# University of Patanjali Haridwar

Accredited by NAAC with 'A$^{+}$' grade

## Department of Allied &Applied Science

## Syllabus

## National Education Policy 2020

## For

## B.Sc. Biological Sciences (2025-28)

# UNIVERSITY OF PATANJALI, HARIDWAR

## FACULTY OF SCIENCE,

## DEPARTMENT OF ALLIED & APPLIED SCIENCE

## Structure of Biological Science Syllabus

# Session 2025-28

| Semester | Core/Major | Minor | ID | AEC | SEC | VA | Total Credits |
|---|---|---|---|---|---|---|---|
| 1 | Cell Biology (5+1)=6 | Human Health and disease (3+1=4) | Chemical Science (3+1=4) | Communicative English (3) | Environment and Ecology (3) | Foundation of Yoga (2) | 22 |
| 2 | Biochemistry (5+1)=6 | Biophysics (3+1=4) | Computer Application (3+1=4) | Advanced Communicative English (3) | Medicinal Plants (3) | Sanskar (2) | 22 |
| 3 | Metabolism of Biomolecules (5+1=6) | Basics of Immunology (3+1=4) | Organic Chemistry (3+1=4) | Biostatistics & Data Science (3) | Herbal Drug Development (2+1) | Yagya Chikitsa (2) | 22 |
| 4 | Genetics (3+1=4) | Industrial Microbiology (3+1=4) | Drug Discovery & Design (3+1=4) | Plant physiology (3+1=4) | Instrumentation (3+1=4) | IKS (2) | 22 |
| 5 | Endocrinology (3+1=4) | Molecular Biology (3+1=4) | Bioinformatics (4) | Bioprocess Technology (3+1=4) | Neurobiology (3+1=4) | Internship/ Review Paper/ Industrial Visit (2) | 22 |
| 6 | Recombinant DNA Technology (3+1=4) | Proteomics & Metabolomics (3+1=4) | IPR, Biosafety and Bioethics (4) | Research Methodology (3+1=4) | Dissertation work/Research Paper (3) | Biomaterials (3) | 22 |

(Dr Laxmi Shankar Rath)

Head of the Department

H.O.D/Coordinator
Department of Allied & Applied Science
University of Patanjali, Haridwar

(Dr A K Singh)

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# 1ST SEMESTER

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: CELL BIOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-MJ-101**
**SEMESTER – I, TOTAL HOURS: 60 CREDITS: 6 (Theory 5 Credits & Practical 1 credit)**
**Course Objectives:**

The cell biology course objectives are:

1. Helping learners to describe cytological, biochemical & physiological aspects of cells.
2. Relate normal cellular structures to their functions.
3. Apply modern cellular techniques to solve aspects of scientific problems.

| **Total Number of Hrs. : 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **5** | **1** | **-** |
| **Hrs/Week** | | **5** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit-1**

Basics of Cell Biology (structure & function) – Discovery of cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; (10 Hours)

**Unit-2**

Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; Lysosome, endosome and micro bodies; Ribosome; Centriole; Nucleus; Chemical components of a cell; Catalysis and use of energy by cells. (10 Hours)

**Unit-3**

Biogenesis of Cellular organelles – Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and Golgi apparatus; Protein synthesis and folding in the cytoplasm; Degradation of cellular components. (10 Hours)

**Unit-4**

Structure and function of Prokaryotic cell & its components - The Slime and the cell wall of bacteria containing peptidoglycan and related molecules; the outer membrane of Gram negative bacteria, the cytoplasmic membrane. Water and ion transport, mesosomes, flagella, Pilus, fimbriae, ribosomes, carboxysomes, sulphur granules, glycogen, polyphosphate bodies, fat bodies, gas vesicles; endospores, exospores, cysts. Mycelia of fungi and Actinomycetes, Cytoskeleton filament, heterocysts and akinets of Cyanobacteria, Gliding and motility. (10Hours)

**Unit-5**

Membrane structure & transport – Models of membrane structure, Membrane lipids, proteins and carbohydrates; Solute transport by Simple diffusion, Facilitated diffusion and Active transport. (10 Hours)

**Unit-6**

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant.(10 Hours)

**CELL BIOLOGY Practical BSBS-MJ-101 -P**

1. To study about the working principle ,parts and uses of a compound microscope
2. To study the different meiotic stages through permanent stained slides.
3. To study the different meiosis stages through permanent stained slides.
4. To prepare a stained temporary mount of onion peel.
5. To study and demonstration the process of mitosis through the preparation of the mount of an onion root tip.
6. To prepare a temporary mount of human cheek epithelial cells.
7. To study by demonstrating the osmosis process by potato osmometer.
8. To prepare a temporary mount of a leaf peel in order to show the stomata of a leaf.
9. To study the process of plasmolysis in epidermal cells of tradescantia leaf
10. To study and comment upon different organelles of a typical cell using specimens/photographs

**11.** To cut a transverse section of a given monocot stem and make a temporary stained mount to study its structure

**12.** To cut a transverse section of a given monocot stem and make a temporary stained mount to study its structure

**13.** To cut a transverse section of a monocot root of Maize and make a temporary stained mount to study its structure

**14.** To cut a transverse section of a given dicot stem and make a temporary stained mount to study its structure

**Reference books:-**


1. Alberts B, Bray D, Johnson A et al. (1997) Essential Cell Biology. London: Garland Publishing.
2. Darwin C (1859) On the Origin of Species. London: Murray.
3. Graur D & Li W-H (1999) Fundamentals of Molecular Evolution, 2nd edn. Sunderland, MA: Sinauer Associates.
4. Madigan MT, Martinko JM & Parker J (2000) Brock's Biology of Microorganisms, 9th edn. Englewood Cliffs, NJ: Prentice Hall.
5. Margulis L & Schwartz KV (1998) Five Kingdoms: An Illustrated Guide to the Phyla of Life on Earth, 3rd edn. New York: Freeman.
6. Watson JD, Hopkins NH, Roberts JW et al. (1987) Molecular Biology of the Gene, 4th edn. Menlo Park, CA: Benjamin-Cummings.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: HUMAN HEALTH AND DISEASE (THEORY)**
**SUBJECT CODE: - BSBS-MN-102**
**SEMESTER – I, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

The Human Health and Disease course objectives are:

1. It Helps learners to understand the human health system.
2. Develop an understanding of disease and its mechanism in organisms.
3. The effect of diseases on Human health.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **3** | **1** | **-** |
| **Hrs/Week** | | **3** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1: Blood** **10 H**

Components of blood and their functions; Structure and functions of haemoglobin, Sickle cell anaemia. Haemostasis: Blood clotting system and Fibrinolytic system, Haemopoiesis, Blood groups: Rh factor, ABO and MN. Brief discussion of Erythrocyte sedimentation rate (ESR), Complete blood count (CBC), Total Leukocyte Count & Differential leukocyte count (TLC & DLC).

**Unit 2: Physiology of Digestion** **07 H**

Structural organization and functions of the gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals, and vitamins. Gastroesophageal reflux disease (GERD) and inflammatory bowel disease (IBD)

**Unit 3: Renal Physiology** **08 H**

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance. Chronic kidney disease (CKD) and acute kidney injury.

**Unit 4: Physiology of Respiration** **10 H**

Mechanism of respiration, pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in the blood; Dissociation curves and the factors influencing it; Carbon monoxide poisoning. Respiratory Diseases: Chronic obstructive pulmonary disease (COPD).

**Unit 5: Physiology of Heart** **10 H**

Structure of Human heart; Coronary circulation; Structure and working of conducting myocardial fibres. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Electrocardiogram (ECG or EKG), nervous and chemical regulation of heart rate. Blood pressure, Hypertension & Hypotension, and Coronary artery disease (CAD).

## Human Health and Disease **Practical: BSBSMN-102-P Credit 1 Lab Hours 30**

1. Estimation of Haemoglobin and cells present in Blood.
2. Estimation of Blood clotting time.
3. Calculation of Body Mass Index (BMI).
4. Identification of enzymes present in saliva.
5. Identification of components present in Urine.
6. Measurement of Lung capacity and tidal volume by Spiro-meter.
7. Measurement of Systolic & Diastolic pressure in normal and other physiological conditions.
8. Human Pulse rate determination in normal and other physiological conditions.

**Suggested reading:**


1. Essentials of Medical Physiology by K Sembulingam & Prema Sembulingam -Review of Medical Physiology - New 10th Edition 2024-2025.
2. Tortora's Principles of Anatomy and Physiology, Global Edition, 15th Edition, June 2017.
3. Textbook of Practical Physiology (5Th Edn) Paperback – 15 September 2020.
4. Guyton and Hall Textbook of Medical Physiology 14th Edition - June 15, 2020.
5. Basics of Medical Physiology, 5ed Paperback – 1 June 2023.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**INTERDISCIPLINARY PAPER**

**SUBJECT TITLE: CHEMICAL SCIENCE (THEORY)**
**SUBJECT CODE: - BSBS-ID-103**
**SEMESTER – I, TOTAL HOURS: 45 CREDITS: 4 (Theory 3 & Practical 1)**

## Course Objectives:

1. To enable the students to understand about the Chemistry of Atomic and Molecular structure, Chemical Bonding, Chemistry of Bio inorganic molecules like Hemoglobin, Chlorophyll, and Vitamin B12.
2. To understand the Bio-Chemical relationship and properties of elements.
3. To enable the students to understand and apply the concepts of Concentration of Solutions, Colloidal behavior, Coagulation, pH in Bio-system, Food industry and in Medicine.
4. To enable the students to understand and apply the concepts of Rate of Reaction, Role of Enzyme Catalyst, Electro-Chemical behavior of body fluids, causes of corrosion in metals.
5. To enable the students to understand and apply the concepts of energy transfer through thermodynamics processes. Application in photosynthesis and global warming.

| **Total Number of Hrs. : 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **3** | **1** | **-** |
| **Hrs/Week** | | **3** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA+ Assignment)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

Unit-1: Atomic Structure & Chemical Bonding: Filling of electrons in orbitals. Chemical Bonding and Molecular Structure: Covalent bonding: VSEPR, VBT, hybridisation and MOT for homonuclear and heteronuclear (CO and HF) diatomic molecules. Ionic and Metallic bonding. Fajan's rule. Coordination bonding. Coordination structure of hemoglobin, chlorophyll, vitamin B12.

Unit -2: Modern Periodic Table: Modern Periodic law, Classification of elements in periodic table, periodicity, electronegativity, electron affinity, ionisation potential, atomic radii, ionic radii.

Unit-3: Solutions: Definition, types and strengths. Indicators: definition, types and uses. Colloidal state: Definition, classification and applications in food and medicine. Acids and

Bases: Arrhenius, Bronsted and Lowry theories and Lewis concept. Buffer solution and pH scale. Basic idea of determination of strength of unknown sample by titration method.

Unit-4: Chemical Kinetics & Electrochemistry: Order and molecularity of reaction, factors influencing rate of chemical reactions, first order chemical kinetics, half life period, Catalysis: definition, classification and characteristics. Enzyme catalysed reactions. Electrochemistry: work done and potential energy, Faraday's laws on electrolysis, galvanic cell and electrode potential. Corrosion: definition, cause and types of corrosion, metallic corrosion and their prevention.

Unit-5: Chemical Thermodynamics: First law of thermodynamics: Work (w), heat (q), changes in internal energy ($\Delta E$) and enthalpy ($\Delta H$). Concept of calorie and joule. Isothermal and adiabatic conditions for reversible and irreversible processes. Concept of standard state and standard enthalpies of formation (Kirchhoff"s equation). Second law of thermodynamics, Carnot's engine, concept of entropy, Gibbs free energy and Helmoltz free energy. Criteria of spontaneity

**Reference Books:**


1. J. D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
2. P.W. Atkins: Physical Chemistry, Oxford University Press
3. F. A. Cotton, G Wilkinson, PL. Gaus: Basic Inorganic Chemistry. Wiley
4. Physical Chemistry, RL Madan, G D Tuli: S Chand


**BSBS-ID-103-P: Chemical Science (Practical)**

1. Introduction to calibration of analytical equipments and apparatus.
2. Determination of strength of given acid using titrimetric method with known Basic solution.
3. Determination of hydroxyl ions (alkalinity) in water sample.
4. Determination of calcium ion from aqueous solution by complexometric method.
5. Determination of pH of a solution using pH meter
6. Determination of surface tension of given liquid.
7. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture
8. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator
9. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer
10. Determination of concentration of Iron using Spectrophotometric method.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**Ability Enhancement Course (AEC)**
**Semester-1**

**Subject-** Communicative English **Max. Marks**: 100
**Subject Code**-BSBS-AE-104

**Evaluation Scheme**

| Credit | L | T | P | Semester End Examination | Internal Examination | Total |
|---|---|---|---|---|---|---|
| **3** | **3** | **0** | **0** | **75** | **25** | **100** |

**Course Objectives**

1- Understand and apply the fundamentals of English grammar and vocabulary in everyday communication.
2- Develop the ability to comprehend spoken and written English through focused listening and reading exercises.
3- Improve writing skills for basic functional and personal communication, including sentence and paragraph formation.
4- Enhance speaking skills for social, academic, and workplace interactions.

