Program Objective of B.Sc. Honours (Biological Science)

The program aims to:

- **PO-1:** Provide students with learning experiences that help instill deep interests in learning Biological Science; to develop an understanding of the complex nature of biomolecules, tissues and organs and their inter-relationship and inter-dependence.
- **PO-2:** Encourage students to study the structure and function of specific molecules and pathways and their interactions and networking in biological systems with particular emphasis on regulation of chemical reactions in living cells.
- **PO-3:** Encourage students to apply the knowledge and skills they have acquired to develop solutions for various applications in medicine like developing vaccines and drugs.
- **PO-4:** Provide students with the knowledge and skill base that would enable them to undertake further studies in Biological Science and related areas or in multidisciplinary areas that involve Biological Science and help develop a range of generic skills that are relevant to pursue research, self-employment and entrepreneurship.

Program Specific Outcomes of B.Sc. Honours (Biological Science)

PSO1. Students enrolled in B.Sc. Honours Program in Biological Science of the University of Patanjali, study and acquire complete knowledge of disciplinary and allied areas of biological sciences.

PSO2. The Learning Outcomes-based Curriculum Framework is designed to demarcate a skeletal structure within which the program can be developed to suit the need of the hour, in keeping with the emergence of new areas of life sciences. The framework is designed to allow for flexibility in program improvement and course content development, while at the same time maintaining a basic uniformity in structure in comparison with other universities across the country.

PSO3. The B.Sc. Honours program in Biological Science covers a wide range of basic and applied aspects of botany, zoology, physics and chemistry courses as well as courses of interdisciplinary nature. The core courses that are a part of the program are designed to build sound knowledge in the student, and furthermore, acquaints the students with the applied aspects of this fascinating discipline as well. The student is thus equipped to pursue higher studies in an institution of her/his choice, and to apply the skills learnt in the program to solving practical biological problems.

PSO4. The program offers a wide range of elective courses to the student. These include skill and ability enhancement courses that prepare the student for an eventual job assignment. Yoga and Physical education is included as value added courses because Paramapujaya Swami Ramdev Ji and Acharya Balkrishna Ji are the soul of the University and the Applied & Allied Science Department is running under their guidance. So at the end of graduation, they have expertise which provide them competitive advantage in pursuing higher studies from India and abroad or seek jobs in academia, research or industries.

UNIVERSITY OF PATANJALI-HARIDWAR

DEPARTMENT OF ALLIED & APPLIED SCIENCE

SYLLABUS OF BSC (HONOURS) IN BIOLOGICAL SCIENCE AS PER NEP-2020 GUIDELINES DATED 07-12-2022 FOR FIRST YEAR SESSION 2023-2024

1	2	3	4	5	6	7	8
Semester	Core-Major	Minor	Inter-disciplinary	AEC	Skill Enhancement Course	Value added course	Total Credit
I	Cell Biology (Credit-6)	Chemical Science (Credit-4)	Human Health & Disease (Credit-4)	English (Credit-2)	Environmental Science (Credit-3)	Foundations of Yoga (Credit-3)	22
II	Biochemistry (Credit-6)	Biophysics (Credit-4)	Diet & Nutrition (Credit-4)	Computer Application (Credit-2)	Medicinal Plants (Credit-3)	Project (Credit-3)	22
Total Credits	12	8	8	4	6	6	44
Those students who wants to exit in the 1st year need to complete summer training of credit							4
GRAND TOTAL							48

Dr Laxmi Shankar Rath **Dr V K Katiyar**

Head of the Department **Dean (A & R)**

University of Patanjali, Haridwar

Syllabus as per NEP-2020

BSBSMJ-101: Cell Biology

1st Semester

Credit-6 (Theory 4 & Practical 2 Credits)

Total Number of Hours: 60

Course Objectives:

1. To give students a solid foundation in biology of cells.

2. To develop analytical and critical-thinking skills that allows independent exploration of biological phenomena through the scientific method.

Total Number of Hrs. : 60		**Theory**	**Practical**	**Tutorial**
Credits		**4**	**2**	**-**
Hts/Week		**4**	**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**	**37**	**13**	

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)

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.

BSBSMJ-101-P

Practical work

1. Basic sterilization techniques required for Media preparation & Cytological techniques.
2. Staining technique of Bacteria:-
    a. Preparation of bacterial smear.
    b. Gram staining.
    c. Simple staining.
    d. Acid fast staining.
3. Study through permanent slides:-Cell division (mitotic and meiosis).
4. Section cutting of following plant materials:-
    a. monocot
    b. dicot

References books

1. Celis JE (ed) (1998) Cell Biology: A Laboratory Handbook, 2nd edn. San Diego: Academic Press.
2. Lacey AJ (ed) (1999) Light Microscopy in Biology: A Practical Approach, 2nd edn. Oxford: Oxford University Press.
3. Paddock SW (ed) (1999) Methods in Molecular Biology, vol 122: Confocal Microscopy Methods and Protocols. Totowa, NJ: Humana Press.
4. Watt IM (1997) The Principles and Practice of Electron Microscopy, 2nd edn, Cambridge: Cambridge University Press.

Course outcome: By the end of the course the student will be able to:

• Develop an understanding of the Cytoskeleton and Cell Membrane.

• Discuss the structure of Microtubules, microfilaments.

• Distinguish between the cellular organization of prokaryotic and eukaryotic cells

• Would have deeper understanding of cell at structural and functional level.

• Would have broad knowledge on the molecular interaction between cells.

• Would demonstrate a clear understanding of the signal transduction, secondary messengers.

BSBSMN-102: Chemical Science

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, 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 behaviour, 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 behaviour 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**	**1**
Hts/Week		**3**	**2**	**1**
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**	**37**	**13**	

Content	**Contact Hours**
Unit-1:	**15**
Atomic Structure: 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:	**8**
Modern Periodic Table: Modern Periodic law, Classification of elements in periodic table, periodicity, electronegativity, electron affinity, ionisation potential, atomic radii, ionic radii.	
Unit-3:	**12**
Solution: 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:	**12**
Chemical Kinetics: Order and molecularity of reaction, factors influencing on rate of chemical reaction. Catalysis: definition, classification and characteristics. Enzyme catalysed reactions. Electrochemistry: work done and potential energy, galvanic cell and electrode potential. Corrosion: definition, cause and types of corrosion, metallic corrosion and their prevention.	
Unit-5:	**10**
Chemical Thermodynamics: First law of thermodynamics: Work (w), heat (q), changes in internal energy (ΔE) and enthalpy (ΔH). 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, concept of entropy, Gibbs free energy and Helmoltz free energy. Criteria of spontaneity.	

Course Outcome:

Upon completion of the course the student should be able to:		
CO	**CO Statements**	**Bloom's Level**
CO1	Get an understanding of the theoretical principles of chemistry of molecular structure, bonding and properties of chemical substances. Structure and function of bioinorganic molecules like Hemoglobin, Chlorophyll, Vitamin B12.	**K4**
CO2	Study of nature of elements and give an idea about the use in biological system for example micronutrients requirements of human body.	**K4**
CO2	Apply the fundamental concepts of concentration of solution in chemical analysis, colloidal behaviour; coagulation and pH are useful in application in food and medicine industry.	**K4**
CO3	Apply the concepts related to Rate of Chemical reaction, role of Enzyme catalyst, Electrical behaviour of body fluids, Corrosion in metals.	**K4**
CO4	Get understand and apply the concepts of thermodynamics like heat, calorie, application in photosynthesis and food industry, role of entropy on global warming.	**K3**

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. YR Sharma: Elementary organic spectroscopy, Banwell
5. Physical Chemistry, RL Madan, G D Tuli: S Chand

BSBSMN-102-P: Chemical Science (Practical)

Course Objectives:

1. To enable the students to understand about the fundamental concepts of Chemical analysis.
2. To enable the students to understand about the analysis of content of calcium ion, hydroxyl ion, pH of water and advanced UV Visible spectrophotometric method.
3. To enable the students to understand about the measure surface tension and viscosity of a liquid.
4. To enable the students to understand to estimate Metal ions Fe (II) and anions.
5. To enable the students to understand about the separation of organic compounds by chromatography method by conventional and green route.

Experiments

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 K2Cr2O7 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.

NOTE: All experiments are compulsory to perform.

Course Outcomes: Upon completion of the course the student should be able to:

	Course Outcomes	Bloom's Level
CO1	Get an understanding of the chemical analysis and use of different analytical instruments.	**K3**
CO2	Get an understanding of the determination of concentration of ions like Fe, Ca, Mg. OH etc given water sample by chemical method and instrumental method using spectrophotometer	**K4**
CO3	Measure the physical properties such as surface tension, viscosity, conductance of solution.	**K4**

Suggested Reading Materials:

1. A.I. Vogel, Vogel's Qualitative Inorganic Analysis, Prentice Hall, 7th Edition
2. A.I. Vogel, Vogel's Quantitative Chemical Analysis, Prentice Hall, 6th Edition
3. B.D. Khosla, Senior Practical Physical Chemistry: R. Chand & Co.

COURSE DETAILS

SUBJECT TITLE: **Human Health and Disease** (THEORY)

SUBJECT CODE: - BSBSID-103

SEMESTER – I TOTAL HOURS: 60 CREDITS: 4 (Th 3 & Pr 1)

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**	**37**	**13**	

Unit 1: Blood **10 Hrs**

Components of blood and their functions; Structure and functions of hemoglobin, Sickle cell anemia. 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 **10 Hrs**

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 **15 Hrs**

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 **15 Hrs**

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 Hrs**

Structure of Human heart; Coronary circulation; Structure and working of conducting myocardial fibers. 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).

Practical: BSBSID-103-P

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

Course Outcome

CO 1. Understand the different aspects of Physiological changes in the human body.

CO 2. The development of understanding for different hematological tests and samples.

CO 3. Apply the understanding of physiology to the different conditions during changes the human health.

CO 4. Develop an understanding of human diseases.

Suggested reading:

1. K Sembulingam - Essentials of Medical Physiology, 6th Edition.
2. Principles of Anatomy and Physiology by Gerard J. Tortora and Bryan H. Derrickson.
3. GK Pal Textbook of Practical Physiology.
4. Guyton & Hall Textbook of Medical Physiology.

