**Suggested readings:**

1. A foundation course in Human Values and Professional Ethics by RR. Gaur, R. Sangal.
2. JUSTICE: What's the Right Thing to Do? Michael J. Sandel.
3. Human Values by A. N. Tripathi New Age International.
4. Environmental Management by N.K. Uberoi.
5. <https://www.un.org/sustainabledevelopment/sustainable-development-goals>.
6. <https://www.india.gov.in/my-government/schemes>.
7. <https://www.legislation.gov.uk/ukpga/2010/23/contents>.
8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN: 9780141918921.

**Details of Activities/Field Visit/Outreach Program**  
**Department of Science**  
**2024-25**

<b>Class</b>	<b>Subject</b>	<b>Field Work/Visit</b>	<b>Faculty In-Charge</b>
<b>B.Sc. I/III/V SEM</b>	Botany	Field Plant Collection & CSIR Institute Visit	Dr. Rishi & Dr. Ritu
	Zoology	In-situ or Ex-situ conservation site	Dr. Soumik
	Chemistry	Department of Material Science, IIT BHU	Dr. Ragini & Dr. Anju
	Physics	Department of Physics, IIT BHU	Dr. Ragini
	Mathematics	Department of Mathematics, IIT BHU	Dr. Anju
<b>Activity</b>			
<b>Date</b>	<b>Events/ Outreach Program</b>		<b>Faculty In-Charge</b>
<b>11.03.2025</b>	Organic color preparation & distribution (In collaboration with BHUMI)		Dr. Soumik
<b>14.04.2025</b>	Mosquito awareness rally & cleaning (World Malaria Day), in collaboration with BHUMI & NSS		Dr. Soumik & Dr. Ritu
<b>16.05.2025</b>	International Day of Light		Dr. Ragini & Dr. Bhupendra
<b>Aug'2025</b>	Outreach Program of Mathematics		Dr. Anju
<b>16.09.2025</b>	World Ozone Day (Lecture) in collaboration with BHUMI & APEIRON		Dr. Soumik
<b>Oct'2025</b>	DAAN Utsav (World Food day) in collaboration with BHUMI		Dr. Soumik
<b>10.11.2025</b>	Presentation on world Science Day for peace & Development		Dr. Rishi & Dr. Ritu
<b>01.12.2025</b>	Blood Donation on World AIDS Day		Dr. Ragini & Dr. Soumik
<b>22.12.2025</b>	Role Play on National Mathematics Day		Dr. Anju
<b>22.04.2026</b>	Special assembly on the occasion of Earth Day		Dr. Ragini & Dr. Bhupendra