**Course Outcomes**

After completing the course, students will be able to:

1. Construct grammatically correct sentences using appropriate vocabulary.
2. Read and understand short texts, instructions, and messages in English.
3. Listen and respond appropriately to spoken English in various everyday contexts.
4. Write simple emails, notes, messages, and personal narratives clearly and coherently.
5. Speak confidently and clearly in common social and functional situations, including introductions, questions, and conversations.

**Unit 1: Fundamentals of English Grammar and Vocabulary Building**

Parts of Speech, Articles, Modals
Subject-verb agreement, Tenses
Direct and Indirect Speech
Synonyms, Antonyms, Homophones and Homonyms
Error Correction

**Unit 2: Reading Skills**

Reading comprehension (Skimming and Scanning)
Reading Academic Texts
Identifying the main idea of the text
**Prescribed Text:** Short Story 'Out of Business' by R.K Narayan

**Unit 3: Listening Skills**

Types of Listening,
Listening vs. Hearing
Listening for the main idea,

Note-Taking strategies

Unit 4: **Speaking Skills**
Phonetics and Pronunciation (Syllable, Stress and Intonation)
Everyday Conversation and dialogue practice,
Extempore
Descriptive and Narrative Speaking,
Oral Presentation

**Unit 5: Writing Skills**
Paragraph writing,
Structuring essays,
Writing Formal and Informal letters,
Article writing
Email writing

**Suggested Readings:**
Adair, John. *Effective Communication*. Revised ed., Pan Macmillan, 2003.
Clark, John, and Colin Yallop. An Introduction to Phonetics and Phonology. 4th ed., Wiley Blackwell, 2016.
Murphy, Raymond. English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Learners of English. 5th ed., Cambridge University Press, 2019.
McCarthy, Michael, and Felicity O'Dell. *Basic Vocabulary in Use*. Cambridge University Press, 2001.
Seely, John. *The Oxford Guide to Writing and Speaking*. 2nd ed., Oxford University Press, 2005.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: ENVIRONMENT AND ECOLOGY (THEORY)**
**SUBJECT CODE: - BSBS- SE- 105**
**SEMESTER – I, TOTAL HOURS: 45 CREDITS: 3**

**Course Objectives:**

1. Investigate the complexities of the natural environment and our relationship with it.
2. Explore the problems we face in understanding our natural environment and in living sustainably.
3. Develop scientific, interpretive, and creative thinking skills.

| **Total Number of Hrs.: 45** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 2 | 1 | - |
| Hrs/Week | | 2 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory: 100** | | **Practical: 50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit-1 Basic Understanding (8 Lectures)**

Introduction of Environment, Categories of Environment, Features of Environment, Components of Environment, Ecology, Ecosystem and Its Dynamics, Ecosystem Dynamics, Terrestrial Ecosystem, Aquatic Ecosystem, Changes in Ecosystem, Ecosystem Conservation, Biogeochemical Cycles, Gaseous Cycle, Carbon Cycle, Effects of High Concentration of Greenhouse Gases, Hydrological Cycle, Nitrogen Cycle, Oxygen Cycle, Sedimentary Cycle, Sulphur Cycle, Phosphorus Cycle

**Unit-2 Natural Resources, Biosphere & Biomes (8 Lectures)**

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people, Water resources: Use and over-utilization of surface

and ground water, floods, drought, conflicts over water, dams-benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies, The extent of the Biosphere, Working of the Biosphere, Importance of the Biosphere, Biosphere of India and Uttarakhand, Biomes, Global Biomes, Major Biomes of the World

**Unit-3 Biodiversity & Conservation (8 Lectures)**

Types of Biodiversity, Value of the Biodiversity, Threats to Biodiversity, Alpha, Beta, Gamma Diversity

Causes of Biodiversity losses, Invasive species, Exotic species, Effects of Loss of Bio-Diversity, Conservation Strategies, IUCN, IUCN Red List, Ecologically Sensitive Area (ESAs), In-situ methods of conservation of biodiversity, Advantages of In-situ Conservation, Disadvantages of In-situ conservation, Ex-situ Methods of Conservation of Biodiversity, Biodiversity Act 2002

**Unit-4 Environmental Pollution & Policies (8 Lectures)**

Water Degradation, Measurement of Water Pollution, Harmful Effects of Water Pollution, Sewage Treatment Technology and Policies, Eutrophication, Air Pollution, Causes of Air Pollution, Harmful Effects of Common Air Pollutants, Control of Air Pollution, Environmental Protection Act 1986, Waste Management, Solid Waste Management, Salient features of SWM Rules, 2016, Bio-Medical Waste Management Rules, 2016

**Unit-5 Climate Change, Environmental Impact Assessment & Disaster (8 Lectures)**

Impact of climate change & its mitigation, Climate Change Management, Conventions, International Organisations, Role of India to minimise the carbon foot prints, Impact of Agriculture on Environment, Sustainable Agriculture, Hi-tech Farming Methods, Rain Water Harvesting, Green Buildings and their Rating System in India, Disaster and their composition, Disaster Management Techniques, Common Wealth Government Plan for Disaster Management, Case Studies

1. **Educational tour : (**Two in Semester) visit to Industries, Research Organisations, Protected Areas

Educational tours are important for environmental science because they help students learn about the environment and how to care for it. They also help students develop a sense of responsibility and empathy towards the world around them. (***One tour is equable to 02 Lectures***)

2. **Environment & Ecology based documentary Screening**: (Two in semester) **equable to 02 Lectures**

**Recommended Books**:


- Essential Environmental Studies by S P Misra & S. N Pandey (Anr Books Pvt. Ltd.)
- Environmental Studies by J P Sharma, Laxmi Publications,
- Paryavaran Addhayan (Hindi version) by Anubha Kaushik & C P Kaushik, New Age Publications
- Ecology & Environmental Biology by Ramdeo Misra, English Book Depot
- Environment and Ecology by R.Rajagopalan, OAK BRIDGE
- Ecology by Dr. Kailash Chaudhary & Dr. Ram Prakash Saran, IFAS Publications
- Fundamentals of Ecology by Eugene Pleasants Odum, CENGAGE Learning


**Practical in Environment & Ecology BSBS- SE- 105-P**

1. Soil Testing: Texture, Moisture, pH, Nitrate, Phosphate, Sulphate, Quadrats Methods.
2. Instrumentation: Secchi Disk, Atmometer, Anemometer, Hygrometer, Luxmeter
3. Water Testing: Hardness, BOD, COD, DO, TDS
4. Common and threatened Plants and Animals spotting
5. Detailed report presentation on educational tour by the students

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**COURSE DETAILS**
**SUBJECT TITLE: FOUNDATION OF YOGA (THEORY)**
**SUBJECT CODE: - BSBS-VA-106**
**SEMESTER-I TOTAL HOURS: 30 CREDITS: 2**

**Course Objectives:**

1. Students of the UG course will have an understanding of Yoga, its origin, history and development of Yoga
2. It will encourage the students to live life with discipline, honesty, kindness and integrity in order to find their purpose and to live it fully.

| **Total Number of Hrs. : 30** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **2** | **-** | **-** |
| **Hrs/Week** | | **2** | **-** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

## UNIT-1: GENERAL INTRODUCTION TO YOGA

Brief about origin of Yoga: Psychological aspects of Yoga, History and Development of Yoga: prior to the Vedic period, Vedic period, Medival period, modern era; Etymology and Definitions of Yoga, Aims and Objectives of Yoga, Misconceptions about Yoga; Importance of Yoga. (10 Hours)

## UNIT-2: DIFFERENT STREAMS OF YOGA

Jnana Yoga: Meaning of Jnana and Jnana-Yoga, Sadhana-chatushtaya, Means of Jñāna, Bhakti Yoga: Meaning of Bhakti and Bhakti-Yoga, Stages of Bhakti, Types of Bhakti,Means of Bhakti- Yoga; Karma Yoga: Meaning of Karma and Karma-Yoga, Concept of Nishkama Karma, Means of Karma Yoga; Inter-relationship between Bhakti

Yoga, Karma-Yoga and Jnana Yoga. (8 Hours)

**UNIT - 3: BRIEF ABOUT YOGA IN TEXTS**

Brief of Yoga in Vedas and Yoga in Principal Upanishads, Yogic perspective: Bhagavad Gita, Yoga Vasishtha, Narada Bhakti Sutras. Yogic perspective: Puranas with emphasis to Bhagavat Purana; Emphasis to Vedantic approach of Shankaracharya, Ramanujacharya, Madhvacharya and Vallabhacharya.
(7 Hours)

**UNIT-4: INTRODUCTION TO EMINENT YOGIS**

Introduction to eminent Yogis and their style of Yoga: Hiranyagarbha, Vyasa, Patanjali, Kapilmuni, Bhrtrihari, Adishankaracharaya, Maharshi Dayanand, Swami Vivekanand, Swami Sivananda, Parmahansa Yogananda, Mahesh Yogi, Maharshi Arvind, Swami Kuvalyanand, BKS Iyangar, Sadguru, Ravi Shankar, Yogrishi Swami Ramdev. (5 Hour)

**TEXT BOOKS**


1. Yogrishi Swami Ramdev Ji : Yog ke moolbhut Sidhhant, Divya Prakashan, Haridwar.
2. Acharya Balkrishna: Grihasth Yog Sadhak k Gun, Divya Prakashan, Haridwar, 2017.
3. Singh S P & Yogi Mukesh: Foundations of Yoga, Standered Publication, New Delhi, 2010.
4. Yogrishi Swami Ramdev Ji: Ek Yogi Ek Yodhha, Divya Prakashan, Haridwar, 2015.
5. Sri Vishwanath Mukharji: Bharat ke Mahan Yogi, Vishvavidyalaya Prakashan, 2012.


**BOOKS FOR REFERENCE**


1. Acharya Balkrishna: Yog Vishwakosh, Divya Prakashan, 2014.
2. Agarwal M M: Six systems of Indian Philosophy, Chowkhambha Vidya Bhawan, varanai, 2010.
3. Swami Bhuteshananda: Nararad Bhakti Sutra, Advaita Ashrama Publication-Dept. Kolkata, II Edition, 2009
4. Radhakrishnan S: Indian Philosophy, Oxford University, UK (Vol. I & II) II Edition, 2008
5. Max Muller K. M: The six systems of Indian Philosophy, Chukhambha, Sanskrit series, Varanasi, 6th Edition, 2008
6. Paul Brunton: A search in secret India, Riders Books, 2003

# 2ND SEMESTER

**University of Patanjali, Haridwar**

**Syllabus of B.Sc.Biological Sciences under NEP**

**Core Course**

**COURSE DETAILS**

**SUBJECT TITLE: BIOCHEMISTRY**

**SUBJECT CODE: - BSBS-MJ-201**

**SEMESTER – II**

**CREDITS: 5+1**

**Course Objectives:**

1. To give students a solid foundation in biology and chemistry.
2. To develop analytical and critical-thinking skills that allow independent exploration of biological phenomena through the scientific method.
3. To introduce students to modern methods of biochemical experimentation within the disciplines of biology and chemistry.

| | Theory | Practical | Tutorial |
|---|---|---|---|
| **Credits** | **5** | **1** | **-** |
| **Hrs/Week** | **5** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | |
| **Total marks: 150** | | | |
| **Theory:100** | | **Practical:50** | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** |
| **75** | **25** | **35** | **15** |

**UNIT-I Amino acids and Proteins [10 H]**

Amino acids: classification, structure, zwitter ions, reactions, properties. Separation of amino acids, essential amino acids. Biologically important oligo peptides. Determination of protein structures– Peptide bond, Ramachandran Plot, protein sequencing methods, primary, secondary, tertiary, and quaternary structural organization. Protein denaturation and renaturation. Relationships in protein families.

**UNIT-II Enzyme and Vitamins [10 H]**

Introduction to enzymes, Fischer's lock and key hypothesis, and Koshland's induced fit hypothesis. Activation and transition energy, factors affecting the enzyme. IUBMB classification of enzymes. Michaelis-Menten equation and Lineweaver-Burk plot. Enzyme inhibition, Competitive, Uncompetitive, and Non-competitive inhibition.

Introduction of Vitamins, structure importance of fat-soluble and water-soluble vitamins, and their clinical significance. Hypervitaminosis.

**UNIT-III Nucleic Acid [8 H]**

Nitrogenous bases: nucleosides and nucleotides- structure, function, and properties. Structure of DNA- Watson Crick model and different forms of DNA. Right-handed and left-handed DNA helix. Supercoiling of DNA. DNA and RNA sequencing methods. Types of RNA mRNA, tRNA, rRNA, gRNA, miRNA, snRNA, and siRNA. Nucleic acid denaturation and renaturation hybridization, macromolecular interaction, protein-nucleic acid interaction.