University of Patanjali, Haridwar

Syllabus as per NEP-2020

BSBSAE-104: English

1st Semester

Credit-2 (Theory 2)

Total Number of Hours: 30

Course Objectives:

An objective is a desired goal that is trying to be accomplished. Dr. S. R. Bloom has defined educational objective as, "the desired goal or outcome at which instruction is aimed". For example, if a teacher wants his students to improve speaking skill, the teacher will have to try his outmost level for speaking skill. After all, the teacher has to follow all his tactics for the improvement of students. So the desired goal of improving speaking skill would be theobjective of speaking. The objectives of a topic in English help in realizing some generalobjectives of teaching English. They are-

1. To be able to speak English fluently and accurately.
2. To think in English and then speak.
3. To be able to compose freely and independently in speech and writing.
4. To be able to read books with understanding.
5. To acquire a vocabulary of 2500 words.
6. Ability to use reference material such as Encyclopedia, dictionary, etc.
7. To be able to talk in English.

Total Number of Hrs. : 30		**Theory**	**Practical**	**Tutorial**
Credits		**2**	**-**	**-**
Hrs/Week		**2**	**-**	**-**
SCHEME OF EXAMINATION				
Total marks: 100				
Theory:100		**No Practical**		
Final Exam (SEE)	**Internal Assessment (CT+TA+ Assignment)**			
75	**25**			

Unit-1

Introduction

Theory of Communication, Types and modes of Communication

Unit-2

Language of Communication:
Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers andStrategies
Intra-personal, Inter-personal and Group communication

Unit-3

Speaking Skills:
Monologue
DialogueGroup
Discussion
Effective Communication/ Mis- Communication
InterviewPublic Speech

Unit-4

Reading and Understanding Close Reading
ComprehensionSummary Paraphrasing Analysis and
Interpretation
Translation(from Indian language to English and vice-versa) Literary/Knowledge Texts

Unit-5

Writing Skills Documenting Report WritingMaking notes Letter writing

Recommended Readings:

1.Fluency in English - Part II, Oxford University Press,
2006.2.Business English, Pearson, 2008.
3.Language, Literature and Creativity, Orient Blackswan, 2013.
4.Language through Literature (forthcoming) ed. Dr. Gauri Mishra,
Dr Ranjana Kaul, Dr Brati Biswas.

Course Outcome:

1. The student should be able to comprehend English literature
2. They should be able to communicate effectively.

ENVIRONMENTAL SCIENCE

BSBSSE-105

Credit-3

First Semester (as per NEP)

Course Objective:

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

Total Number of Hrs. : 60		**Theory**	**Practical**	**Tutorial**
Credits		**3**	**-**	**-**
Hts/Week		**3**	**-**	**-**
SCHEME OF EXAMINATION				
Total marks: 100				
Theory:100		**No Practical**		
Final Exam (SEE)	**Internal Assessment (CT+TA)**			
75	**25**			

Introduction to Environmental studies & Ecosystems **10 classes**

Multidisciplinary nature of environmental studies, Environmental Education aim and objectives, Scope and importance, Need for public awareness. Concept, Structure and function of an ecosystem, Energy flow in an ecosystem: food chains, food webs and ecological pyramids. Examples of various ecosystems such as: Forest, Grassland, Desert, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Natural Resources: Renewable & Non- renewable resources **15 classes**

Classification, Land as a resource, land degradation, landslides (natural & man-induced), soil erosion and desertification. Forests & forest resources: Use and over-exploitation, deforestation. Impacts of deforestation, mining, dam building on environment and forests. Resettlement and rehabilitation of project affected persons; problems and concerns with examples. Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international & inter-state). Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems with examples. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs.

Biodiversity & Conservation **10 classes**

Levels of biological diversity: genetic, species and ecosystem diversity. Bio geographic zones of India. Ecosystem and biodiversity services. Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions. Conservation of biodiversity: In-situ and Ex-situ conservation.

Environmental Pollution **15 classes**

Environmental pollution and its types. Causes, effects and control measures of :a) Air pollution b) Water pollution – freshwater and marine c) Soil pollution d) Noise pollution e) Thermal pollution, Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste, Global Warming, Climate Change

Environmental Policies & Practices **10 classes**

Wasteland reclamation. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Biological Diversity act 2002

Books Recommended

- Environmental Science: Toward A Sustainable Future by Dorothy F. Bourse and Richard T. Wright
- Social Learning in Environmental Management: Towards a Sustainable Future by Meg Keen, Valerie A. Brown, Rob Dyball
- Principles of Environmental Science by William P. Cunningham and Mary Ann Cunningham
- Visualizing Environmental Science by Linda R. Berg, Mary Catherine Hager and David M. Hassenzahl
- Environmental Studies From Crisis to Cure by R. Rajagopalan
- Environmental Science: Systems and Solutions by Michael L. McKinney, Robert M. Schoch, Logan Yonavjack and Grant A. Mincy
- Environmental Science: A Global Concern by William P. Cunningham and Mary Ann Cunningham
- Fundamental Concepts in Environmental Studies by Dr. D.D Mishra

- Neeraj Publication BEVAE-181 ENVIRONMENTAL STUDIES
- Dinesh Environment Science (English Medium) (AECC) (B.A/B.Sc./B.Com/B.B.A/B.C.A./B.Voc. 1st year
- Neeraj Publications BEVAE-181 ENVIRONMENTAL STUDIES
- CSAT Environmental Ecology Biodiversity & Climate Change

Course Outcome:

- The students will be able to learn the approaches to the study of ecology.
- To understand the role and importance of biotic and abiotic environment factors in the sustenance of plant life.

Semester-I

COURSE DETAILS

Course Name: FOUNDATIONS OF YOGA
Code: BSBSVA-106
Total Credit: 3 (Theory 2 and Practical 1 credit)
Total Hours: 30

Course Objectives:
The Course entitled 'Foundation of Yoga' has the following objectives:
• Students of the UG course will have an understanding about origin, history and development of Yoga.
• They will have an idea about the insights of different Yoga streams.
• Introduction about Yoga according to various Yogic texts, eminent Yogis.
• Quote references of each practice as per traditional texts.
•

Total Number of Hrs. : 30		**Theory**	**Practical**	**Tutorial**
Credits		**2**	**1**	**-**
Hts/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**	**37**	**13**	

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, Kapilmuni, Bhrtrihari, Adishankaracharaya, Maharshi Dayanand, Swami Vivekanand, Maharshi Arvind, Swami Kuvalyanand, Swami Shivanand, Yogrishi Swami Ramdev. (5 Hours)

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. Yogendra Purusharthi (Sw. Divyananda Saraswati): Vedo me Yog Vidya, Yogic Sodhsansthan, 1985.
5. Yogrishi Swami Ramdev Ji: Ek Yogi Ek Yodhha, Divya Prakashan, Haridwar, 2015.
6. 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.

Course Outcomes:

● Students of the UG course will have an understanding of Yoga, its origin, history and development of Yoga

● 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.

Course Name: **YOGA PRACTICAL**
Course Code: **BSBSVA-106-P**
Total Credit: **1**
Teaching Hours: **30 Hrs**

Objectives

Following the completion of this course, students shall be able to

- Understand the principle and practice of various dand baithak of Indian origin
- Understand the principle and practice of Suryanamaskar and different type of Yogasanas.
- Demonstarate each Asana and explain its procedure.
- Quote references of each practice as per traditional texts

UNIT-1: RECITATION OF HYMNS & HASTA MUDRA [10 HRS.]

Recitation of Shanti Mantras; Recitation of Pranava Japa and Soham Japa; Recitation of Hymns from Upanishad & Yoga Texts; Hasta Mudra: Chin, Jnana, Hridaya, Bhairav, Yoni, Pran, Apan, Apanvayu, Shankh, Kamajayi.

UNIT-2: EIGHT BAITHAK AND TWELVE DAND BY YOGRISHI SWAMI RAMDEV JI [15 HRS]

Ardh baithak, Purna baithak, Rammurti baithak, Pahalwani baithak-I, Pahalwani baithak-II, Hanuman baithak-I, Hanuman baithak-II, Hanuman baithak –III, Simple Dand, Rammurti Dand, Vakshvikasak Dand, Hanuman Dand, Vrishchik Dand-I, Vrishchik Dand-II, Parshvadand, Chakradand, Palatdand, Sherdand, Sarpdand, Mishradand (mixed Dand)

UNIT-3: SHATKARMAS AND BREATHING PRACTICES [15 HRS.]

Neti (Jalneti, Rubber Neti), Dhauti (Jal Dhauti); Kapalbhati (upto 1000 stroks) and its variations; Trataka (Jatru and Jyoti), Breathing practices: Hands in and out, Hands stretch, Ankle stretch, Rabbit, Dog, Tiger, Straight leg raising breathing; Breath Awareness: Shwas-prashwas samyama; Abdomen, Thoracic & Clavicular Breathing, Abdomen+Thoracic Breathing, Abdomen + Thoracic +Clavicular Breathing; Yogic Breathing: Pause Breathing (Viloma Pranayama), Spinal Passage Breathing (Sushumna Breathing); Practice of Puraka, Rechaka & Kumbhaka (Antar & BahyaKumbhaka).

UNIT-4: YOGASANA (SUPINE LYING POSTURES) AND (PRONE LINE POSTURES) [10 HRS.]

Navasana, Pavanamuktasana, Utthana-padasana, Padavrittasana, Chakrikasana, Chakkichalana, Ardha Halasana, Halasana, Setubandhasana, Sarvangasana, Matsyasana, Chakrasana, Shavasana. Makarasana, Markatasana, Bhujangasana, Sarpasana, Shalabhasana, Dhanurasana, Purnadhanurasana.

UNIT- 5: SURYA NAMASKARA AND BHOJAN MANTRA, PRATAH EVAM RATRI MANTRA [10 HRS.]

Understanding, recitation and memorization.

TEXT BOOKS

1. Acharya Balkrishna: Dainik Yogabhyasakram, Divyayog Prakashan, Haridwar,2015.
2. Yogrishi Swami Randev Ji: Dand-baithak, 2015.
3. Swami Dhirendra Bhrahmachari: Yogasana Vijnana, Dhirendra Yoga Publications, New Delhi.
4. Swami Kuvalyananda : Asana Kaivalyadhama, Lonavla

BOOKS FOR REFERENCES

1. Tulsi Naina: A Complete Guide for structural Body Work, Divya Prakashan, Haridwar, 2015.
2. Basavaraddi, I.V. & others: Yogasana: A Comprehensive description about Yogasana, MDNIY, New Delhi, 2011.
3. Iyengar, B.K.S.: Light on Yoga, Harper Collins Publishers.
4. Swami Satyananda Saraswati: Asana, Pranayama, Bandha, Mudra Bihar School of Yoga, Munger.
5. Tiwari, O.P.: Asana Why and How? Kaivalyadhama, Lonavla.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Major Course

2nd Semester

COURSE DETAILS

SUBJECT TITLE: BIOCHEMISTRY (THEORY)

SUBJECT CODE: - BSBSMJ-201

SEMESTER – II, TOTAL HOURS: 60 CREDITS: 6 (Theory 4 and Practical 2 Credits)

Course Objectives:

1. To give students a solid foundation in biology and chemistry.

2. To develop analytical and critical-thinking skills that allows 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.

Total Number of Hrs. : 60		**Theory**	**Practical**	**Tutorial**
Credits		**4**	**2**	**-**
Hrs/Week		**4**	**4**	**-**
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**	**37**	**13**	

Unit - 1: [15 hrs.]
Introduction to Biochemistry; chief intracellular components; Introduction to chemical receptors/co-receptors, cell to cell communication, channels & transportation; Definition and classification of Vitamins and their Clinical importance; Basics of Molecular mechanism of O2 transport and storage; Fundamentals of Bio-Energetics: Biological Oxidation, General Concept of oxidation, features of cellular Oxidation-respiratory chain oxidative phosphorylation, Structure and analysis of water.

Unit – 2: [15 hrs]
Carbohydrates: Definition, classification with examples and general functions; Concept of isomerism, types & mode of action; Introduction to metabolism, Integration of metabolism and catabolism.

Unit-3: [15 hrs]
lipids and proteins Lipids: definition, classifications and general functions; Introduction to essential fatty acids, cholesterol, Blood lipids, brief review of lipoproteins and fatty liver; Proteins: definition, classification and Biomedical Importance, Plasma Proteins and functions; Definition, classification and nomenculature of Enzymes, basic introduction to Enzymology and regulation of Enzymatic activity. Structure of DNA, RNA, nuclic acid metabolism and diseases associated with it.

Unit- 4: [15 hrs]
Functional Bio-chemistry Introduction to hormones, molecular basis of hormonal action; Introduction to common metabolic disorders; Basic techniques for estimation of different Bio-chemical markers i.e., diffusion, Osmosis, Electrophoresis,

SUGGESTED READING

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning

2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone

3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman

4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company

5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company,

6. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill 7. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons,

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

BSHBMJ-201-P Biochemistry (Practical) Credits 2

1. Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts

2. Qualitative/Quantitative tests for carbohydrates, reducing sugars, and non-reducing sugars

3. Qualitative/Quantitative tests for lipids and proteins

4. Study of protein secondary and tertiary structures with the help of models

SUGGESTED READING

1. **Introductory Practical Biochemistry, S.K. Sawhney, Narosa Publishing House**

Course Outcome:

On completion of course students are able to understand

- Basics of biomolecules
- Basics of carbohydrate, its classification and
- Basics of Amino acid & protein
- Basics of lipids , Vitamins, etc

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP-2020

COURSE DETAILS

SUBJECT TITLE: BIOPHYSICS

COURSE CODE: BSBSMN-202

CREDIT: 4 (Theory 3 & Practical 1)

Course Objectives:

The biophysics course objectives are

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

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**	**37**	**13**	

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, First Law and Second law of thermodynamics, Carnot's Cycle, Gibb's Free Energy

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, Ramchandran 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,

Unit4: Algebra, Matrices, Differentiations, Integrations [10 hrs]

SUGGESTED READINGS

1. Physical Biochemistry, David Freifelder, 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

PRACTICAL: Code BSBSMN-202-P CREDIT: 1

1. Determination of the acceleration due to gravity using bar pendulum

2. Determination of the coefficient of Viscosity of water by capillary flow method (Poiseuille's method)

3. Verification of Beer Law

4. Effect of different solvents on UV-Vis absorption spectra of proteins.

Course Outcome:

On completion of course students are able to understand

- Concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law
- Principle, working and applications of spectrophotometer and AAS
- Principles of ECG, EEG, etc

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under CBCS

Interdisciplinary Course

COURSE DETAILS

SUBJECT TITLE: Diet and nutrition

SUBJECT CODE: - BSBSID-203

SEMESTER – II, TOTAL HOURS: 60 CREDITS: 4

Course Objectives:

1. **Helping learners to understand analytical aspect of food science.**
2. **To understand various aspect of food and nutrients.**
3. **Apply modern concept to solve aspects of food problems.**

Total Number of Hrs. : 60		**Theory**	**Practical**	**Tutorial**
Credits		**4**	**-**	**-**
Hrs/Week		**4**	**-**	**-**
SCHEME OF EXAMINATION				
Total marks: 100				
Theory:100		**No Practical**		
Final Exam (SEE)	**Internal Assessment (CT+TA)**	**Final Exam (SEE)**	**Internal Assessment (CT+TA/PR)**	
70	**30**	**-**	**-**	

Unit1: Basic understanding of food and its importance in term of nutrition [l0Hr .]

Basic concepts and components of food and nutrition Understanding Nutrition Basic Terminology in Relation to Nutrition Requirement, Human Nutritional Requirements; Concept of food, Acceptance of Food, Functions of Food; Components of Food & their Classification.

Unit 2: basic understanding of different nutrients and its importance [12 hrs]

Macro Nutrients- sources, functions and effects on the body; Micro Nutrients – sources, function and effect on the body; Fats soluble nutrients- sources, functions and effect on the body; Water soluble nutrients – sources, Functions and effects on the body.

Unit 3: Basic idea of different groups of foods available in relation to nutrients [14 hrs]

Food groups, Cereals &Millets- Selection, Preparation and Nutritive Value; Pulses, Nuts and Oil Seeds- Selection, Preparation and Nutritive Value; Milk and Milk Products- Selection, Preparation and Nutritive Value; Vegetables and Fruits- Selection, Preparation and Nutritive Value, Fats, Oils and Sugar, Jaggery-Selection, Preparation and Nutritive Value.

Unit 4: Basic ideology of yoga as recommended for yoga practitioners (14Hrs.]

Yogic concept of diet & nutrition General Introduction of Ahara (Diet), concept of Mitahara; Definition and Classification in Yogic diet according to traditional Yoga texts; Concepts of Diet according to Gheranda Samhita, Hatha Pradeepika and Bhagavadgeeta-Rajasik, Tamasic and Sattvic food; Pathya and Apathyain diet according to Yogic texts; lmportance of Yogic Diet in Yog Sadhana; Yogic Diet and its role in healthy living.

Unit -5

Carbohydrates, proteins, Fats Minerals and vitamins and their role in diet and nutrition

TextBooks

1.Stanley Davidson &others: Human Nutrition & Dietetics, The English Language Book Society & Churchill Livings, Revised Edition.

2. Dennis Thompson: The Ayurvedic Diet,Newagebooks,NewDelhi,200l. Randolph Stone: A Purifing Diet, Lilawati Bhargav Charitable Trust, Delhi, Revised Edition.

3. World Health Organisation/World Economic Forum.(2008).Preventing NoncommunicableDiseasesintheWorkplacethroughDietandPhysicalActivity WHO/World Economic Forum Report of a Joint Event.World Health Organisation/ WorldEconomicForum,52.doi:ISBN9789241596329

Course Outcome:

Nutrition & Dietetics students will demonstrate the following learning objectives upon completion of this course:

1. Understanding, critically assessing and knowing how to use and apply information sources related to nutrition, food, lifestyle and health.

2. Understand concepts of Diet according to Gheranda Samhita, Hatha Pradeepika and Bhagavadgeeta

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

ABILITY ENHANCEMENT COURSE

SUBJECT TITLE: COMPUTER APPLICATION

SUBJECT CODE: - BSBSAE-204

SEMESTER – II, TOTAL HOURS: 30 CREDITS: 2 (THEORY 1 and PRACTICAL 1)

Course Objectives:

1. To understand the basic concept of Computer Programming.

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

Total Number of Hrs. : 30		**Theory**	**Practical**	**Tutorial**
Credits		**1**	**1**	**-**
Hrs/Week		**1**	**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**	**37**	**13**	

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.

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.

Course Outcome:

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

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.

Practical: BSBSAE-204-P Credit:1

Computer practical (Programming in Python)

1. To calculate perimeter/ circumference and area of shapes such as triangle, rectangle, square and circle
2. To find largest and smallest numbers in a list
3. To find the sum of squares of the first 100 natural numbers
4. Create a dictionary to store names of states and their capitals
5. To find average and grade for given marks
6. To print the highest and lowest values in the dictionary
7. Create a dictionary of students to store names and marks obtained in 5 subjects

B.Sc. Biological Science

Subject: Medicinal Plants: Utilization and Conservation

SUBJECT CODE: BSBSSE-205

SEMESTER-II: TOTAL HOURS: 60

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**	**37**	**13**	

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 (BSBSSE-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

DEPARTMENT OF ALLIED & APPLIED SCIENCESYLLABUS OF BSC (HONOURS) IN BIOLOGICAL SCIENCE AS PER NEP-2020 FOR SECOND YEAR SESSION 2023-2024

1	2	3	4	5	6	7	8
Semester	Core-Major	Minor	Inter-disciplinary	AEC	Skill Enhancement Course	Value added course	Total Credit
III	1. Microbiology (Credit-5) 2. Metabolism (Credit-4)	1. Organic Chemistry (Credit-4) 2. Biostatistics (Credit-2)	Technical Writing (Credit-2)	Personality Development (Credit-2)	Yagna Chikitsha (Credit-3) To be given by Yoga Department	-----	22
IV	1. Genetics (Credit-4) 2. Plant Physiology (Credit-4) 3. Ecology (Credit-4) 4. Drug Discovery (Credit-4)	1. Biomaterials (Credit-4)	-----	Hindi (Credit-2)	-------	------	22
Total Credits	25	10	2	4	3	------	44
Those students who wants to exit in the 2nd year need to complete summer training of credit							4
GRAND TOTAL							48

Dr Laxmi Shankar Rath **Dr V K Katiyar**

Head of the Department **Dean (A & R)**

University of Patanjali, Haridwar

Course Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: MICROBIOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-301

SEMESTER – III, TOTAL HOURS: 60 CREDITS: 5 (Th 4 & Pr 1)

Course Objectives:

1. **Describe disease causing microorganisms and microbial agents at organismal, cellular or molecular levels.**
2. **Relate normal cellular and molecular structures their functions.**
3. **Apply modern biological techniques to identify potential pathogens and solve aspects of scientific problems.**

Total Number of Hrs. : 60		**Theory**	**Practical**	**Tutorial**
Credits		**4**	**1**	**-**
Hrs/Week		**4**	**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**	**37**	**13**	

Unit 1 [10Hrs]

Historical development and origin of microorganisms:-Introduction of microbial world, Origin of life, primitive cells and evolution of microorganism's Historical development of Microbiology – Theory of spontaneous generation, Biogenesis and Abiogenesis. Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky and Elie Metchnikoff. Contribution of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms.. Microscopy- working principle, construction and operation of simple and compound microscopes.