**UNIT-IV Carbohydrates [8 H]**

Chemistry of Carbohydrates: Structure, Classification, physical and chemical properties and biological importance of sugars. Monosaccharides, Disaccharides, and polysaccharides. Reducing and non-reducing sugar. Important derivatives of monosaccharides. Blood group polysaccharides, storage, and structural polysaccharides, proteoglycans, and glycoproteins.

**UNIT-V Fatty Acids and Lipids [9 H]**

Introduction of lipids: classification and properties. Essential fatty acids ω3 and ω6 fatty acids. Triacyl glycerides- properties and biological significance. Storage and membrane lipids biological significance. Phospholipids- properties and functions. Isoprenoids, sterols, cholesterol, prostaglandins, and glycolipids.

## Biochemistry (Practical) BSBS-MJ-201-P Credits 1 Hours 30

1. Different properties of water and their importance in biomolecules.
2. Concept of Molarity and normality, calculations for solution preparation
3. Concept of pH and buffers, preparation of buffers.
4. Qualitative/Quantitative tests for carbohydrates, reducing sugars, and non-reducing sugars.
5. Study of protein secondary and tertiary structures with the help of models.
6. Qualitative/Quantitative tests for proteins.
7. Study of Denaturation Protein.
8. Qualitative/Quantitative tests for lipids.
9. Qualitative/Quantitative Nucleic acid.
10. Study of Denaturation of Nucleic Acids.

**Suggested reading:**


1. Nelson DL and Cox MM (2017) Lehninger Principles of Biochemistry, 7th Edition.,
2. W.H. Freeman and Company,
3. Jeremy Berg; Gregory Gatto Jr.; Justin Hines; John L. Tymoczko; Lubert Stryer;
4. Biochemistry Tenth Edition ©2023.
5. Principles of Biochemistry, Global Edition, 5th Edition Donald Voet, Judith G. Voet, Charlotte W. Pratt ISBN: 978-1-119-45515-4 August 2018.
6. Biochemistry, 6th Edition (2022) by U. Satyanarayana.
7. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: BIOPHYSICS (THEORY)**
**SUBJECT CODE: - BSBS-MN-202**
**SEMESTER – II, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:** The biophysics course objectives are

1. It Helps learners to understand the laws of physics to biological problems.
2. Biophysics helps to understand the various laws & principles used for biological systems.

| **Total Number of Hrs.: 45** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 4 | 0 | - |
| Hrs/Week | | 4 | 0 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

**Unit1: General Physics: [15 Hrs.]**

Conservation of momentum and energy, work energy theorem. Angular momentum, Physiological effects of acceleration and angular motion. Simple harmonic motion, Wave equation, superposition principle, interference, effects of vibrations in humans.

**Unit 2: Cell, Protein Structure & Stability [15 Hrs.]**

Cell structure and mechanics, Elasticity and its types, Cell signaling, Cell Cycle and growth, Cell interaction, Viscometry Predicting properties of proteins from amino acid composition. Primary structure sequencing of polypeptide, hemoglobin, homologies in proteins, Secondary structure alpha and beta conformation, collagen structure, stability of alpha helix, Ramachandran plot, Tertiary structure, structure of myoglobin and hemoglobin, Quaternary structure, Analysis of subunits and chain arrangement of subunits, stability of globular quaternary structure. Protein folding rules.

**Unit 3: Biophysics of Various Organs [20 Hrs.]**

(i) Structure of the eye, Optics of Vision, retinal pigments, rods and cones, Photochemistry of vision, structure of ear, physics of audition (amplitude, frequency, pitch), unit of measurement of sound, intensity, Audiometry, deafness, hearing aids. Taste & Smells: taste receptors & their role,

(ii) Electrocardiogram (ECG) and its characteristics, structure of lungs, diffusion, exchange and transport of gases, Effect of altitude changes on body, high altitude- mountain sickness. Biophysics of nerves, generation and propagation of nerve impulse, synapse, synaptic transmission, Brain Waves (EEG): origin of alpha, beta, delta & theta waves.

**Unit4: [10 hrs.]**
Algebra, Matrices, Determinants, Differentiations, Integrations.

**Suggested Readings:**


1. Physical Biochemistry, David Frei elder, Applications to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman and Company, 2005.
2. Hoppe et. al., Biophysics, Translation of 2nd German Edition, Springer Verlag, 1983.
3. Keith Wilson and John Walker, Principles and Techniques of Biochemistry and Molecular Biology, 6th Edition, Cambridge University Press, 2005

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: COMPUTER APPLICATION (THEORY)**
**SUBJECT CODE: - BSBS-ID-203**
**SEMESTER – II, TOTAL HOURS: 45 CREDITS: 4**

**Course Objectives:**

**1.** To understand the basic concept of Computer Programming.

**2.** To understand various aspects of Biology and Computer Programming techniques.

**Course Outcome:**

**1.** This is a skill based paper that introduces the students to the basics of computer operations The student is imparted with knowledge on both hardware and software.
**2.** The student has a better understanding on the use of computers for various applications

| **Total Number of Hrs. : 30** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **3** | **1** | **-** |
| **Hrs/Week** | | **3** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical: 50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

## COMPUTER PROGRAMMING FOR BIOLOGISTS

Fundamentals of computers, algorithms, computer basics, Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts, AI and Generative AI, Its applications.

### Simple programming in Python: Getting started with Python program

Variables, keywords and Operators, Control flow statements, Numbers and Functions, Strings, Lists, Tuples, Dictionary and Sets, More of Python functions, Object oriented programming with Python, Exception Handling in Python, File handing, Regular expression, Multithreading, Database, Python Debugging and Automation, Usage of standard module and web-scrapping.

**Books Recommended:**


1. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).
2. Let us Python by Kanetkar, BPB Publication, Noida.


**SUBJECT TITLE: COMPUTER APPLICATION (PRACTICAL)**
**SUBJECT CODE: - BSBS-ID-203-P CREDITS: 1 TOTAL HOURS: 30**

**a.** To calculate perimeter/ circumference and area of shapes such as triangle, rectangle, square and circle
**b.** To find largest and smallest numbers in a list
**c.** To find the sum of squares of the first 100 natural numbers
**d.** Create a dictionary to store names of states and their capitals
**e.** To find average and grade for given marks
**f.** To print the highest and lowest values in the dictionary
**g.** Create a dictionary of students to store names and marks obtained in 5 subjects

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**Ability Enhancement Course (AEC)**
**Semester-2**

**Subject-** Advanced Communicative English Max. Marks: 100
**Subject Code-**BSBS-AE-204

**Evaluation Scheme**

| Credit | L | T | P | Semester End Examination | Internal Examination | Total |
|---|---|---|---|---|---|---|
| 3 | 3 | 0 | 0 | 75 | 25 | 100 |

**Course Objectives:**

1. Enhance vocabulary through prefixes, suffixes, idioms, and phrasal verbs.
2. Develop critical reading and text analysis skills.
3. Improve public speaking, debating, and interview techniques.
4. Strengthen academic and professional writing skills.
5. Build confidence in formal communication settings.

**Course Outcomes:**

After completing the course, students will be able to:

1. Use advanced vocabulary appropriately in context.
2. Analyze and interpret academic and professional texts.
3. Speak fluently and confidently in various formal settings.
4. Write structured essays, reports, and business documents.
5. Perform effectively in group discussions and interviews.

**Unit 1: Vocabulary expansion**

Suffixes and Prefixes, Phrasal Verbs, Idioms and Collocations,
Learning words in context (academic, professional and social)

**Unit 2: Reading Comprehension and Analysis**

Strategies to read Academic and Professional Texts
Critical reading (Analysis and Interpretation)
Vocabulary in context
**Prescribed Texts:** An excerpt titled 'The Boat' from the book *My Journey: Transforming Dreams into Actions* by A.P.J Abdul Kalam

'Peace- A Poem by Swami Vivekananda'

**Unit 3: Advanced Speaking Skills**

- Public Speaking
  Preparing speeches and presentation
  Techniques for effective public speaking (body language, eye contact and voice modulation)
- Debate and Group Discussion
  Strategies for formal debates
  Critical thinking and analytical skills
  Leadership and teamwork in group discussion,
- Interview Skills

Different types of interviews
Identifying your strengths, weaknesses, skills and achievements,
Prepare answers to typical interview questions
Understanding body language and other non-verbal ques,

**Unit 4: Academic and Professional Writing**

- Essay writing
  Structure of academic essays
  Developing arguments
- Academic writing
  Conventions of Academic writing
  Summarizing and Paraphrasing
- Business writing
  Writing formal emails and reports
  Creating professional documents (resume CVs and cover letter)
  Writing business letters
- Technical writing
  Research paper and abstract writing
  Documentation and user manuals
  Data interpretation and presentation (charts, graphs, tables)

**Suggested Readings**

Eastwood, John. Oxford Guide to English Grammar. Oxford University Press, 1994. Hewings, Martin.
Butterfield, Jeff. *Soft Skills for Everyone*. 2nd ed., Cengage Learning India, 2020.
Burnett, Ann, and Pamela Stephens. Group Discussion: A Practical Guide to Participation and Leadership. 4th ed., Allyn & Bacon, 2000.
McCarthy, Michael, and Felicity O'Dell. English Vocabulary in Use: Advanced. Cambridge University Press, 2008.
Paul, Richard, and Linda Elder. Critical Thinking: Tools for Taking Charge of Your Learning and Your Life. 4th ed., Pearson, 2021.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**Subject: Medicinal Plants**

**SUBJECT CODE: BSBS-SE-205**

**SEMESTER-II: TOTAL HOURS: 45**

**Credit 3 (Theory 2 and Practical 1 Credit)**

**Course Objectives**:

1. To make the students aware of the novel properties of medicinal plants.
2. To make the students expert in identifying the medicinal plants available in their locality, irrespective of the field to which he/she belongs.
3. To learn to identify the most common and useful medicinal plants

| **Total Number of Hrs. : 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **2** | **1** | **-** |
| **HRs/Week** | | **2** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1:**Diversity and Geographical Distribution of Medicinal Plants in India; Taxonomic identification of Medicinal Plants; Drug Adulteration and Substitutions; Conservation Status of Medicinal Plants in India.

**Unit 2:**Detail study like botanical name, family name, common names, plant parts used, botanical description, chemical constituents, medicinal uses, contraindication, adverse effect of some important medicinal plants obtained from different plant sources like

**Root/Rhizome Sources:** Acorus (Vach), Ashwagandha, Ginger (Adrak), Jatamansi, Indian Snakeroot (Sarpagandha), Satawar, Turmeric (Haldi)

**Oil Sources:** Castor (Erand), Chaulmoogra, Mustard (Sarson), Sesame (Til)

**Bark/Stem Sources:** Arjuna, Ashoka, Cinnamon (Dalachini), Giloy, Kutaj

**Gum and Resin Sources:** Gum Arabic (Babool), Guar gum, Guggul, Gum Sterculia, Tragacanth

**Leaf Sources:** Aloe vera, Curry Leaves, Kalmegh, Mint (Pudina), Margosa (Neem), Cinnamon Leaves (Tejpatra), Holy Basil (Tulsi), Vasaka

**Fruit/Seed Sources:** Indian Gooseberry (Amla), Bahera, Black pepper (Kali Mirch), Cardamom (Elaichi), Clove, Coriander (Dhania), Fennel, Fenugreek (Methika, Methi), Harad, Wood Apple (Indian Bael), Indian Screw Tree (Marod Phali), Shikakai, Timbru

**Unit 3:**Study of some rare and highly prized medicinal plant of India like Keeda Jadi, Morchella, Salam Punja

**Practical (BSBS-SE-205-P)**

**1.** Morphological examinations, botanical name, family, parts used and uses of some important medicinal plants like Aloe vera, Amla, Arjuna, Ashwagandha, Babool, Bahera, Black pepper, Cardamom, Cinnamon (Dalachini), Giloy, Clove, Curry Leaves, Ginger, Harad, Indian Screw Tree, Sarson, Satawar, Tejpatra, Tulsi, Turmeric, Vasaka

**2.** Preparation and submission of herbarium sheets of 10 medicinal plants

**Suggested Reading:**


1. Acharya Balkrishna: Ayurveda Jadi Booti Rahasya

2. B.K.Verma: Introduction to Taxonomy of Angiosperms

3. C.P. Khare: Indian Medicinal Plants: An Illustrated Dictionary

4. S.S. Handa & V.K. Kapoor: Textbook of Pharmacognosy

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**COURSE DETAILS**
**SUBJECT TITLE: SANSKAR (THEORY)**
**SUBJECT CODE: - BSBS-VA-206**
**SEMESTER – II TOTAL HOURS: 30 CREDITS: 2**
**Course Objectives:**

**Course Outcome:**

| **Total Number of Hrs. : 30** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **2** | **-** | **-** |
| **Hrs/Week** | | **2** | **-** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

**Unit I:**

Varna-Ashrama System Origin and development of Varna Vyavastha
Origin, development and significance of Ashrama Jati Vyavastha

**Unit II:**

Marriage and Family Meaning and objectives of marriages
Types of marriages Concept and component of family

**Unit III:**

Position and Role of Women Position and status of women in Ancient society
Stree Dhan and her Property rights

**Unit IV:**

Purusharth and Samsakaras
Types of Purushartha
Types of Samsakaras

**Unit V:**

Education System Objectives of education
Important centers of education: Nalanda, Balabhi, Kashi and Taxila

**Text Book:** Mishra, J.S., Prachin Bharat ka Samajik Itihas, Patna, 1986

**Recommended Readings:**


1- Altekar, A. S., Education in Ancient India (Also in Hindi) Altekar, A.S., Position of Women in Hindu Civilization,

2- Dutt, N. K., Origin and Growth of Caste in India, Calcutta, 1931.