Unit 2 [08 Hrs]

Staining, sterilization and Culture techniques: **Staining:** Nature of stains, principles, mechanism, methods and types of staining simple, Differential-Gram staining, acid fast staining, capsule staining, endospore, and inclusion bodies.

Sterilization: Principles, types and techniques - physical and chemical.

Microbiological culture media: Types, Composition, Preparation, Application and storage; Ingredients of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media.

Unit 3 [12Hrs]

Overview of eubacteria cell organization: nucleoid, ribosomes, intra cytoplasmic membranes and cell inclusions. Detailed account of biogenesis and function of various cell structure appendages: flagella- structure, assembly and mechanism of movement; pili and fimbriae- types, structure and their role.

Microbial diversity Fungi: General characteristics of fungi distribution, thallus organization and aggregation. Cell wall structure and composition. Modes of reproduction: vegetative, asexual, sexual and parasexual. Morphology and life cycle of Saccharomyces, Rhizopus and Aspergillus. Economic importance of fungi. Basic structure & development of virus & mycoplasma.

Microbial diversity (Protozoa): General characteristics of protozoa with special reference to cell structure, reproduction and economic importance. Type studies of Amoeba, Paramecium and Giardia.

Unit 4 [10 Hrs]

Molecular Genetics: RNA directed RNA synthesis, Reverse Transcription and Integration, Translation, and genome replication of DNA viruses: Generic steps in transcription, host polymerases, initiation, splicing, alternate splicing, promoter structure, and steps in regulation of transcription, enhancers, and virus coded transcriptional regulators, transcriptional cascade, and export.

Unit-5 [08Hrs]

Applications of Microbial Agents: Basic concepts of Antibiotics and its Production like penicillin & its types, tetracycline, ampicillin, kanamycin production aspects: Development of therapeutic proteins (haemostasis factors, thrombolytic agents, hormones and recombinant vaccines), Antimicrobial Activity.

Unit-6 [12 HRS]

Therapeutic value of Medical Microbiology: Vaccines production, antibody production, therapeutic enzymes, industrially important enzymes and green fuel production, Development of bio-pesticides and bio-fertilizers. Disease control: Principles of plant disease control, physical and chemical methods of disease control, bio control, and bio control agents - concepts and practices,

fungal agents, Trichoderma as bio control agent The diagnosis of infectious diseases and the assessment of likely response to specific therapeutic interventions.

Text Books/References

1. 1. A Clinician's Dictionary of Pathogenic Microorganisms by James H. Jorgensen; Michael A. PfallerCall Number: QR81 .J67 2004 ISBN: 1555812805 Publication Date: 2022-01-01.
2. Medical Microbiology by Patrick R. Murray; Ken S. Rosenthal; Michael A. P faller Call Number: QR46.M4683 2013 ISBN: 9780323086929 Publication Date: 08-11-2020.
3. The Dictionary of Virology by Brian W. J. Mahy ISBN: 9780123737328 Publication Date: 2019-12-02.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

BSBSMJ-301-P MICROBIOLOGY (PRACTICALS)

SEMESTER – III, TOTAL HOURS: 30 CREDITS: 1

1. Microbiological laboratory standards and safety protocols.
2. Operation and working principles of light and compound microscope.
3. Working principle and operations of basic equipment of microbiological laboratory (Autoclave, oven, incubator, LAF, pH meter, spectrophotometer, colorimeter, vortex, magnetic stirrer etc.).
4. Bacterial motility by hanging drop method.
5. Simple staining – Negative staining.
6. Differential staining – Gram staining.
7. Acid fast staining.
8. Structural staining – Flagella and capsule.
9. Bacterial endospore staining.
10. Staining of reserved food materials (granular).
11. Staining of fungi by lactophenol cotton blue.
12. Exercise Good laboratory practices.

SUGGESTED READINGS

1. **Practical Microbiology Paperback –D.K.** Maheshwari & R.C. Dubey, S. Chand & Company Limited.
2. **Introductory Practical Microbiology-** J. Mudili, Narosa Publishing House
3. **Practical Manual for Undergraduates Microbiology-** Mukesh Kumar 3rd Edition, Jain Brothers

Course Outcome:

On completion of course students are able to understand

- Concept of gene, pseudogene, cryptic gene and split gene
- DNA replication and regulation in prokaryotes and eukaryotes
- Transcription in prokaryotes and eukaryotes & Post translation and transcriptional mechanism

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science as per NEP 2020

COURSE DETAILS

SUBJECT TITLE: **Metabolism of Biomolecules**

SUBJECT CODE: - BSBSMJ-302

SEMESTER – III, TOTAL HOURS: 60 CREDITS: 4 (TH 3 & Pr 1)

Course Objectives:

1. Knowledge of the historical background for 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		**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**	**37**	**13**	

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 nucleotides metabolism-Gout, Lesch–Nyhan disease, Severe combined immunodeficiency syndrome (SCID) and adenosine deaminase (ADA) deficiency.

Metabolism of Biomolecules Practical (BSBSMJ-302-P) Credit: 01

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 readings:

1. Lehninger: Principles of Biochemistry (2021) 8th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN: 9781319230906.

2. Textbook of Biochemistry with Clinical Correlations (2024) 8th ed., Devlin, T.M., John John Wiley & Sons, Incorporated, 2024, ISBN: 9781119431954.

3. Biochemistry (2015) 8th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN-13: 978-1-4641-2610-9 ISBN-10: 1-4641-2

University of Patanjali, Haridwar

Department of Allied and Applied science
B.Sc. Biological Science
Course Structure according to NEP-2020
SEMESTER – III
Nature of subject-Minor

SUBJECT'SNAME: Fundamentals of Organic Chemistry
CODE: BSBSMN-303

Total Number of Hrs. : 60		**Theory**	**Practical**	**Tutorial**
Credits		**3**	**1**	**-**
Hrs/Week		**3**	**2**	**-**
Evaluation Scheme				
Total marks: 150				
Theory:100		**BSBSMN-302(P) Practical:50**		
End Sem. Exam (ESE)	**Internal Assessment (CT+VIVA+TA)**	**End Sem.Exam (ESE)**	**Internal Assessment (TA/PR)**	
75	**25**	**37**	**13**	

Course Objectives:

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

Unit-1. Introduction to organic compounds, Structure and properties, Nature of chemical bonds, Dipole moment, Nomenclature, Isomerism, Organic acids and Bases.

Unit-2. Electronic Displacements: Inductive Effect, Electromeric Effect, Mesomeric effect. Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reaction intermediates: Carbocations, 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. Biomolecules and Bioinorganic Chemistry- Classification, chemistry and importance of Lipids, Carbohydrates, Amino acids, Enzymes, Nucleic acids, Vitamins and Drugs.

Unit-6- Polymers-Definition, Classification andpolymerization reactions (addition, condensation, coordinate and copolymerization).Synthesis and application of some important polymers: like polythene, nylon, polyesters, Bakelite.Elastomers, Biodegradable and non-biodegradable polymers.

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

6. Billmeyer, F.W. 3rd Edition (1984), Text Book of Polymer Science, John Wiley

Course Outcome:

After studying Course the student shall be able to understand the following concepts:

➢ Organic reaction mechanism of the chemical reaction.

➢ Purification of the organic compounds by crystallisation, precipitation and distillation etc.

➢ Product analysis by physical and chemical methods.

SUBJECT NAME: Fundamentals of Organic Chemistry Practical
CODE: BSBSMN-303-P
Practical

Note- Perform any 8 practical

1. Introduction to organic chemistry practical
2. Differentiation between aliphatic and aromatic compounds
3. Detection of elements in organic compounds
4. Oxidation of alcohols to acid using Jones reagent
5. Iodoform test organic compounds
6. Estimation of sugars by using Fehling solution
7. Tollens reagent test of organic compounds
8. Carbylamine test of amines
9. Synthesis of Acetanilide
10. Determination of saponification value of the given oil
11. Study of the titration curve of glycine

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: Biostatistics

SUBJECT CODE: - BSBSMN-304

SEMESTER – III, TOTAL HOURS: 30 CREDITS: 2

Course Objectives:

The Biostatistics course objectives are

1. It helps learners to analyzing 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. : 30		**Theory**	**Practical**	**Tutorial**
Credits		**2**	**-**	**-**
Hts/Week		**2**	**-**	**-**
SCHEME OF EXAMINATION				
Total marks: 100				
Theory:100		**Practical: NA**		
Final Exam (SEE)	**Internal Assessment (CT+TA)**	**Final Exam (SEE)**	**Internal Assessment (CT+TA/PR)**	
70	**30**	**-**	**-**	

Unit-1 Biostatistics (8hrs)

Definition –statistical methods – basic principles, Variables-measurements, functions, limitations and uses of statistics.

Unit-2 Collection of data primary and secondary (7hrs)

Types and methods of data collection procedures-merits and demerits. Classification-tabulation and presentation of data-sampling methods.

Unit-3 Measures of central tendency (8hrs)

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

Unit 4 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 5 Population and Sample (15 hrs)

Population and sample, Sampling, Type of sampling, Simple Random Sampling and Stratified Random sampling (description without mathematical details). Analysis of Variance, one way and two way classified data, Design of experiment (DOE), principle of DOE, CRD, RBD, LSD (Description without mathematic details)

Unit 6 Vital events (10 hrs)

Vital events, Vital statistics, Rates and Ratios, Measures of fertility and mortality, Gross and Net reproduction rates, Life tables, complete and abridged life tables, description of life table, uses of life tables, population projection, population projection models.

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.

University of Patanjali

Department of Allied and Applied Science

Course structure according to NEP-2020

Semester - III

Inter Disciplinary

Subject's Name: Technical Writing and Communication

Code: BSBSID-305

Total Number of Hrs. : 60		Theory	Practical	Tutorial
Credits		1	1	-
Hrs/Week		1	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	37	13	

Objective: To enhance the skill of technical writing and communication amongst undergraduate/ postgraduate students enabling them for batter content creation, writing, presentation and communication in science, technology and innovation.

Unit I:

1. Sources of scientific information, primary, secondary, and tertiary sources
2. Books, monographs, encyclopaedia, etc.
3. Research journals, magazines, websites, AI tools, chat GPT, etc.
4. Theses, conference proceedings, dissertations, patents, databases, etc.
5. Orations, discussions, interviews, etc.

Unit II:

1. Technical jargon, terminology, glossary etc.
2. Listening, understanding, appreciation, assimilation, internalisation
3. Ideation, keywords, points, notes, synopsis
4. Popular writing, semi-technical writing, technical writing
5. Different genres of writing, editing, punctuation, proofreading

Unit III:

1. Writing research paper, review paper, research note etc.
2. Power point presentation, animation, simulation, graphics etc.
3. Talk, lecture, discussion, radio/ television presentation
4. Exhibition, demonstration, models, competitions, debates, posters, films, etc.
5. Writing for blogs, social media, etc.

Reference Books:

1. Technical communication Principles and practice by Meenakshi Resmas & Sangeeta Sharma, Oxford
2. Technical writing, B. N. Basu, Atlantic
3. Science in Massmedia, Dileep M. Salwi, Vigyan Prasar, New Delhi

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science as per NEP 2020

Personality Development

Credits: 02

BSBSAE-306

Course Objectives:

1. The course intends to develop talent, facilitate employability enabling the incumbent to excel and sustain in a highly competitive world of business.
2. The programme aims to bring about personality development with regard to the different behavioural dimensions that have far reaching significance in the direction of organisational effectiveness.
3. To make students know about self-awareness, life skills, soft skills, need for personal development etc.

Total Number of Hrs.: 60		**Theory**	**Practical**	**Tutorial**
Credits		**1**	**1**	**-**
Hrs/Week		**1**	**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**	**37**	**13**	

Course Outcomes:

1. The student will be able to understand, analyse develop and exhibit accurate sense of self.
2. Think critically.
3. Demonstrate knowledge of personal beliefs and values and a commitment to continuing personal reflection and reassessment.
4. Learn to balance confidence with humility and overcome problems associated with personality.

Career Prospects: The chances of being noticed increase by several folds, if you possess a good Personality. The first impression on the person in front of you is always good if you have an attractive personality. Personality is an important attribute in one‘s life not only for success in professional life, but also determines your overall behaviour and attitude of the individual.

UNIT 1. Introduction to Personality Development: Define Personality, types, Determinants of Personality Development, Perception – Definition, Perceptual Process, Personality traits and theories, Self-Image and Self-Concept, Dressing Sense and Table Mannerisms, Diet, Exercise and Mental Health, Body Language. (10 HRS)

UNIT 2. Self Grooming: Group Dynamics, Team Building, Time management: Importance of time management, Techniques of time management, Time management styles. Positive Attitude, Self-esteem, Self-confidence, Assertiveness, Motivation. (10 HRS)

UNIT 3. Social and Corporate Etiquettes: Interpersonal Relations, Communication in organizations, Personal Branding, Leadership Skills, Presentation Skills, Personal skills- Stress Management, Negotiation skills, Conflict Management, Anger Management. (10 HRS)

Suggested Books

- **Think and Grow Rich - Napoleon Hill, Ross Cornwell**
- **I''m Ok, you''re Ok-Thomas A.Harris**
- **Rich dad poor dad - Robert Kiyosaki**
- **The Monk Who Sold his Ferrari - Robin Sharma**
- **The Power of Habit - Charles Duhigg**

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP 2020

COURSE DETAILS

SUBJECT TITLE: GENETICS (Major)

SUBJECT CODE: - BSBSMJ-401

SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4 (Th 3 & Pr 1)

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**	**37**	**13**	

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.

Course Outcome:

1. Revising the Mendelian Genetics and molecular basis of heredity.

2. Analysing the type's gene mutation and causes on genetic disorders.

3. Revising the Mendelian Genetics and molecular basis of heredity.

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:13:978-1-4292-7606-1 / 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.

1. Genetics (2022)- P.K Gupta

BSBSMJ-401-P GENETICS (PRACTICALS) Credit: 1

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, 13:3, 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.

University of Patanjali, Haridwar

Course Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: PLANT PHYSIOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-402

SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4 (Th 3 & Pr 1)

Course Objectives:

1. **Describe metabolic reactions which occur in cells.**
2. **Compare the structure and function of organ systems in a variety of animal phyla.**
3. **Outline the steps involved in 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**	**37**	**13**	

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 (Apical cell theory, Histogen theory, Tunica Corpus theory, Types of vascular bundles; Anatomy of dicot and monocot stem. Kranz anatomy.

Leaf: Morphology of dicot and monocot leaf.

Root: Organization of root apex, Root cap; Anatomy of dicot and monocot root.

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 & photorespiration [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.

Microbial Respiration: Electron transport chain, protein translocation, and substrate level phosphorylation, oxidative phosphorylation, inhibitors of ETC and mechanism, structure and function of ATP synthase and ATP synthesis & Antioxidants.

Primary & Secondary metabolites: Brief introduction; Major classes of metabolites, examples of each class, roles in plant defence.

Unit 4 Plant growth regulators [18HRS]

Discovery and physiological roles of Auxin, gibberellins, cytokinins, ABA, ethylene. brief introduction of genetically engineered plants.

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.

PLANT PHYSIOLOGY/

BSBSMJ-402-P (PRACTICALS)

TOTAL HOURS: 30 CREDITS: 1

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 Root.

SUGGESTED READINGS

1. Plant Physiology and Development. Seventh Edition. Lincoln Taiz, Ian Max Møller, Angus Murphy... 9780197577240. Hardcover 26 August 2022.

Plant Physiology and Development · *6th edition* · 978-1605352558 · Hardback · Sinauer Associates is an imprint of Oxford University Press (10/15/2020).

Course Outcome:

Upon completing this course, students will be familiar with contemporary concepts in plant Physiology and the physiological mechanisms controlling plant growth and development. • Students will have an understanding of movement of water and solutes in plant. • Understand the plant movements • Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration. • Learn about the movement of sap and absorption of water in plant body.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: ECOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-403

SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 04 (Th 3 & Pr 1)

Course Objectives:

2. **Describe plant and animal distribution patterns in relation to abiotic and biotic factors.**
3. **Define the essential characteristics underlying natural ecosystems.**
4. **Identify global environmental problems**

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**	**37**	**13**	

UNIT 1. Introduction: Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, Biotic and abiotic components and their dynamism, homeostasis. Basic concepts and definitions: ecology, landscape, habitat, ecozones, biosphere, ecosystems, ecosystem stability, resistance and resilience; autecology; synecology; BOD and COD. (10HRS)

UNIT 2. Biotic interactions: Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop, community structure and organization: keystone species, ecotone and edge effect; species interactions: positive and negative ecological succession and climax community.(10 HRS)

UNIT 3. Habitat and niche: Definition, Concept of habitat and niche; niche width and overlap, fundamental and realized niche; Characters displacement; analytical and synthetic; Ecotone and edge effect; ecological amplitude (10HRS)

UNIT 4. Ecosystems & Animal behaviour: Structure; Processes (aquatic, grass land and forest), Adaptations in hydrophytes, halophytes and xerophytes, Processes, types; climax concepts, Behaviour: Definition - Innate behaviour, learning, reasoning, motivation, conflict and sexual behaviour. Migration and homing with special reference to birds. Camouflage and

Mimicry - types of mimicry, Ecological Aspects of Behaviour: Habitat selection, food selection and optimal foraging theory, anti-predator defense mechanisms, aggression, territoriality and dispersal. (12HRS)

UNIT 5. Functional aspects of ecosystem: Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus. (8HRS)

UNIT 6. Phyto-geography: Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India. Vegetation of Eastern Himalaya (10HRS)

SUGGESTED READINGS

1. Wilkenson DM - 2007 - Fundamental Processes in Ecology

2. Aber J.D. & Melillo J M 1991- Terrestrial Ecosystems

3. Smith R.L. Elements of ecology

4. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole

Course Outcome:

The students will be able to learn the approaches to the study of ecology.

• To understand the role and importance of biotic and abiotic environment factors in the sustenance of plant life.

• The course will impart importance of phytogeography and zoogeography to teach managing regional flora.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

BSBSMJ-403 Ecology Practical

SEMESTER – III, TOTAL HOURS: 15 CREDITS: 01

1. Study of morphological adaptations of hydrophytes and xerophytes (four each).
2. Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche) Epiphytes.
3. Principle and function of Sechi disc, Atmometer, Anemometer, Hygrometer, Hair hygrometer, Luxmeter, Rain guage, Soil thermometer, Min-Max thermometer
4. To determine density/frequency/abundance of the vegetation by quadrat method.
5. To determine soil texture
6. To determine soil density, bulk density, particle density and pore space.
7. To determine water holding capacity and percolation rate of soil.
8. To determine pH, Cl, SO_4 , NO_3 in the soil.
9. Excursion to familiarize students with ecology of different sites
10. Field Photography, Observation & Birds studies

SUGGESTED READINGS

1. Wilkenson DM - 2007 - Fundamental Processes in Ecology

2. Aber J.D. & Melillo J M 1991- Terrestrial Ecosystems

3. Smith R.L. Elements of ecology

4. Ricklefs Economy of nature

5. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole

University of patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: DRUG DISCOVERY & DEVELOPMENT (THEORY)

SUBJECT CODE: - BSBSMJ-404

SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4 (Th 3 & Pr 1)

Course Objectives:

1. To make the students understand about the basic concept of drug and its targets.

2. To understand the Fundamentals of Physicochemical principles of drug action.

3. To understand the role of pharmainformatics 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**	**37**	**13**	

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, 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, bioavailablity, 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, 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, concept of prodrugs.