3- Jauhari, M., Prachin Bharata Mem VarnasramaVyavastha (Hindi), Varanasi, 1985.

4- Kapadia, K. M., Marriage and Family in India (English)

Tripathi, L.K. (ed.), Position and Status of Women in Ancient India, 2 Vols., Varanasi, 1988 and 1992

# 3RD SEMESTER

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**Major Course Details:**
**SUBJECT TITLE: METABOLISM OF BIOMOLECULES (THEORY)**
**SUBJECT CODE: - BSBS-MJ-301**
**SEMESTER –III, TOTAL HOURS: 60 CREDITS: 6**

**Course Objectives:**
1. Knowledge of the historical background of metabolism.
2. Explain the basic elements of the integration of metabolism
3. Compare and contrast the basic differences between carbohydrate, lipid, and protein Metabolism.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 5 | 1 | - |
| Hrs/Week | | 5 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory: 100** | | **Practical: 50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1.** **[10 Hrs]**

**Bioenergetics:** First law of thermodynamics, second law of thermodynamics, Gibbs free energy, endergonic & exergonic reactions, Feasibility of reactions. Structure, properties, and energy currency of the cell, Importance of Coupled reactions, High energy compounds. Introduction to Metabolism - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways

**Unit 2.** **[10 Hrs]**

**Carbohydrate Metabolism:** Introduction, Aerobic and anaerobic pathways: Glycolysis and its regulation, Gluconeogenesis and its regulation. TCA cycle, amphibolic & anaplerotic reactions. Electron Transport chain, Oxidative phosphorylation, & production of ATP, balance sheet of glucose oxidation, Oxidative stress. Pentose phosphate pathway (HMP shunt) & its regulation.

**Unit 3.** **[10 Hrs]**

**Glycogen metabolism:** Glycogenolysis, phosphorylase regulation, role of epinephrine and glucagon for glycogenolysis, glycogenesis; reciprocal regulation of glycogenesis and

glycogenolysis. Glycogen storage disease (GSD), von Gierke disease, Andersen disease, McArdle disease and Pompe's Disease.

**Unit 4.** **[10 Hrs]**

**Fatty acid synthesis and degradation:** TAG as an energy source, β oxidation of fatty acids in mitochondria and peroxisomes, ketone bodies. Biosynthesis of fatty acids - elongation and unsaturation of fatty acids. Regulation of fatty acid oxidation and synthesis.

**Unit 5.** **[10 Hrs]**

**Amino acid catabolism and anabolism:**

Protein degradation to amino acids, urea cycle, feeder pathways into TCA cycle. Nitrogen fixation, synthesis of non-essential amino acids. Disorders of amino acids metabolism, phenylketonuria, alkaptonuria, maple syrup urine disease, methylmalonic acidemia (MMA), homocystinuria, and Hartnup's disease.

**Unit 6.** **[10 Hrs]**

**Nucleotide metabolism:** Biosynthesis - de novo and salvage pathways, regulation of nucleotide synthesis by feedback inhibition, degradation, and excretion. Disorder of nucleotide metabolism-Gout, Lesch–Nyhan disease, Severe combined immunodeficiency syndrome (SCID) and adenosine deaminase (ADA) deficiency.

**SUBJECT TITLE: METABOLISM OF BIOMOLECULES (PRACTICAL)**
**SUBJECT CODE: - BSBS-MJ-301-P CREDITS: 1 TOTAL HOURS: 30**

1. Estimation of blood glucose –Glucose Oxidase method.
2. Estimation of serum urea.
3. Estimation of lipoprotein (HDL and LDL) in Blood sample.
4. Estimation of serum uric acid.
5. Case study: Fatty liver disease in India to respect of Western countries.
6. Case study: Role of metropolitan lifestyle in Diabetes Type-I and Type-II disease development in India.

**Suggested reading:**


1. Nelson DL and Cox MM (2017) Lehninger Principles of Biochemistry, 7th Edition., W.H. Freeman and Company,
2. Jeremy Berg; Gregory Gatto Jr.; Justin Hines; John L. Tymoczko; Lubert Stryer; Biochemistry Tenth Edition ©2023.
3. Lippincott's Illustrated Reviews - Biochemistry, 2nd South Asian Edition 6 June 2024.
4. HARPER'S ILLUSTRATED BIOCHEMISTRY 32nd Edition, 7 September 2022.
5. Principles of Biochemistry, Global Edition, 5th Edition Donald Voet, Judith G. Voet, Charlotte W. Pratt ISBN: 978-1-119-45515-4 August 2018.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: BASICS OF IMMUNOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-MN-302**
**SEMESTER – III, TOTAL HOURS: 60 CREDITS: 4**
**Course Objectives:**

1. To teach students immune system and its components, the defense mechanisms that can establish a state of immunity against infection, and Immune-related diseases.
2. To provide knowledge on immune deficiencies and several immunological techniques.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1 Introduction No. of Hours: 4**
Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa.

**Unit 2 Immune Cells and Organs No. of Hours: 7**
Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.

**Unit 3 Antigens No. of Hours: 4**
Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants.

**Unit 4 Antibodies No. of Hours: 6**
Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies.

**Unit 5 Major Histocompatibility Complex No. of Hours: 5**

Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways).

**Unit 6 Complement System No. of Hours: 4**

Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation.

**Unit 7 Generation of Immune Response No. of Hours: 10**

Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance.

**Unit 8 Immunological Disorders and Tumour Immunity No. of Hours:10**

Types of Autoimmunity and Hypersensitivity with examples; Immunodeficiency - Animal models (Nude and SCID mice), SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD; Types of tumours, tumour Antigens, causes and therapy for cancers.

**Unit 9 Immunological Techniques No. of Hours: 10**

Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescences, Flow cytometry, Immunoelectron microscopy.

**SUBJECT TITLE: IMMUNOLOGY (PRACTICAL)**
**SUBJECT CODE: - BSBS-MN-302-P CREDITS: 1 TOTAL HOURS: 30**

1. Identification of human blood groups.
2. Perform Total Leukocyte Count of the given blood sample.
3. Perform Differential Leukocyte Count of the given blood sample.
4. Separate serum from the blood sample (demonstration).
5. Perform immunodiffusion by Ouchterlony method.
6. Perform DOT ELISA.
7. Perform Immunoelectrophoresis.

**Suggested readings**:


1. Goldsby RA, Kindt TJ, Osborne BA. (2015). Kuby's Immunology. 7th edition W.H. Freeman and Company, New York.
2. Richard C and Geiffrey S. (2015). Immunology. 7th edition. Wiley Blackwell Publication.
3. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
4. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwell Scientific Publication, Oxford.
5. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
6. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: Organic Chemistry (THEORY)**
**SUBJECT CODE: - BSBS-ID-303**
**SEMESTER – III, TOTAL HOURS: 60 CREDITS: 4**

**Objectives:**

1. Basic concepts involved in of bonding, nomenclature and structure in organic compounds.
2. To understand the core concepts of organic chemistry i.e. resonance, hyper conjugation, inductive effect.
3. To acquire basic knowledge of reactive intermediates and mechanism of organic reactions
4. To analyses and elucidate the functional group in aliphatic and aromatic compounds.
5. To understand chemistry in everyday life.
6. To study about the Biodegradable and non-biodegradable polymers.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory: 100** | | **Practical: 50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit-1.**

Introduction to organic compounds, Nature of chemical bonds, Dipole moment, Organic acids and Bases.

**Unit-2.**

Electronic Displacements: Inductive Effect, Electrometric Effect, Mesmeric effect. Resonance and Hyper conjugation. Cleavage of Bonds: Haemolysis and Heterolysis. Reaction intermediates: Carbocation, Carbanions and free radicals. Types of organic reactions and their mechanism.

**Unit-3.**

Aliphatic Hydrocarbons, alkenes, alkynes, Alkyl Halides, Alcohols, Phenols, Esters, Aldehydes and ketones, Carboxylic acids, Amines (General preparations, reactions and physical properties).

**Unit-4.**

Aromatic hydrocarbons and aromaticity- Structure of benzene, Aromatic Character, Nomenclature, Aromatic reactions and their mechanism.

**Unit-5.**

Polymers- Definition, Classification, and polymerization reactions (addition and coordination). Synthesis and applications of some important polymers: like polythene, nylon, polyesters, etc. Chemistry in everyday life, medicines, soaps & detergents, green chemistry

**SUBJECT TITLE: Organic Chemistry (PRACTICAL)**
**SUBJECT CODE: - BSBS-ID-303-P CREDITS: 1 TOTAL HOURS: 30**

1. Introduction to organic chemistry practical
2. Detection of elements in organic compounds
3. Oxidation of alcohols to acid using Jones reagent
4. Estimation of sugars by using Fehling solution
5. Tollens reagent test of organic compounds
6. Carbylamines test of amines
7. Synthesis of Acetanilide
8. Determination of saponification value of the given oil

**Books recommended:**


1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Seventh Edition, 2019 Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Sixth Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Sixth Edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.
5. Berg, J. M., Tymoczko, J. L. &Stryer, L. Biochemistry 7th Ed., W. H. Freeman

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: BIOSTATISTICS & DATA SCIENCE (THEORY)**
**SUBJECT CODE: - BSBS-AE-304**
**SEMESTER – III, TOTAL HOURS: 60 CREDITS: 3**

**Course Objectives:**

1. It helps learners to analyze data from various biological experimental problems.
2. It helps to determine the appropriate sampling techniques and coordinate data collection
   Procedures.
3. It helps to conduct statistical analyses to answer scientific questions.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 0 | - |
| Hrs/Week | | 3 | 0 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

**Unit-1 Biostatistics (8Hrs)**

Definition –statistical methods – basic principles, Variables-measurements, functions, limitations and uses of statistics. Collection of data primary and secondary. Types and methods of data collection procedures and demerits. Classification-tabulation and presentation of data-sampling methods.

**Unit-2 Measures of central tendency (8Hrs)**

Mean, median, mode, geometric mean – merits & demerits. Measures of dispersion range, standard deviation, mean deviation, quartile deviation-merits and demerits; Co-efficient of variations.

**Unit 3 Correlation (12 Hrs)**

Correlation: Types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression. Statistical inference: Hypothesis- simple hypothesis – student‘t’ test –chi-square test.

**Unit-4 -Introduction to data science (9Hrs)**

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape –Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modelling – DBMS-Presentation.

**Unit-5 - Data visualization (9HRS)**

Introduction to data visualization – Data visualization options – Filters – Map Reduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary.

**SUGGESTED READINGS**


1. Danniel, W.W. (1987), Biostatistics, New York, John Wiley Sons.
2. Banerjee, P. (2001), Introduction to Biostatistics, S. Chand Publication, Delhi.
3. Goon, Gupta & das Gupta: Fundamentals of Statistics Vol II, Calcutta: The world press.
4. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016.
5. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: HERBAL DRUG DEVELOPMENT (THEORY)**
**SUBJECT CODE: - BSBS-SE-305**
**SEMESTER – III, TOTAL HOURS: 45 CREDITS: 3**

**Course Objectives:**

1. Identify and authenticate the herbal drugs.
2. To make the students aware of the novel properties of herbal plants.
3. To make the students expert in identifying the medicinal plants available in their locality, irrespective of the field to which he/she belongs.
4. To learn to identify the most common and useful herbal plants

| **Total Number of Hrs.: 45** | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|
| Credits | 3 | 0 | - |
| Hrs/Week | 3 | 0 | - |

| **SCHEME OF EXAMINATION** | | | |
|---|---|---|---|
| **Total marks: 100** | | | |
| **Theory:100** | | **Practical:00** | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** |
| **75** | **25** | **00** | **00** |

**UNIT-I 11 Hours**

Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials Processing of herbal raw material Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. Indian Systems of Medicine a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

**UNIT-II 7 Hours**

Nutraceuticals General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following

herbs as health food: Alfa alfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

**UNIT-III 10 Hours**

Herbal Cosmetics 154 Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products. Herbal excipients: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. Herbal formulations: Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes.

**UNIT- IV 10 Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

**UNIT-V 07 Hours**

General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant-based industries and institutions involved in work on medicinal and aromatic plants in India. Schedule T – Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule – T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and record

**Recommended Books: (Latest Editions)**


1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy).