Unit-5 Drug discovery and pharmainformatics [20HRS]

Drug discovery pipeline, drug target identification and validation for 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.

BSBSMJ-404-P PRACTICALS

TOTAL HOURS: 15 CREDITS: 1

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Preparation of Benzocaine,
2. Preparation of Aspirin and determination of partition coefficient in octanol-water system,
3. Preparation of Paracetamol, Preparation of Phenacetin,

SUGGESTED READINGS

1. Introduction to Medicinal Chemistry, 4th edition (2009), Graham l. Patrick, Oxford University Press. ISBN-13: 978-0199234479.

2. The Organic Chemistry of Drug Design and Drug Action, 2 nd edition (2004), Richard B. Silvermann, Elsevier, Academic Press. ISBN-13: 978-0126437324.

3. Medicinal Chemistry: A Molecular and Biochemical Approach, 3rd edition (2005), Thomas Nogrady and Donal F. Weaver, Oxford University Press. ISBN-13: 978-0195104561.

University of patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: BIOMATERIALS (THEORY) SUBJECT CODE:

BSBSMN-405

SEMESTER – IV, TOTAL HOURS: 60 CREDITS: 4 (Th 3 & Pr 1)

Course objectives:

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

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	37	13	

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, nanomembranes. Synthesis of bio-materials, Characterization of chemical, physical, mechanical properties, visco elasticity, end group analysis, determination of molecular weight of a polymer.

Unit 2: Biocompatibility [10HRS]

Biocompatibility of Bio-materials, 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]

Biodegradative 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 Fractures fixation devices, joint replacements. Artificial Organs Artificial Heart, Prosthetic cardiac Valves, Limb prosthesis, Externally Powered limb, prosthesis, Dental Implants, Other applications. Liposomes, hydrogels and Nanomaterials in drug delivery. Biomaterials in diagnostics and bioanalytical techniques.

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

BSHBMN-405-P BIOMATERIALS (PRACTICALS)

TOTAL HOURS: 30 CREDITS:1

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 image processing, biomaterials, biomechanics, and cellular and molecular biotechnology

5. Perform literature search

6. Prepare a scientific poster

7. Collect, analyze, and interpret physiological measurements

8. Visit to a R&D section of a leading Pharmaceutical company/ surgical theatre of Hospital. Prepare a laboratory report

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: Hindi

SUBJECT CODE: - BSBSAE-406

SEMESTER – IV, TOTAL HOURS: 30 CREDITS: 2

Course Objectives:

The Hindi course objectives are

1. Understand The Basic Principles of Hindi language.
2. Have Knowledge Of grammar used in Hindi.

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

संप्रेषण कौशल (4 Credits)
(Sampreshan Kaushal)

Hours

1. हिंदी व्याकरण 15
   - अ. स्वर-व्यंजन : वर्गीकरण
   - आ. संज्ञा, सर्वनाम, विशेषण, क्रिया, लिंग, वचन, कारक
   - इ. शब्द-उच्चारण : ध्वनि गुण

2. भाषिक संप्रेषण : स्वरूप एवं प्रकार 15
   - अ. संप्रेषण : अवधारणा एवं महत्व
   - आ. संप्रेषण के प्रकार – मौखिक और लिखित, वैयक्तिक और सामाजिक, व्यावसायिक
   - इ. संप्रेषण की चुनौतियाँ

3. संप्रेषण के माध्यम – एकालाप, संवाद, सामूहिक चर्चा, दृश्य -श्रव्य 15
   (व्यावहारिक प्रयोग अपेक्षित है।)

4. प्रभावी संप्रेषण- गहन अध्ययन, कल्पनाशीलता, व्याख्यायित करना, चर्चा, विवेचन, विवाद, तर्कसंगत विश्लेषण, मूल्यांकन आदि के आधार पर निम्नलिखित कहानियों, कविताओं, फिल्मों का मूल्यांकन करना अनिवार्य है । 15

   कहानियाँ – चंद्रधर शर्मा गुलेरी - उसने कहा था
   यशपाल - फूलो का कुरता
   मन्नू भंडारी - यही सच है
   ओमप्रकाश वाल्मिकी - ग्रहण

   कविताएँ – नागार्जुन- प्रेत का बयान
   केदारनाथ सिंह - बनारस
   दुष्यंत कुमार - मैं जिसे ओढ़ता - बिछाता हूँ ,
   केदारनाथ अग्रवाल - सब चलता है लोकतंत्र में

   फिल्म – एक कला फिल्म, एक व्यावसायिक फिल्म

UNIVERSITY OF PATANJALI-HARIDWAR

DEPARTMENT OF ALLIED & APPLIED SCIENCE

SYLLABUS OF BSC (HONOURS) IN BIOLOGICAL SCIENCE AS PER NEP-2020 GUIDELINES DATED 07-12-2022 FOR THIRD YEAR SESSION 2023-2025

1	2	3	4	5	6	7	8
Semester	**Core-Major**	**Minor**	**Inter-disciplinary**	**AEC (Literature)**	**Skill Enhancement Course**	**Value added course**	**Total Credit**
V	**1. Molecular Biology (Credit-4)** **2. Endocrinology (Credit-4)** **3. Neurobiology (Credit-4)**	**1. Disease Pathology (Credit-3)** **2. Spectroscopy (Credit-3)**	**------**	**------**	**Internship & Case Studies (IPD/OPD) (Credit-4)**	**-----**	**22**
VI	**1. Biotechnology (Credit-4)** **2. Recombinant DNA Tech (Credit-4)** **3. Biophysical Techniques(Credit-4)**	**1. Immunology (Credit-3)** **2. Biodiversity (Credit-3)** **3. Bioinformatics (Credit-4)**	**-----**	**------**	**-------**	**------**	**22**
Total Credits	**24**	**16**			**4**	**------**	**44**

Dr Laxmi Shankar Rath

Head of the Department

Dr V K Katiyar

Dean (A & R)

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: MOLECULAR BIOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-501

SEMESTER – V, TOTAL HOURS: 45 (Th) CREDITS: 4 (Th-03 & Pr-01)

Course Objectives:

1. Outline the structure of the biomolecules found in all living organisms.
2. To describe how RNA, DNA and Proteins are synthesized.
3. To explain the process of cell division in both somatic and germ cells.

Total Number of Hrs. : 45 (Th)		**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**	**37**	**13**	

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 – tetracyclins, aminoglycosides, chloramphenicol and aminoglycosides.

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-13: 978-0805395921.

2. Cell and Molecular Biology: Concepts and Experiments, 7th edition (2013), Gerald Karp. ; Wiley Publishers ISBN-13: 978-1118206737.

3. Molecular Cloning: A Laboratory Manual, 4th edition (2012), Michael R. Green and Joseph Sambrook; Cold Spring Harbor Laboratory Press, ISBN-13: 978-1936113422.

4. The World of the Cell, 7th edition (2008), Becker, Kleinsmith, Hardin and Bertoni. Benjamin Cummings, ISBN-13: 978-0805393934.

5. The Cell: A Molecular Approach, 6th edition (2013), Cooper and Hausman; Sinauer Associates, Inc. ISBN-13: 978-1605351551.

6. DNA Replication, 2nd edition (2005), Arthur Kornberg; University Science Books ISBN-13: 978-1891389443.

MOLECULAR BIOLOGY BSBSMJ-501-P

(PRACTICALS)

TOTAL HOURS: 30 CREDITS: 1

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

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

Course Outcome:

On completion of course students are able to understand

- Concept of gene, gene cistron relationship in prokaryotes and eukaryotes,
- DNA regulation and replication
- Types of DNA damage, DNA repair pathways
- Transcription in prokaryotes
- Reverse transcription
- Repeated sequences and transposition mechanism

University of patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: ENDOCRINOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-502

SEMESTER – V, TOTAL HOURS: 45 CREDITS: 4 (Th-01 & Pr-01)

Course objectives

1. **To explain the roles of the endocrine system in maintaining homeostasis, integrating growth and development.**
2. **To differentiate among endocrine, paracrine and autocrine systems.**

Total Number of Hrs. : 45 (Th)		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	37	13	

Unit 1: Introduction [**3HRS]**

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

Unit 2: Hypothalamic-Pituitary system [**12HRS]**

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 [8HRS]

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, role of parathyroid hormone and calcitonin in calcium metabolism, disorders of parathyroid gland

Unit 4: Adrenal gland and its hormones [12HRS]

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 [10HRS]

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 Unit 7: Gastrointestinal hormones No. of Hours: 5 A brief account of hormones of gastrointestinal tract and kidney

BSBSMJ-502-P ENDOCRINOLGY (PRACTICALS)

TOTAL HOURS: 30 CREDITS: 1

1. Study of the permanent slides of all the endocrine glands

2. Esrous cycle of rat.- Vaginal smear

3. Compensatory ovarian hypertrophy or adrenal hypertrophy

4. Castration/ ovariectomy

SUGGESTED READINGS

1. J. Larry Jameson, editor. (2010). Harrison's Endocrinology. 2nd Edition. McGraw-Hill Press: New York.

2. Turner, D.C. and Bagnara, J.T. (Editor) (1976). General Endocrinology. W. B. Saunders Company, Philadelphia, Pennsylvania.

3. Hall, J.E. (2011). Guyton and Hall Textbook of Medical Physiology (Guyton Physiology).

Course Outcome:

Provide students with a deep knowledge in biochemistry, physiology and endocrinology. Defining and explaining the basic principles of biochemistry useful for biological studies for illustrating different kinds of food, their structure, function and metabolism. Explaining various aspects of physiological activities of animals with special reference to humans. Students acquire a broad understanding of the hormonal regulation of physiological processes in invertebrates and vertebrates. Familiarize students with hormonal regulation of physiological systems in several invertebrate and vertebrate systems which will provide a basic understanding of the experimental methods and designs that can be used for further study and research.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: NEUROBIOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-503

SEMESTER – V, TOTAL HOURS: 60 CREDITS: 4 (Th-03 & Pr-01)

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. : 45 (Th)		**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**	**37**		**13**

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 sleepwakefulness cycle.Chemical senses: Vision. Auditory. Sensation of touch. Thermoreception. 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,

BSBSMJ-503-P: NEUROBIOLOGY (PRACTICALS)

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

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

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: DISEASE PATHOLOGY (THEORY)

SUBJECT CODE: - BSBSMN-504

SEMESTER – V, TOTAL HOURS: 60 CREDITS: 3 (Th -02 & Pr-01)

Course Objectives:

1. The students will well understand the various concept of Pathology.
2. The students will develop the understanding of hematology and gastrointestinal pathology.
3. Students will learn the various prospects of pathology and related disease.

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**	**37**	**13**	

Unit-1: Introduction to pathology [10Hours]

Importance of the study of pathology; Definition of terms; Methods and techniques; Cellular and Tissue changes; Infiltration and regeneration; Inflammations arid Infections; Wound healing; Vascular changes; Cellular growth, Neoplasms; Normal and Cancer cell; Benign and Malignant growths; Carcinoma Disturbances of fluid and electrolyte imbalance.

Unit-2: Hemodynamics changes [15 Hours]

Oedema, Shock, Thrombosis, Embolism, Infarction; Neoplasia: Cell cycle, Hyperplasla, Metaplasia, Hypertrophy, Atrophy, Nomenclature (classification of tumours), Differences between begin and malignant tumours, Aetiopathogenesis of neoplasia (cancer), Signs of malignancy, Chemical and physical carcinogens, Biological carcinogens (RNA & DNA viruses), Spread of tumours (Metastasis), Dysplasia (Carcinoma in-situ), Lab diagnosis of cancer.

Unit-3: Haematology [20Hours]

Normal Haematopoiesis, Bone marrow examination, Anaemia (Classification of anaemia); Iron deficiency anaemia, Vitamin B12 deficiency anaemia (megaloblastIcanaemia), Pernicious anaemia, Haemolyticanaemia (inherited disorders & acquired), Hereditary Spherocylosis, Hereditary Elliptocytosis, Immune Haemolyticanaemia, Thalassemia, Sickle cell anaemia, Leukaemia Lymphomas (Hodgkin's & non-type Hodgkin's; Normal Coagulation mechanism; ThromboCytopenia (I1P); Haemophilia; Haemophilia B; Rh Incompatibility

Unit-4: Gastrointestinal pathology [15 Hours]

Typhoid, Tuberculosis,Appendicitis; Inflammatory diseases of appendix and large Amoebi: colitis, Bacillary dysentery; Ulcerative Colitis; Ischemic and pseudo membranous enterocolitis, Malabsorption: Celiac disease, Tropical and other causes; Jaundice Types, Pathogenesis arid Differentiation; Hepatitis,Pathogenesis and pathology; Cirrhosis: Ateiology, Post necrotic, Alcoholic, Metabolic, Pathology, Morphology (Macronodular, Micronodular, Mixed), complications; Portal Hypertension.

Course Outcome:

At the completion of this course, the students should be able to:

1. Describe the basic pathological processes/concepts in terms of pathogenesis and morphological changes in tissues.
2. Explain the association of morphological changes with basic clinical features.
3. Describe specimen collection, transport and proper handling with regard to histopathological, cytological, haematological and chemical pathological investigations.

BSBSMN-504-P

DISEASE PATHOLOGY PRACTICAL

TOTAL HOURS: 30 CREDITS: 1

1. Determination of Blood groups (ABO system);
2. Estimation of hemoglobin;
3. Enumeration of RBCs (RBC count);
4. Total leucocyte count (Total count); Differential leucocyte count (DC);
5. Peripheral smear staining and reporting;
6. Absolute eosinophil count

SUGGESTED READINGS

1 Pathologic basics of disease- Kumar, cortan-Saunders Collins

2. Basic Pathology- Kumar, cortan-Saunders

3.Text book of Pathology-Andersons-C.V. Mosby Volume I & II Company

4.General Pathology- Walter & Israel

5.Clinical Laboratory Methods-RAmniksood-Jaypee

6.G.C.DeGruchy Clinical-David Penington-CBS Publishers &Haematology in medical

7.Bryan Rush Distributors Peter Castaldi

8.IIlustrated Pathology-Govans-ELBS Edition 1992

University of Patanjali, Haridwar

Department of Allied and Applied science
B.Sc. Biological Science
Course Structure according to NEP-2020
SEMESTER – V
Nature of subject-Minor

SUBJECT NAME: Spectroscopy
CODE: BSBSMN-505

The course objectives are:

1. To understand the light interaction with organic compounds and their characteristics
2. It helps learners to analyzing data using various spectroscopic techniques.
3. To find the structure of organic compound using spectrophotometer and helps to determine the appropriate sampling techniques
4. It helps to conduct spectroscopy analysis to answer scientific questions.

Total Number of Hrs. : 30 (Th)		**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**	**37**	**13**	

UNIT-1

Fundamentals of electromagnetic radiation, units, types of spectroscopy. Molecular Spectroscopy

Ultra Violet Spectroscopy: Absorption laws, electronic transitions, λmax, Lambert-Beer's law and its limitations, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward rules for calculation of λmax for the following systems: α,β the unsaturated aldehydes: ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

UNIT-2

IR Spectroscopy: Molecular vibrations; IR absorption positions of O and N containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in simple functional group analysis.

UNIT-3

NMR Spectroscopy: Basic principles of Magnetic Resonance, chemical shift, factors influencing on chemical shift, Spin-spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics; Interpretation of NMR spectra of simple compounds.

Unit – 4

Mass Spectroscopy- Basic principle, Fragmentation pattern, instrumentation, determination of m/e ratio. Application of mass spectroscopy on CH4, C2H6, n-butane and neo-pentane. Applications of IR, UV & NMR for identification of simple organic molecules.

Reference Books

1. Spectroscopy by William Kemp, Ist Ed. Red Globe Press
2. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
3. Advanced Physical Chemistry by Atkins Edition. ***12th,*** Publisher, Oxford University Press
4. Elementary organic spectroscopy by Y.R. Sharma S. Chand and Company Ltd.
5. Spectroscopy by P.S.Kalsi, 6th Ed. New Age International Publication
6. Spectroscopy by Pavia Fourth Edition
7. Organic Spectroscopy by J. R. Dyer

BSBSMN-505-P

Organic Spectroscopy Practical

TOTAL HOURS: 30 CREDITS: 1

1. Determination of Molar Extinction Coefficient using UV/Vis Spectrophotometer
2. Demonstration of IR spectrophotometer
3. Demonstration of NMR spectrophotometer

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: CASE STUDIES

SUBJECT CODE: - BSBSSE-506

SEMESTER – V, TOTAL HOURS: 60 CREDITS: 2

Course Objectives:

1. Students will go to Patanjali wellness center and yoggram for case studies
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.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: SKILL ENHANCEMENT COURSE/INTERNSHIP

SUBJECT CODE: - BSBSSE-507

SEMESTER – V, TOTAL HOURS: 60 CREDITS: 2

Course Objectives:

The students will be going through internship in industries related to pharmaceutical, herbal, biotechnological products. Then they have to submit their dissertation report and on that basis they will be awarded grades.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: BIOTECHNOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-601

SEMESTER – VI, TOTAL HOURS: 60 CREDITS: 4 (Th-03 & Pr-01)

Course Objectives:

1. **Describe Biotechnology and its innovations.**
2. **To understand transgenic plants and DNA technology**

Total Number of Hrs. : 45		**Theory**	**Practical**	**Tutorial**
Credits		**3**	**1**	**-**
Hrs/Week		**3**	**1**	**-**
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**	**37**	**13**	

Unit-1

Definition and scope, Fundamentals of genetic engineering (Isolation of DNA, Cutting of DNA and sorting out of DNA pieces, PCR and cloning).Instrumentation used in Biotechnology: Autoclave, Laminar Air flow, centrifuge, water bath, oven, PCR, Biotechnological innovations in the area of medical,agriculture,industrial and forensic sciences.

Unit-2

Laboratory requirements for animal culture, media preparation, serum and serum free media, Primary culture and cell line Adhesion, proliferation and differentiation of culture cells.

Unit-3

General idea of production of transgenic animals. Production of transgenic plants: marker genes and various genes transfer methods. Application of transgenic animals and plants.

Unit-4

Genetic modification in medicine-gene therapy, types of gene therapy, vector in gene therapy, molecular engineering, human genetic engineering, problems and ethics.

Suggested readings:

1. A text Book of Biotechnology by R.C.Dubey
2. Molecular Biotechnology Glick & Pasternak
3. Advances in Animal biotechnology and its applications Gahlawat, S.K & Duhan, J.S.
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7 th edition. Blackwell Publishing, Oxford, U.K
5. Biotechnology by B.D.Singh (Kalyani Publishers).

BIOTECHNOLOGY BSBSMJ-601-P (PRACTICALS)

TOTAL HOURS: 30 CREDITS: 1

1. Sterilization techniques: Theory & Practical, Glassware sterilization, Media sterilization, Lab sterilization
2. Working mechanism of instruments (Autoclave, Laminar Air flow, centrifuge, water bath, oven, PCR)
3. Isolation of DNA
4. Gel electrophoresis
5. Media preparation & sterilization

Course Outcome:

On completion of course students are able to understand

- Genomics and Proteomics and gene expression
- Drug Discovery and Designing: Drug and target identification, target validation
- Bioprospecting and conservation: importance of biodiversity

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: RECOMBINANT DNA TECHNOLOGY (THEORY)

SUBJECT CODE: - BSBSMJ-602

SEMESTER – VI, TOTAL HOURS: 45 (Th) CREDITS: 4 (Th-03 & Pr-01)

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. : 45 (Th)		**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**	**37**		**13**

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 labeling, 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.