SUBJECT TITLE: **Yagna Chikitsha**

**SUBJECT CODE: - BSBS-VA-306 SEMESTER – III, TOTAL HOURS: 30**

**CREDITS: 2**

| Total Number of Hrs. : 30 | | Theory | Practical | Tutorial |
|---|---|---|---|---|
| Credits | | 2 | - | - |
| Hrs/Week | | 2 | - | - |
| SCHEME OF EXAMINATION | | | | |
| Total marks: 100 | | | | |
| Theory:100 | | Practical:00 | | |
| Final Exam (SEE) | Internal Assessment (CT+TA) | Final Exam (SEE) | Internal Assessment (CT+TA/PR) | |
| 75 | 25 | - | - | |

पाठ्यक्रम के उद्देश्यः–

- यज्ञ के शास्त्रीय अर्थ से परिचय कराना तथा यज्ञों के प्रकार पर प्रकाश डालना।
- ऋषि परम्परा से चले आ रहे इस वैज्ञानिक यज्ञ चिकित्सा का बोध कराना।
- सृष्टि चक्र के संतुलन के परिपेक्ष्य में यज्ञीय विधान का परिचय।
- आत्मिक, शारीरिक, मानसिक, आध्यात्मिक, सामाजिक, वैश्विक समस्याओं/रोगों के समाधान पर्यावरण संरक्षण एवं सुख शांति हेतु।

इकाई प्रथम–

1. वैदिक धर्म एवं वैदिक देवताओं का परिचय एवं इतिहास।
2. यज्ञ संस्था का परिचय एवं विवेचन।
3. यज्ञ के प्रकार एवं उपदेयता एवं वैज्ञानिकता।
4. नित्य पंचमहायज्ञ (ब्रह्मयज्ञ, देवयज्ञ, पितृयज्ञ, बलिवैश्वदेवयज्ञ, अतिथियज्ञ)

इकाई द्वितीय–

1. यज्ञीय पदार्थ– हवनकुण्ड आदि पात्र, समिधा, सामग्री व घी।
2. यज्ञ प्रक्रिया विधि– आचमन, अंङ्ग स्पर्शन, ईश्वर–स्तुतिप्रार्थनोपासना, द्वीप प्रज्जवलन, अग्न्याधान इत्यादि।

इकाई तृतीय–

1. यज्ञकुण्ड का परिमाण एंव स्वरुप एवं मंत्रविज्ञान।
2. शास्त्रों में यज्ञ की महिमा–बल, शत्रुपराजय, ऐश्वर्य, स्वर्ग कल्याणादि।
3. नैमत्तिक–16 संस्कार, भूमि पूजन, गृह प्रवेश, होली, दीपावली पर्व आदि।
4. काम्य–पुत्रेष्टि, वर्षेष्टि, शारीरिक व मानसिक रोग हेतु यज्ञ। कृषि वर्षा पर्यावरण यज्ञ।
5. .विभिन्न समप्रदायों में यज्ञ एवं उसकी प्रकियाएं।

इकाई चतुर्थ–

1. यज्ञ चिकित्सा/थरेपी
2. यज्ञ चिकित्सा का शास्त्रीय प्रमाण–वेदादि शास्त्रों में रोग निवारण हेतु बताये गये मन्त्र–श्लोक।
3. यज्ञ चिकित्सा के वैज्ञानिक प्रमाण–अनेक वैज्ञानिकों द्वारा किये गये शोध का विवरण।
4. . रोगानुसार हवन सामग्री–प्राणेष्टि, मेधेष्टि, पित्तेष्टि, कफेष्टि, कर्कटष्टि, वातेष्टि, चर्मेष्टि, सन्ततीष्टि, हदयेष्टि, मधु–इष्टि, दिव्येष्टि, प्रारब्धेष्टि, गुग्गल।

इकाई पंचम–

मंत्र स्मरण एवं उच्चारण

निर्धारित पाठ्यपुस्तक–

- यज्ञ–योग–आयुर्वेद चिकित्सा एवं यज्ञ दर्शन, वैदिक नित्यकर्म विधि
- वैदिक साहित्य एवं संस्कृति, डॉ0 कपिलदेव द्विवेदी।
- संध्योपासना विधि– पतंजलि योगपीठ।
- पंच महायज्ञ विधि– महर्षि दयानन्द।

# 4TH SEMESTER

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**Major Course Details**

**SUBJECT TITLE: GENETICS (THEORY)**

**SUBJECT CODE: - BSBS-MJ-401**

**SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. Apply Quantitative problem-solving Skills to genetics problems and issues.
2. Demonstrate their ability to reason both inductively and deductively with experimental information and data.
3. Select and apply experimental procedures to solve genetic problems.
4. To make the students understand the functional aspect of genes.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1: Mendelian Genetics and Extensions [12 HRS]**

Mendel's work on the transmission of traits, Genetic Variation, and Molecular basis of Genetic Information. Principles of Inheritance, Chromosome theory of inheritance, Laws of probability, Pedigree analysis, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis and Pleiotropy.

**Unit 2: Linkage, Crossing over and Chromosomal Mapping [10 HRS]**

Linkage and Crossing over, cytological basis of crossing over, Molecular mechanism of crossing over. Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and Coincidence.

**Unit 3: Mutations [12 HRS]**

Chromosomal mutations, Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced v/s Spontaneous, Back v/s Suppressor mutations. Molecular basis of mutations, UV light and chemical mutagens, Detection of mutations: ClB method, Attached X-method, DNA repair mechanisms.

**Unit 4: Genome Dynamics-Transposable Genetic Elements [10 HRS]**
Prokaryotic transposable elements, IS elements, Composite transposons, Tn-3 elements; Eukaryotic transposable elements- Ac-Ds system in maize and P-elements in drosophila; Importance of transposons.

**Unit 5: Extrachromosomal Inheritance [08 HRS]**
Chloroplast mutation/Variegation in four 'o clock plant and Chlamydomonas, Mitochondrial mutations in Neurospora and yeast, Maternal effects, Infective Heredity-Kappa particles in Paramecium

**Unit: 6 Population and Evolutionary Genetics [08 HRS]**
Concept of population, Allele frequencies, Genotype frequencies, Gene pool, Hardy-Weinberg Law, role of natural selection, Genetic drift.

**SUBJECT TITLE: GENETICS (PRACTICAL)**
**SUBJECT CODE: - BSBS-MJ-401-P CREDITS: 1 TOTAL HOURS: 30**

1. To study different types of Cell divisions using permanent slides (Mitosis and Meiosis).
2. Laboratory exercises on monohybrid, dihybrid, and test cross and back cross.
3. Pedigree analysis for dominant and recessive autosomal and sex-linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 15:3, 15:1, 12:3:1,9:3:4)
5. Chromosome mapping using point test cross data.
6. Laboratory exercises in probability.
7. Photographs/permanent slides showing Translocation Ring, Laggard's and Inversion bridge.
8. Demonstration of DNA Fingerprinting.
9. Exercise using RAPD Markers.

**SUGGESTED READINGS:**


1. Genetics (2021) 6th ed., Snustad, D.P. and Simmons, M.J., John Wiley & Sons. (Singapore), ISBN: 978-1-118-09242-2.
2. Genetics - A Conceptual Approach (2022), 4th ed., Pierce, B.A., W.H. Freeman & Co. (New York), ISBN:15:978-1-4292-7606-1 / ISBN:10:1-4292-7606-1.
3. An Introduction to Genetic Analysis (2018), 10th ed., Griffiths, A.J.F, Wessler, S. R, Carroll, S. B. and Doebley, J., W.H. Freeman & Company (New York), ISBN:10: 1-4292-2943-8.
4. Genetics (2022)- P.K Gupta.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**COURSE DETAILS**
**SUBJECT TITLE: INDUSTRIAL MICROBIOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-MN-402**
**SEMESTER – IV**
**CREDITS: 3+1=4**

**Course Objective:**

1. To teach students about the use of microorganisms to produce products and services, and to develop their technical and theoretical skills.
2. To learn about microbial metabolites and their usefulness

**Course Outcome:**

1. Students gather fairly knowledge of how microbes are used in the fermentative production of organic acids, alcohols, enzymes, antibiotics
2. Students get knowledge of various physical parameters, which affect production of industrial products by the microorganisms, and the safety aspects of the production.

| | Theory | Practical | Tutorial |
|---|---|---|---|
| **Credits** | **3** | **1** | **-** |
| **Hrs/Week** | **3** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | |
| **Total marks: 150** | | | |
| **Theory:100** | | **Practical:50** | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** |
| **75** | **25** | **35** | **15** |

**Unit 1: Introduction to Industrial Microbiology** **No. of Hours:10**

Fermentation and pasteurization; Alexander Fleming: Discovery of antibiotics; Carl Neuberg: Enzyme fermentation); Fermented foods, additives, and enzymes; industrial products by the microorganisms, and the safety aspects of the production.

**Unit 2: Fermentation Technology** **No. of Hours:10 hours**

Principles of fermentation; Types of fermentations: Submerged and solid-state; types of cultures: batch, fed-batch and continuous; Inoculum development; basic design and functions of different part of fermenter/bioreactor; Types of bioreactors; Scale-up and scale-down processes; Downstream processing and product recovery.

**Unit 3: Microbiology for Industrial production** **No. of Hours: 15 hours**

Overview of microorganisms (Bacteria: Bacillus, Escherichia coli, Streptomyces; Fungi: Aspergillus, Penicillium; Yeasts: Saccharomyces cerevisiae; Algae: Chlorella, Spirulina; Characteristics of industrially important microorganisms; Sources and isolation of industrial

microorganisms; Preservation and maintenance of industrial strains; Primary and secondary screening techniques; use of recombinant DNA technology for strain improvement and industrial production.

**Unit 4: Production of Industrial Products** **No. of Hours: 10 hours**

Production of antibiotics (Penicillin & Streptomycin), alcohols (Ethanol &Butanol), enzymes (Amylase & Lipase), organic acids (Citric acid & lactic acid) and vitamins (B-12&C); Introduction and industrial production of Biopolymers and bioplastics.

**BSBS-MN-402-P INDUSTRIAL MICROBIOLOGY (PRACTICAL)**
**TOTAL HOURS: 30 CREDITS: 01**

1. Isolation of microorganisms from natural sources.
2. Quantitative estimation of amylase production by bacterial culture.
3. Isolation and screening of bacterial and fungal cultures for enzyme production
4. Quantitative estimation of lipase production by bacterial culture
5. Glucose fermentation and Ethanol production using yeast
6. Demonstration of antibiotic production and activity on agar plate.
7. Display of fermenter /bioreactor design

**Suggested Readings:**


1. Industrial Microbiology by L.E. Casida 2022 2nd Ed.
2. *Industrial Microbiology text book Edition*: *3rd (2017); by* Wulf *Crueger*, Anneliese *Crueger*, K.R. Aneja
3. Industrial Microbiology by Reed, G. Prescott and Dunn.4th Edition 2004
4. Industrial Microbiology: An Introduction by Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton 1st Edition 2015
5. Principles of Fermentation Technology by Peter F. Stanbury, Allan Whitaker, StephenJ. Hall 3rd Edition 2016
6. Microbial Biotechnology: Fundamentals of Applied Microbiology by Alexander N. Glazer, Hiroshi Nikaido 2nd Edition 2007
7. Industrial Biotechnology: Sustainable Growth and Economic Success edited by Wim Soetaert, Erick J. Vandamme (Latest Edition)
8. Modern Industrial Microbiology and Biotechnology by Nduka Okafor
9. Practical Fermentation Technology Edited by Brain McNeil and Linda M. Harvey

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: DRUG DISCOVERY & DESIGN (THEORY)**
**SUBJECT CODE: - BSBS-ID-403**
**SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. To make the students understand the basic concept of drugs and their targets.
2. To understand the Fundamentals of Physicochemical principles of drug action.
3. To understand the role of pharma informatics in drug discovery.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit-1 General Introduction [20HRS]**

Definition and scope of drug design; Drug target classification: Proteins as drug targets: Receptors - receptor role, ion channels, membrane-bound enzyme activation, agonist and antagonists, the concept of inverse agonist, desensitization and sensitization of receptors, affinity, efficacy and potency. Enzymes - Enzyme inhibitors (competitive, noncompetitive, suicide inhibitors), medicinal use of enzyme inhibitors. Nucleic acids as drug targets: Classes of drugs that interact with DNA: DNA intercalators and DNA alkylators.

**Unit-2 Physicochemical principles of drug action [05HRS]**

Partition coefficient, drug dissolution, acid-base properties, surface activity, bioavailability, stereochemical aspects of drug action.

**Unit-3 Drug receptor interactions [05HRS]**

Kinetic analysis of ligand-receptor interactions using Scatchard plot, double reciprocal plot, Hill plot, forces involved, and the relationship between dose and effect (graded and quantal response).

**Unit-4 Principles of drug design [10HRS]**

Introduction to SAR, strategies in the search for new lead compounds, analogue synthesis versus rational drug design, and concept of prodrugs.

**Unit-5 Drug discovery and pharma informatics [20HRS]**

Drug discovery pipeline, drug target identification, and validation for a microbial pathogen, selection of gene unique to the pathogen, screening for its presence in other microbes and human host, Drug Databases, PubChem, Calculating drug-like properties, introduction to rational drug design methods, optimization of lead compounds.

**SUBJECT TITLE: DRUG DISCOVERY (PRACTICAL)**

**SUBJECT CODE: - BSBS-ID-403-P CREDITS: 1 TOTAL HOURS: 30**

1. Preparation of Benzocaine,
2. Preparation of Aspirin and determination of partition coefficient in octanol-water system,
3. Preparation of Phenacetin.
4. To perform preliminary phytochemical screening of crude drugs.
5. Determination of the alcohol content of Asava and Arista.
6. Evaluation of excipients of natural origin.
7. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
8. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
9. Monograph analysis of herbal drugs from recent Pharmacopoeias.
10. Determination of Aldehyde content.
11. Determination of Phenol content.
12. Determination of total alkaloids.

**Suggested readings:**


1. Introduction to Medicinal Chemistry, 4th edition (2009), Graham l. Patrick, Oxford University Press. ISBN-15: 978-0199234479.
2. The Organic Chemistry of Drug Design and Drug Action, 2nd edition (2004), Richard B. Silverman, Elsevier, Academic Press. ISBN-15: 978-0126435324.
3. Medicinal Chemistry: A Molecular and Biochemical Approach, 3rd edition (2005), Thomas Nogrady and Donal F. Weaver, Oxford University Press. ISBN-15: 978-0195104561.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: PLANT PHYSIOLOGY AND PATHOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-AE-404**
**SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4**
**Course Objectives :**

1. Describe metabolic reactions that occur in cells.
2. Compare the structure and function of organ systems in a variety of animal phyla.
3. Outline the steps involved in the transmission of nerve impulses.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical: 50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1: Plant Morphology (15HRS.)**
Introduction to Indian ancient, Vedic and heritage Botany and contribution of Indian Botanists, in context with the holistic development of modern science and technology. Tissues: Classification of tissues; Simple and complex tissues (no phylogeny); cytodifferentiation of tracheary elements and sieve elements; Pits and plasmodesmata. Stem: Organization of shoot apex. Types of vascular bundles; Anatomy of dicot and monocot stem.

**Unit 2 [12 HRS]**
**Plant-water relationship:** Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.
Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps, brief introduction of Hydroponics and aeroponics Technology and its applications in Plant Science.

**Unit 3 Photosynthesis & Metabolites: [15HRS]**
Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction centre, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation. Primary & Secondary metabolites:

Brief introduction; Major classes of metabolites, examples of each class, roles in plant defense.

**Unit 4 Plant growth regulators [18HRS]**

Discovery and physiological roles of Auxin, gibberellins, cytokines, ABA, and ethylene. Plant response to light and temperature: Photoperiodism (SDP, LDP, Day-neutral plants); Phytochrome (discovery and structure), red and far red-light responses on photo morphogenesis; Vernalization.

**Unit 5.**

**Plant Pathology:** Importance, definitions, and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases. Growth, reproduction, survival, and dispersal of important plant pathogens, the role of environment and host nutrition on disease development. Host-parasite interaction, recognition concept, and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism is affected by plant pathogens.

**SUBJECT TITLE: PLANT PHYSIOLOGY AND PATHOLOGY (PRACTICAL)**
**SUBJECT CODE: - BSBS-AE-404-P CREDITS: 1 TOTAL HOURS: 30**

1. Determination of the activity of antioxidative enzymes (peroxidase and catalase)
2. Demonstration of Hill reaction.
3. To study the phenomenon of seed germination (effect of light).
4. Study of the effect of various environmental factors on transpiration in an excised twig/leaf
5. Demonstration of Hydroponics and Aeroponics Technology.
6. Study of the mechanism of stomatal opening and closing.
7. Section cutting of the dicot and monocot stem.
8. Section cutting of the dicot and monocot stem.

**SUGGESTED READINGS**


1. Plant Physiology and Development. Seventh Edition. Lincoln Taiz, Ian Max Møller, Angus Murphy 9780197577240. Hardcover 26 August 2022.
2. Plant Physiology and Development · 6th edition · 978-1605352558 · Hardback · Sinauer Associates is an imprint of Oxford University Press (10/15/2020).
3. Knut Schmidt-Nielsen, Animal Physiology, Cambridge University Press.
4. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
5. H. S. Srivastava. Plant Physiology, Rastogi Publications, New Delhi

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: INSTRUMENTATION (THEORY)**
**SUBJECT CODE: - BSBS-SE-405**
**SEMESTER – IV, TOTAL HOURS: 45 CREDITS: 4**

| **Total Number of Hrs.: 45** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 4 | 0 | - |
| Hrs/Week | | 4 | 0 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

1. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
   (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   (b) Identify and separate the sugars present in the given mixture by paper chromatography.
2. Optical methods of analysis: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.
3. Infrared spectroscopy: Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR).
4. NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spincoupling, Applications.
5. Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio
6. Electrophoresis: Basic Principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, discontinuous gel electrophoresis, PAGE, SDS-PAGE, Native and

denaturing gels. Agarose gel electrophoresis, buffer systems in electrophoresis. Electrophoresis of proteins and nucleic acids, protein and nucleic acid blotting, detection and identification. Molecular weight determination

**7.** Centrifugation

Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient, various

types of centrifuges, different types of rotors, differential centrifugation, density gradient centrifugation

**Books: `**


1. Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).
2. Instrumental Methods of Analysis, 7th ed, Willard, Merritt, Dean, Settle.
3. P.W. Atkins: Physical Chemistry.
4. G.W. Castellan: Physical Chemistry.
5. C.N. Banwell: Fundamentals of Molecular Spectroscopy.

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**COURSE DETAILS**
**SUBJECT TITLE: IKS**
**SUBJECT CODE: - BSBS-VA-406**
**SEMESTER-IV CREDITS: 2**

**UNIT 1:-**

**Indian Knowledge System (Part A)** [15 HRS.]

CATURDASA VIDYASTHANA-S: 14 branches of learning in ancient India-purana, nyaya, Mimamsa, dharmasastra, six vedanga-s: (siksa, vyakarana, nirukta, chanda, jyotisa, kalpa) and four Vedas-Rigveda, yajurveda, samaveda and atharvaveda; introductory information on them. 18 PURANAS; their names and five general characteristics of purana-s-sarga, pratisarga, vamsa, manvantara and vamsanucarita.

**UNIT 2:- Indian Knowledge System (Part B)** [15 HRS.]

Introduction and Contribution of Ancient Indian gurukula System: Odantapuri, Mithila, Kanchi, Kasmira , Ujjain, Definitions and Meanings from various texts (mahabharata, manusmrti, vaisesika sutra). kamya, nitya, nisiddha, naimittika, prayascita & upasana. Meaning of the word artha-purusarhta; Root and derivation and meaning. Social outlook for tirthayatra, festivals, saptapuri, 12 jyotirlinga-s and unity of India.

**Reference books:**


1. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
2. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
3. Baladev Upadhyaya, Samskrta Śāstrom ka Itihās, Chowkhambha, Varanasi, 2010.
4. The Beautiful Tree: Indigenous India Education in the Eighteenth Century, Dharampal, Biblia Impex, New Delhi, 1983. Reprinted by Keerthi Publishing House Pvt Ltd., Coimbatore, 1995.
5. Indian Science and Technology in the Eighteenth Century, Dharampal. Delhi: Impex India, 1971. The British Journal for the History of Science.
6. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.
7. Dharampal, Some Aspects of Earlier Indian Society and Polity and Their Relevance Today, New Quest Publications, Pune, 1987.
8. Mohanty, J. N. (2008). A History of Indian Philosophy. A Companion to World Philosophies, 24–48.

**9.** Potter, K. H. (1987). Encyclopedia of Indian Philosophies Vol IV. Delhi, India: Motilal Banaridass Publishers.

**10.** Press, O. U. (1928). Indian Philosophy: A Very Short Introduction. Mind (Vol. 35).

**11.** Radhakrishnan, S., & Moore, C. A. (Eds.). (1957). A Source Book in Indian Philosophy. New Jersey, NJ: Princeton University Press.

**12.** Schweizer, P. (1993). Mind/ Consciousness Dualism in Sankhya-Yoga Philosophy.

**13.** Philosophy and Phenomenological Research, 53(4), 845–859. doi:10.2307/2108256

**14.** Timalsina, S. (2008). Consciousness in Indian philosophy: The Advaita doctrine of "awareness only."

# 5TH SEMESTER

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**Core Course**

**SUBJECT TITLE: ENDOCRINOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-MJ-501**
**SEMESTER – V, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. To explain the roles of the endocrine system in maintaining homeostasis, integrating growth and development.
2. To understand endocrine disorders, and how to diagnose and treat them
3. To differentiate among endocrine, paracrine, and autocrine systems.
4. Understand how hormones affect physiology and behaviour.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1: Introduction [03 Hrs]**

History of endocrinology, characteristics of Hormones, Classification –Local and circulating hormones, chemical classification, Neurosecretions and Neurohormones

**Unit 2: Hypothalamic-Pituitary system [10 Hrs]**

Hypothalamus; structure of hypothalamus, names and functions of important hypothalamic nuclei, neuroendocrine regulation of endocrine glands and feedback mechanisms. Pituitary Gland, structure of pituitary, its hormones, their secretion, transportation, storage, functions and hypothalamic regulation; disorders of pituitary gland. Pineal gland, secretions and their functions in biological rhythms and reproduction.

**Unit 3: Thyroid-Parathyroid system [06 Hrs]**

Thyroid gland; structure of thyroid gland, synthesis and functions of thyroid hormones, regulation of thyroid hormone secretion; thyrocalcitonin. Disorders of thyroid gland.

Parathyroid Glands: Secretion Action of parathyroid Hormones, the role of parathyroid hormone and calcitonin in calcium metabolism, disorders of the parathyroid gland.

**Unit 4: Adrenal gland and its hormones [08 Hrs]**

Structural of Adrenal Gland – Synthesis and structure of hormones of the adrenal cortex and medulla; Biological Action of glucocorticoids, mineralocorticoids, adrenaline, and noradrenaline on carbohydrate and protein metabolism; and cardiovascular system, osmoregulation, Stress and diseases related to adrenal cortex and medulla.

**Unit 5: Pancreas and its hormones [08Hrs]**

Structure of Pancreatic Islets of Langerhans and hormones secreted by it; insulin secretion (proinsulin) its activation, Glucagon secretion, mechanism of action of both hormones in controlling the blood glucose level. Diabetes mellitus.

**Unit 6: Reproductive endocrinology [10Hrs]**

Male Reproductive system; hormonal control of testes; chemistry and biosynthesis of testosterone, functions of testosterone. Female Reproductive system, role of hormones in Female Sexual cycle, placental hormones; parturition and lactation.

**SUBJECT TITLE: ENDOCRINOLOGY (PRACTICAL)**
**SUBJECT CODE: - BSBS-MJ-501-P CREDITS: 1 TOTAL HOURS: 30**

1. Study of the permanent slides of the Hypothalamus and their importance.
2. Study of Hormonal therapy.
3. Study of the permanent slides of the Pituitary gland and its role in hormonal regulation.
4. Study of the permanent slides of the Thyroid gland and related Diseases.
5. Study of the permanent slides of the Adrenal Gland and its hormone function.
6. Study of the permanent slides of the Pancreas and their Hormones.
7. Demonstration of ovarian hypertrophy or adrenal hypertrophy.
8. Demonstration of Castration and ovariectomy.

**Suggested reading:**


1. Essentials of Medical Physiology by K Sembulingam & Prema Sembulingam -Review of Medical Physiology - New 10th Edition 2024 – 25.
2. Tortora's Principles of Anatomy and Physiology, Global Edition, 15th Edition, June 2017.
3. Hadley, M.E. and Levine, J.E., “Endocrinology”, 6th Edition, Pearson Education Inc. 2007.
4. J. Larry Jameson, editor. (2010). Harrison's Endocrinology. 2nd Edition. McGraw-Hill Press: New York.
5. Hall, J.E. (2011). Guyton and Hall Textbook of Medical Physiology (Guyton Physiology).

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: MOLECULAR BIOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-MN-502**
**SEMESTER – V, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. To understand the mechanisms of DNA replication, transcription, and translation
2. To describe how RNA, DNA, and Proteins are synthesized.
3. Understand how genes and chromosomes function.
4. Understand the central dogma of biology

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1 Molecular Biology [10 Hrs]**

General principles - bidirectional replication, Semi-conservative, discontinuous. RNA priming, Various models of DNA replication. Enzyme involved in DNA replication – DNA polymerases, DNA ligase, primase, telomerase and other accessory proteins. Denaturation and renaturation of DNA, Cot curves.

**Unit 2 The mutability and Repair of DNA [10 Hrs]**

Replication Errors (Transitions, transversion and thymine dimer), DNA Damage (deamination, depurination and dimerization) and their repair: mismatch repair, SOS response (recombination), Excision Repair, Photoreactivation.

**Unit 3 Information Transfer –I: Mechanism of Transcription [10Hrs]**

Basic transcription apparatus, Initiation, elongation and termination of transcription, Eukaryotic transcription of mRNA, tRNA and rRNA, types of RNA polymerases, transcription factors, Inhibitors of transcription- rifampicin and α-amanitin. Reverse Transcription in virus.

**Unit 4 Post-Transcriptional Modifications [10 Hrs]**

Split Genes, Concept of introns and exons, RNA splicing, Spliceosomes and Self splicing introns, alternative splicing and exon shuffling, mRNA transport.

**Unit 5 Information Transfer-II: Mechanism of Translation [5 Hrs]**

Features of genetic code and exceptions in some systems, Ribosome structure- rRNA and proteins, charging of tRNA, aminoacyl tRNA synthetases, Proteins involved in initiation (in prokaryotes and eukaryotes), elongation and termination of polypeptides, Fidelity of translation, Inhibitors of protein synthesis – tetracyclines, aminoglycosides, chloramphenicol and aminoglycosides.

**SUBJECT TITLE: MOLECULAR BIOLOGY (PRACTICAL)**
**SUBJECT CODE: - BSBS-MN-502-P CREDITS: 1 TOTAL HOURS: 30**

1. Preparation of various stock solutions required for Molecular Biology Laboratory.
2. Preparation of culture medium (LB) for E. coli (both solid and liquid) and raise culture of E. coli.
3. Isolation of chromosomal DNA from bacterial cultures and visualization on Agarose Gel Electrophoresis.
4. Quantitative estimation of salmon sperm/ calf thymus DNA using colorimeter (Diphenylamine reagent) and Spectrophotometer (A260 measurement).
5. Isolation of genomic DNA from blood/ tissue.
6. Demonstration of Polymerase Chain Reaction (PCR) technique
7. Demonstration of AMES test or reverse mutation for carcinogenicity

**Suggested readings:**


1. Molecular Biology of the Gene, 6th edition (2007), Watson, J. D., Baker T. A., Bell, S. P., Gann, A., Levine, M., and Losick, R; Benjamin Cummings Publishers, ISBN-15: 978-0805395921.
2. Cell and Molecular Biology: Concepts and Experiments, 7th edition (2015), Gerald Karp. ; Wiley Publishers ISBN-15: 978-1118206735.
3. Molecular Cloning: A Laboratory Manual, 4th edition (2012), Michael R. Green and Joseph Sambrook; Cold Spring Harbor Laboratory Press, ISBN-15: 978-1936115422.
4. The World of the Cell, 7th edition (2008), Becker, Kleinsmith, Hardin and Bertoni. Benjamin Cummings, ISBN-15: 978-0805393934.
5. The Cell: A Molecular Approach, 6th edition (2015), Cooper and Hausman; Sinauer Associates, Inc. ISBN-15: 978-1605351551.
6. DNA Replication, 2nd edition (2005), Arthur Kornberg; University Science Books ISBN-15: 978-1891589443.

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: BIOINFORMATICS (THEORY)**
**SUBJECT CODE: - BSBS-ID-503**
**SEMESTER – V, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. The objective of the course is learning and understanding the detailed developments and applications of the field of Bioinformatics in diverse area of biological research.
2. The course generally focuses on genomics, proteomics and computational biology studies and their relevance on research platforms.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1 (10 Hours)**

Introduction to Bioinformatics, NCBI, Protein Data Bank, PubMed, GenBank, EMBL, and data retrieval. Enzymes structure-function relationship and the basis of structure-based drug design.

**Unit 2. (8 Hours)**

European Bioinformatics Institute database search; Understanding EXPASY server; ESPript, European Molecular Biology server. Visualization software like PyMOL and others.

**Unit 3. (10 Hours)**

Introduction to Sequence comparison, global and multiple sequence alignment, Multiple sequence alignment using FASTA, Sequence alignment using CLUSTALW, BLAST, and advanced BLAST.

**Unit 4**. (**7 Hours)**

Introduction of Homology modeling, homology modeling using various tools such as MODELLER and Phyre-2, etc. Fold Recognition, Ab-initio Method, Protein folding. Classification family of proteins and fold.

**Unit 5. (10 Hours)**

Introduction to 3-dimensional protein structure, superposition of molecules, Molecular Docking of Protein with small molecules and nucleotides, Molecular Dynamics of Protein, and Concepts of Force Field.

**SUBJECT TITLE: BIOINFORMATICS (PRACTICAL)**
**SUBJECT CODE: - BSBS-ID-503-P CREDITS: 1 TOTAL HOURS: 30**

1. Introduction to different operating systems - UNIX, LINUX and Windows.
2. Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ, Uniprot, PDB.
3. Sequence retrieval using BLAST.
4. Sequence alignment & phylogenetic analysis using clustalW & phylip.
5. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, ENSCAN), Primer designing, Genscan/Genetool.
6. Protein structure prediction: primary structure analysis, secondary structure prediction using psipred,homology modeling using Swissmodel. Molecular visualization using jmol, Protein structure modelevaluation (PROCHECK).
7. Prediction of different features of a functional gene.

**Suggested reading:**


1. Higgins, D. and Taylor, W., "Bioinformatics – Sequence, Structure and Databanks", Oxford University Press. 2003
2. Lacroix, Z. and Critchlow, T., "Bioinformatics – Managing Scientific Data", Morgan Kaufmann Publishers. 2003
3. Bourne, E., P. and Weissig H., "Structural Bioinformatics" John Wiley and Sons. 2003
4. Campbell, A.M., and Heyer, I.J., "Discovering Genomics, Proteomics and bioinformatics"' Benjamin Cummings. 2003
5. Mount D.W., "Bioinformatics – Sequence and Genome Analysis" Cold Spring Harbor Lab. Press. 2001
6. Pevsner, J., "Bioinformatics and Functional Genomics"' John Wiley & Sons. 2003

**University of Patanjali, Haridwar**

**Syllabus of B.Sc. Biological Sciences under NEP**

**COURSE DETAILS**
**SUBJECT TITLE: BIOPROCESS TECHNOLOGY (THEORY)**
**SUBJECT CODE: BSBS-AE-504**
**SEMESTER-V TOTAL HOURS: 45 CREDITS: 4**

**Course Objectives:**

1. To acquaint students with technical and biological aspect of microbial utilisation for production of metabolites

**Course Outcomes:** After completion of this course, student will be able to

1. Designing of bioreactors and control necessary for maximising production.
2. Select and optimise media for maximum production of microbial metabolites.
3. Designing of protocols for strain improvement and separation of molecules after fermentation process

| **Total Number of Hrs. : 45** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **3** | **1** | **-** |
| **Hrs/Week** | | **3** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**UNIT I (10 Hours)**

Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fed batch and Continuous culture.

**UNIT II (10 Hours)**

Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inoculum development and sterilization.

**UNIT III (10 Hours)**

Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.

**UNIT IV (15 Hours)**

Introduction to downstream processing, product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.

**BSBS-AE-504-P BIOPROCESS TECHNOLOGY PRACTICALS**

**Duration 30Hours Credit-1**

1. Isolation and Preservation (Agar plate, Slant, Glycerol stock) of economically important strain of microorganisms.
2. Bacterial growth curve.
3. Effect of media supplements on growth of microorganisms and production of metabolite
4. Calculation of thermal death point (TDP) of a microbial sample.
5. Production and analysis of ethanol.
6. Production and analysis of amylase.
7. Production and analysis of lactic acid.
8. Isolation of industrially important microorganism from natural resource.
9. Immobilisation of enzyme.
10. Display of fermenter/bioreactor design

**Suggested Reading :**


1. Industrial Microbiology by L.E. Casida 2022 2nd Ed.
2. *Industrial Microbiology text book Edition*: *3rd (2017)* ;by Wulf *Crueger*, Anneliese *Crueger*, K.R. Aneja
3. Stanbury PF, Whitaker A and Hall SJ. (2016). Principles of Fermentation Technology. 3rd edition, Elsevier Science Ltd

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: NEUROBIOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-SE-505**
**SEMESTER – V, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

1. Describe the structure and function of cells that comprise the nervous system.
2. Outline sensory and motor systems.
3. Generate a hypothesis from a set of observations and then suggest experiments to test the hypothesis.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 3 | 1 | - |
| Hrs/Week | | 3 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit-1 [12HRS]**

Introduction to neurons, glia and muscle, Membrane Potentials: Basic concept of resting membrane potential: equilibrium potentials, Nernst equation, Action potential: generation and propagation.

**Unit-2 [12HRS]**

Ion Channels and Ion Pumps: Ion channels, ion pumps, Ohm's law, sodium channels, potassium channels, calcium channels, acetylcholine receptor channels, NMDA receptor channels, diversity of potassium channels.

**Unit -3 [12HRS]**

Drugs and toxins as tools in neuroscience research, Muscle Contraction: Mechanism of muscle contraction, Synapse: Electrical synapses, chemical synapses, molecular and cellular mechanisms of synaptic transmission, neuropharmacology of synaptic transmission, calcium regulation of synaptic transmission.

**Unit-4 [12HRS]**

Neural System and Behavior: Functional neuroanatomy of human central nervous system. Neurotransmitter systems, G protein-coupled receptors and effectors. Biology of sleep-wakefulness cycle. Chemical senses: Vision. Auditory. The sensation of touch. Thermoreceptor. Pain and the placebo effects.

**Unit -5 [12HRS]**

Homeostasis in the Nervous System: Diseases of Nervous System: Neurobiology of affective disorders or mood disorders; dopamine and addiction; current research on Alzheimer's disease, Parkinson's disease, Huntington's disease, autism spectrum disorders (ASD) and Japanese encephalitis.

**SUBJECT TITLE: NEUROBIOLOGY (PRACTICAL)**
**SUBJECT CODE: - BSBS-SE-505-P CREDITS: 1 TOTAL HOURS: 30**

1. The vertebrate nervous system and its organization chart.
2. Demonstration of tissue sectioning techniques.
3. Introduction to behavioural measurements and statistical analysis.

**Suggested readings:**

1. M. Bear, B. Connors, M. Paradiso, Neuroscience: exploring the brain, Lippincott Williams &Wilkins,3rd edition,2006.

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: INTERNSHIP/ REVIEW PAPER / INDUSTRIAL VISIT**
**SUBJECT CODE: - BSBS-VA-506**
**SEMESTER – V, TOTAL HOURS: 30 CREDITS: 2**

1. Here Students will go to Patanjali wellness centre and/or Yoggram for internship or Patanjali Herbal Park at Padartha or some relevant industry for industrial visit 2. After that they have to prepare a project report and submit to the department 3. It will be assessed by a departmental committee and evaluated accordingly out of 100 marks.

Else they can write a review paper supervised by a departmental teacher. It will be assessed by a departmental committee and evaluated.

# 6TH SEMESTER

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: RECOMBINANT DNA TECHNOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-MJ-601**
**SEMESTER – VI, TOTAL HOURS: 60 CREDITS: 4**

**Course objectives**

1. To understand the basic concept of recombinant DNA technology.
2. To understand various aspects of cloning vectors for prokaryotes and eukaryotes.
3. To understand the applications of recombinant DNA technology in medicine, production of recombinant pharmaceuticals and in agriculture.

| **Total Number of Hrs. : 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| **Credits** | | **3** | **1** | **-** |
| **Hrs/Week** | | **3** | **2** | **-** |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit-1:**

Introduction of Recombinant DNA Technology and its application. Cloning vectors: Plasmids, Phage, Cosmids Yeast cloning vectors, Animal & Plant virus as vectors, BAC, PAC, YAC, Nucleic acid modifying enzymes, Restriction endonuclease. Isolation of nucleic acid from Plant, animal, Bacteria

**Unit-II**:

Basic steps of gene cloning and cloning strategies, Synthesis of cDNA, Construction of cDNA and genomic libraries, Chromosome walking, Probe labelling, Hybridization, Blotting techniques (Southern, Northern, Western blotting)

**Unit-III:**

DNA sequencing, chemical and enzymatic methods, PCR, Site directed mutagenesis, DNA foot printing, DNA profiling, DNA fingerprinting

**Unit IV:**

Genomic analysis: Exon-intron trapping, RFLP, RAPD, AFLP, Transgenic technology: Types and application in Plants and animals

**Unit-V:**

Gene therapy: principle, strategy, Genomics: Structure and function, Human genome project: Strategy & Implications.

**BSBS-MJ-601-P RECOMBINANT DNA TECHNOLOGY TOTAL HOURS: 30 CREDITS: 1**

1. Isolation of DNA form bacterial cell
2. Demonstration of steps involved in molecular cloning using RDT
3. Demonstration of Electrophoresis and Transfer DNA
4. Isolation of genomic DNA from plant sample.
5. Isolation of plasmid DNA from bacterial cell culture.
6. PCR amplification of DNA.
7. Restriction digestion of vector and DNA.

**SUGGESTED READINGS**


1. Gene cloning T.A.Brown
2. Recombinant DNA Watson & et.al
3. Molecular Biotechnology Glick & Pasternak.


**Course outcomes:**

1. Technical know-how on versatile techniques in recombinant DNA technology.
2. An understanding on application of genetic engineering techniques in basic and applied experimental biology.
3. Proficiency in designing and conducting experiments involving genetic manipulation.

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**
**SUBJECT TITLE: PROTEOMICS & METABOLOMICS (THEORY)**
**SUBJECT CODE: - BSBS-MN-602**
**SEMESTER – VI, TOTAL HOURS: 45 CREDITS: 4**

**Course Objectives:**

1. Understanding the fundamental principles of protein and metabolite analysis.
2. Learn sample preparation and grasp the concepts of mass spectrometry-based identification and quantification.
3. To identify biomarkers and elucidate biological pathways.
4. Applying these techniques to relevant research in different biological disciplines.

| **Total Number of Hrs.: 45** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 4 | 0 | - |
| Hrs/Week | | 4 | 0 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

**Unit I**:
Introduction to proteome, proteomics technology, types and kinds of proteomics investigation, overview of systems biology, evolution from protein chemistry to proteomics, importance of proteomics.

**Unit II:**
Abundance-based proteomics, Quantitation proteomics, Interaction Proteomics: Sample preparation and pre-fractionation steps, two-dimensional gel electrophoresis (2-DE), 2D-DIGE and their applications. Merits and demerits of gel-based proteomics. MudPIT, Mass spectrometry (Ionizers, analyzers and detectors) technology, data analysis – computational/bioinformatics tools and its application in proteomics. ICAT, SILAC, iTRAQ, and their applications. Proteomic profiling for host-pathogen interaction, Understanding proteomics for post-translational modifications. Protein-Protein Interaction (PPI) and its application in proteomics. Yeast two-hybrid, bacterial two-hybrid system, immunoprecipitation, protein microarrays, Nucleic Acid Programmable Protein Array (NAPPA), Label-free nanotechnologies in proteomics.

**Unit III:** Application of proteomics for drug discovery. Biomarkers and drug targets identification. Validation of drug targets and assessment of its toxicology, Bioinformatics and proteomics: computational models of proteomics networks.

**Unit IV:**

Introduction to metabolomics world. High throughput screening systems and utility. Lessons from metabolites, metabolic fingerprinting, and metabolic profiling. Biotechnological potentials of metabolomics. Proteomics approaches in metabolomics. Analysis of differential protein expression, post-translational modifications and protein activity for metabolomics. HPLC and FPLC based approaches in metabolomics.

**Unit V:**

Application for cellular metabolomics for metabolic pathway structure. Size of metabolome, metabolite identification, pathway identification and pathway integration. Computational approaches for metabolite identification and translation of results into biological knowledge. Metabolite profiling for infectious disease. Application of metabolite profiling in heart disease. Metabolic signature and metabolite profiling in heart disease.

**Unit VI:**

Metabolomics in preclinical pharmaceutical discovery and development. Analytical considerations, and biological aspects and applications.

**Suggested readings**


1. T. Palzkill. 2002. Proteomics, Kluwer Academic Publishers, New York, USA.
2. E.D. Hoffmann, V. Stroobant. 2007. Mass Spectrometry: Principles and Applications, John Wiley & Sons Ltd. The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
3. D. Kambhampati. 2004. Protein Microarray Technology, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.
4. E. Fung. Methods in Molecular Biology, Volume 264: Protein Arrays, Humana Press Inc., Totowa, NJ. S.G. Villas-Boas. 2007. Metabolome Analysis: An Introduction, Wiley lackwell,USA.
5. B. J. Nikolau. 2007. Concepts in Plant Metabolomics, Wurtele, Eve Syrkin, Springer, USA.

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: IPR, BIOSAFETY& BIOETHICS (THEORY)**
**SUBJECT CODE: - BSBS-ID-603**
**SEMESTER – VI, TOTAL HOURS: 60 CREDITS: 4**
**Course Objectives:**

1. To introduce basic concepts of ethics and safety that is essential for Life Science Labs.
2. To understand the procedures involved in protection of Intellectual property.
3. To give an insight into different treaties signed. To gain knowledge about patent filing.

**Course Outcome:**

1. Gain Knowledge of working principles in a laboratory taking all safety measures, handling of live cultures, disposal of infectious waste, care of the equipment requiring safety audit.
2. Get an insight into Biosafety guidelines and Analyse and Manage the Risks involved with GMOs.
3. Understand about different treaties, rights and duties of Patent owner

| **Total Number of Hrs.: 45** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 4 | 0 | - |
| Hrs/Week | | 4 | 0 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory: 100** | | **Practical: 00** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

**Unit 1 No of Hours: 5**

Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms, AERB/RSD/RES guidelines for using radioisotopes in laboratories and precautions

**Unit 2 No of Hours: 20**

Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. .

**Unit 3 No of Hours: 10**

Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications-importance of IPR – patentable and non-patentable – patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO).

**Unit 4 No of Hours: 10**

Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.

**Unit 5 No of Hours: 15**

Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV & Brine conventions; Patent Co-operation Treaty (PCT); Indian Patent Act 1970 & recent amendments.

**Suggested reading:**


1. Bare Act, 2024.Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
2. Kankanala C (2007). Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd. New Delhi.
3. Mittal, D.P. (2022). Indian Patents Law, Taxmann, Allied Services (p) Ltd.
4. Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Implications, Springer India.

**University of Patanjali, Haridwar**
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**SUBJECT TITLE: RESEARCH METHODOLOGY (THEORY)**
**SUBJECT CODE: - BSBS-AE-604**
**SEMESTER – VI, TOTAL HOURS: 60 CREDITS: 4**

**Course Objectives:**

To familiarize the students to the principles of scientific methodology in business enquiry, to develop analytical skills of business research, and to develop the skills for scientific communications

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 4 | 0 | - |
| Hrs/Week | | 4 | 0 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 100** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **00** | **00** | |

**Unit-1 Introduction** **No. of hours: 10**

Meaning, objectives and motivations in research, Characteristics and limitations of research – Components of research work - Criteria of good research, Research process – Types of Research, Fundamental, Pure or Theoretical Research –Applied Research –Descriptive Research – Evaluation Research –Experimental Research – Survey Research – Qualitative Research – Quantitative Research – Historical Research.

**Unit-2 Research Design:** **No. of hours: 10**

Research Design – definition – essentials and types of research design – errors and types of errors in research design. Research problem: Selecting and analyzing the research problem – problem statement formulation – formulation of hypothesis. Literature review: purpose, sources, and importance - literature review procedure. Objectives: Learning Objectives; Definitions; Formulation of the research objectives.

**Unit-3: Measurement.** **No. of hours: 10**

Scaling and Sampling Variables in Research – Measurement and scaling – Different scales – Construction of instrument – Validity and Reliability of instrument. Data Collection methods – primary and secondary data – Construction of questionnaire and instrument – validation of instruments. Sample size determination - Sample design and sampling techniques.

**Unit-4: Data Analysis and Tools Processing of Data:** **No. of hours: 10**

Editing of Data – Coding of Data – Classification of Data – Statistical Series. Qualitative vs Quantitative data analyses – Univariate, Bivariate and Multivariate statistical techniques Measures of Central Tendency, Dispersion, correlation and Regression, Chi-square test: Applications, Steps, characteristics, limitations, Analysis of Variance and Covariance, Factor analysis – Discriminant analysis – cluster analysis – multiple regression and correlation – multidimensional scaling – Conjoint Analysis - Application of statistical software for data analysis.

**Unit-5: Research Report Writing** **No.of hours: 20**

Research report – Different types – Contents of report –executive summary – chapterization – contents of chapter – report writing – the role of audience – readability – comprehension – tone – final proof – report format – title of the report – Ethical issues in research: Code of Ethics in Research – Ethics and Research Process – Importance of Ethics in Research.

**Course Outcome:** The students will be able to

1. Formulate research problem,
2. Construct testable hypotheses,
3. Design survey, collect, process and analyse the data,
4. Apply statistical tools such as regression in their research, and
5. Write a decent research report.

**Suggested Readings:**


1. Cooper, D.R., Schindler, P.S. and Sun, J., 2006. Business research methods (Vol. 9). New York: McGraw-Hill Irwin.
2. Creswell, J.W. and Creswell, J.D., 2017. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.
3. Kothari, C.R., 2004. Research methodology: Methods and techniques. New Age International.
4. Krishnaswamy, K.N., 2006. Management Research Methodlogy: Integration of Principles, Medthods and Techniques. Pearson Education India.
5. Sekaran, U. and Bougie, R., 2016. Research methods for business: A skill building approach. John Wiley &Sons.


**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Microbiology under NEP**

**COURSE DETAILS**

**SUBJECT TITLE: DISSERTATION WORK/ RESEARCH PAPER**

**SUBJECT CODE: - BSMB-AE-605**

**SEMESTER – VI CREDITS: 3**

Here students have to write a standard research paper under the supervision of a teacher. Finally the paper will be presented by the student before the departmental committee for evaluation out of 100 marks.

**University of Patanjali, Haridwar**
**Syllabus of B.Sc. Biological Sciences under NEP**

**SUBJECT TITLE: BIOMATERIALS (THEORY)**
**SUBJECT CODE: - BSBS-VA-606**
**SEMESTER- VI, TOTAL HOURS: 60 CREDITS: 3**

**Course objectives:**

1. To understand the basics of nano-science and technology.
2. To understand the various process techniques available for biomaterials.
3. The application of nanotechnology in various fields such as biomedicine, Tissue Replacement Implants and Acute Wound Healing etc.
4.

| **Total Number of Hrs.: 60** | | **Theory** | **Practical** | **Tutorial** |
|---|---|---|---|---|
| Credits | | 2 | 1 | - |
| Hrs/Week | | 2 | 2 | - |
| **SCHEME OF EXAMINATION** | | | | |
| **Total marks: 150** | | | | |
| **Theory:100** | | **Practical:50** | | |
| **Final Exam (SEE)** | **Internal Assessment (CT+TA)** | **Final Exam (SEE)** | **Internal Assessment (CT+TA/PR)** | |
| **75** | **25** | **35** | **15** | |

**Unit 1: Introduction to biomaterials [20HRS]**

Classification, Chemistry and characterization of biomaterials. The state of the art of biomaterials and the challenges. Disciplines involved in biomaterials science and the path from a need to a manufactured medical device. Material selection requirements for biomaterials – metals, composites, ceramics and polymers. Tissue environment of the implanted biomaterial: unit cell processes. Tissue responses to implants. Nanomaterials: fullerenes, carbon nanotubes, Nano membranes. Synthesis of biomaterials, Characterization of chemical, physical, mechanical properties, visco elasticity, end group analysis, determination of molecular weight of a polymer.

**Unit 2: Biocompatibility [10HRS]**

Biocompatibility of Biomaterials, wound-healing process, body response to implants, blood compatibility. Tests to assess biocompatibility of a polymer, modifications to improve biocompatibility. Reactions of biomaterials with cellular and extra cellular components.

**Unit 3: Modified Biomaterials [10HRS]**

Bio degradative biomaterials, bioactive polymers and biosynthetic polymers, inert biomaterials, genetically engineered biomaterials.

**Unit 4: Applications of Biomaterials [20HRS]**

Tissue Replacement Implants, Acute Wound Healing, Blood Clotting, Chronic Wound Healing and Foreign Body Response. Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, and joint replacements. Artificial Organs Artificial Hearts, Prosthetic cardiac Valves, Limb prostheses, Externally Powered limbs, prostheses, Dental Implants, and Other applications. Liposomes, hydrogels and Nanomaterials in drug delivery. Biomaterials in diagnostics and bioanalytical techniques.

**SUBJECT TITLE: BIOMATERIALS (PRACTICAL)**
**SUBJECT CODE: - BSBS-VA-606-P CREDITS: 1 TOTAL HOURS: 30**

1. Understand and follow guidelines regarding biological safety and maintain a laboratory notebook that follows the guidelines given in class. Prepare a laboratory report
2. Demonstrate aseptic cell culture techniques
3. Perform transformation into a bacterial cell
4. Describe and demonstrate basic concepts and examples of biomedical signal and
5. image processing, biomaterials, biomechanics, and cellular and molecular biotechnology
6. Perform literature search
7. Prepare a scientific poster
8. Collect, analyse, and interpret physiological measurements
9. Visit to a R&D section of a leading Pharmaceutical company/ surgical theatre of Hospital. Prepare a laboratory report.

**Suggested Readings**


1. Sujata V. Bhat, Biomaterials, 2nd edition, Narosa Publishing House, New Delhi, 2006.
2. Buddy D. Ratner, B. D. Ratner, Allan S. Hoffman, Biomaterials Science: An Introduction to Materials in Medicine, 2nd Edition (2004) Publisher: Academic Press.
3. Fred W.Billmeyer, Text book of Polymer Science. 3 rd edition John Wiley and Sons publications. 4. Basic & Clinical Pharmacology, 10th ed B.G. Kat sung, McGraw-Hill 2007