BSBSMJ-602-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. 15. 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

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: BIOPHYSICAL TECHNIQUES

SUBJECT CODE: - BSBSMJ-603

SEMESTER – VI, TOTAL HOURS: 60 CREDITS: 4 (Th-03 & Pr-01)

Course Objectives:

1. **To understand various biological techniques.**
2. **To understand détails regarding instrumentation useful in biological studies**

Total Number of Hrs. : 45 (Th)		**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**	**37**	**13**	

Unit I:

Microscopy and Biosensors Microscopy (Principles and applications): Light, phase contrast, fluorescence and confocal microscopy, Scanning and transmission electron microscopy; Biosensors: Introduction and principles, First, second and third generation instruments, Cell based biosensors, Enzyme immunosensors, DNA biosensor.

Unit II:

Centrifugation Basic principle and applications of centrifugation; Centrifugal force; Sedimentation rate; Sedimentation coefficient; Common centrifuges used in laboratory (Clinical, micro, high speed, ultra and industrial centrifuges); Types of rotors (Fixed- angle, swinging bucket and continuous tubular); Types of centrifugation (Principle and applications): Preparative (Differential and density gradient centrifugation) and analytical centrifugation.

Unit III:

Chromatography General principle and applications of chromatography; Types of chromatography (Principles and applications): Adsorption chromatography, Ion exchange chromatography, Affinity chromatography, Size exclusion chromatography, Thin layer chromatography, Gas chromatography, High pressure liquid chromatography (HPLC), Supercritical fluid chromatography.

Unit IV:

Electrophoretic Techniques General principle and applications of electrophoresis; Types of electrophoresis (Principles and applications): Paper electrophoresis, Moving boundary electrophoresis, Isotachophoresis, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis (SDS-PAGE, Native-PAGE, Denaturing-PAGE and Reducing-PAGE), Isoelectric focusing (IEF), Pulse field gel electrophoresis (PFGE), Disc gel electrophoresis.

Reference Books

1. Wilson, K. and Walker, J. Principles and techniques of biochemistry and molecular biology. Cambridge University Press, Cambridge.

2. Robyt, J.F. and White, B.J. Biochemical techniques: Theory and practice. Waveland Press, Long Grove.

3. Holme, D.J. and Peck, H. Analytical biochemistry. Longman Group Limited, London.

4. Chatwal, G. and Anand, S. Instrumental methods of chemical analysis. Himalaya Publishing House, Mumbai.

5. Miller, J. Chromatography: Concepts and contrasts. John Wiley and Sons, New York.

BSBSMJ-603-P: BIOPHYSICAL TECHNIQUES (PRACTICALS) Credit: 1

1. Separation and identification of amino acids by ascending and descending paper chromatography.

2. Separation and identification of sugars by paper chromatography.

3. Separation and identification of sugars by thin layer chromatography.

4. Verification of Lambert Beer's law.

5. Determination of molecular weight of DNA by agarose gel electrophoresis

University of patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: IMMUNOLOGY (THEORY)

SUBJECT CODE: - BSBSMN-604

SEMESTER – VI, TOTAL HOURS: 60 CREDITS: 3 (Th-02 & Pr-01)

Course Objectives:

4. The students will well understand the various concept of Immunology.
5. The students will develop the understanding of Transplantation.
6. Students will learn the various prospects of autoimmune disease.

Total Number of Hrs. : 30 (Th)		**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**	**37**	**13**	

Unit I: Immune System and Immunity History of immunology;

Innate and acquired immunity; Determinants of innate immunity; Hematopoiesis; Cells and organs of immune system: B lymphocyte, T lymphocyte, NK cells, Monocyte/Macrophages, Dendritic cells, Eosinophils, Basophils, Neutrophils, Mast cells, Organization and structure of lymphoid organs and their role in immunity; Humoral and cellmediated immunity;

Unit II: Antigens and Antibodies

Antigens: Structure and properties; Haptens; Adjuvents; Immunogenicity; Immunoglobulin: Structures, Heterogeneity, Types and subtypes, Properties (Physiochemical and biological), Recombinant antibodies, Monoclonal antibodies (General properties and applications), Hybridoma technology;

Unit III: Complement system,Cytokines and Major Histo-compatibility Complex
Complement System: Structure, properties and functions of different components, Complement activation pathways (Classical, alternate and lectin pathways), Complement assay; Structure and function of various cytokines; Cytokine receptors; Antigen presenting cells; Structure and functions of MHC and HL-A system; Antigen processing and presentation.

Unit V: Immunopathology and Transplantations Immunopathology:

Rh- blood groupings, Hypersensitivity reactions (Antibody mediated type I, anaphylaxis, type II-antibody dependent cell cytotoxicity, type III-immune complex mediated reactions and type IV-delayed hypersensitivity reactions), , Autoimmune diseases, Immunodeficiency; Tumor immunology: Immunotherapy of cancer, Immunotoxins; Transplantation: Graft vs. host reaction and rejection; Immunization: Active and passive; Vaccines.

BSBSMN-604-P

IMMUNOLOGY PRACTICAL

TOTAL HOURS: 30 CREDITS: 1

1. Separate serum from blood.
2. To separate plasma from blood sample.
3. To determine the blood groups of human by A, B, O blood group system
4. To separate lymphocytes for culturing

SUGGESTED READINGS

1. Kindt, T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J. Kuby immunology. W.H. Freeman and Company, New York.
2. Male, D.K. Immunology: An illustrated outline. Elsevier Health Sciences, Philadelphia.
3. Abbas, A.K., Lichtman, A.H.H. and Pillai, S. Cellular and molecular immunology. Saunders, Philadelphia.
4. Delves, P.J., Martin, S.J., Burton, D.R. and Roitt, I.M. Roitt's essential immunology. WileyBlackwell, New Jersey.
5. Tizard, I.R. Immunology: An introduction. Saunders, Philadelphia

Course Outcome:

Provide knowledge on the correlation between structure and function of immune cells. Make the student aware of the health related problems and their origin. Make student to understand how efficiently our immune system work in our body. Acquire knowledge about preventing common diseases rather than curing.

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

Core Course

COURSE DETAILS

SUBJECT TITLE: BIODIVERSITY (THEORY)

SUBJECT CODE: - BSBSMN-605

SEMESTER – VI, TOTAL HOURS: 30 (Th) CREDITS: 3 (Th 2 & Pr 1)

Course Objectives:

4. Identify and describe the structural features of plants.
5. Describe major evolutionary lineages of plants and their defining characterstics.
6. Describe the cultural uses of plants for food, fiber, medicine, biotechnology etc

Total Number of Hrs. : 30		**Theory**	**Practical**	**Tutorial**
Credits		**2**	**1**	**-**
Hrs/Week		**2**	**1**	**-**
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**	**37**	**13**	

Unit 1 Defining Biodiversity [15 hrs]

Components of Biodiversity. Biodiversity crisis and biodiversity loss. Importance of biodiversity in daily life. Biodiversity and climate change. Threats to biodiversity, threatened criteria, Types of Ecosystems: India as mega biodiversity Nation. Hot spots and biodiversity in India. Biodiversity and Ecosystem functioning. Plant and Animal systematic. Species concept in biodiversity studies. Indian Wildlife protection act, 1972

Unit 2 Modern Tools in the study of Biodiversity [15 hrs]

Endemism, endemic plants and animals; Assessment of mapping of biodiversity; GIS/Remote sensing; Biotechnology and Conservation, IUCN; Protected areas networks, reserve forests, biosphere reserve forest, wetlands, Biodiversity park, Germplasm banks, National Parks,

Botanical and Zoological Gardens; Wildlife Sanctuaries, Bioresources, rescue centers, captive breeding centres, zoo. Biological diversity act, 2002.

Unit 3 Crop Diversity [15 hrs]

Wild relatives of cultivated plant; BM Crops, Domesticated diversity; Spice diversity; Forest diversity and wild life. Men biosphere program 1988

Unit 4 Bio-prospecting [10 hrs]

Bio-prospecting - Micro organisms as a source of novel enzymes, antibiotics, antiviral agents; Immunosuppressive agents and other therapeutic agents.

Unit5: Different Projects for conserving wild animals [5 hrs]

Project Tiger, Project Asiatic lion and elephant, Project Crocodile, Project Vultures

Books recommended:

1. Aber, J.D.and Melillo J.M., Terrestrial Ecosystems: 1991, W.B.Saunders
2. Ingrowille, M Diversity and Evolution of land plants 1992 chapman and Hall

BSBSMN-605-P

BIODIVERSITY PRACTICAL

TOTAL HOURS: 30 CREDITS: 1

1. Study of a few endangered species of amphibians, reptiles, birds and mammals of India
2. Report on visit to National Park/Wild life sanctuary/Botanical garden.
3. Study through specimens/photographs/slides of a. Key stones species (b) Ecads, Ecotypes, Ecophenes (c) Sacred flora (havan materials etc.)
4. Study of the characteristic features of any flower for each family a. Malvaceae/ Fabaceae/Cruciferae/Ranunculaceae (any one family), (b) Compositae b. Euphorbiaceae, (d) Poaceae/Liliaceae (any one family)

University of Patanjali, Haridwar

Structure of B.Sc. (Hons) Biological Science under NEP

COURSE DETAILS

SUBJECT TITLE: BIOINFORMATICS (THEORY)

SUBJECT CODE: - BSBSMN-606

SEMESTER – VI, TOTAL HOURS: 30 CREDITS: 4 (Th-03 & Pr-01)

Course Objectives:

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

Total Number of Hrs. : 45 (Th)		**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**	**37**		**13**

Unit I

What is Bioinformatics and its relation with molecular biology Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pub med, PDB) and software (RASMOL,Ligand Explorer), Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray).

Unit II

Sequence Alignments and Visualization, Introduction to Sequences, alignments and Dynamic Programming,Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm).Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization.

Unit III

Fundamentals of X-ray diffraction, NMR spectroscopy of macromolecules, Protein Structure: Primary, Secondary, Super Secondary, Domains, Tertiary, Quaternary, Ramachandran plot.

Unit IV

Protein secondary structure classification databases: HSSP, FSSP, CATH, SCOP, Protein secondary structure prediction methods: GOR, Chou-Fasman, PHD, PSI- PRED, J-Pred.

Unit V

Protein Tertiary structure prediction methods: Homology Modeling, Fold Recognition, Ab-intio Method, Protein folding, Molecular Dynamics of Protein, Molecular Docking of Protein, Small molecule and Nucleotide, Concepts of Force Field

Unit VI

Motif and Domain: Motif databases and analysis tools, Domain databases (CDD, SMART, ProDom) and Analysis tools. HMM (Hidden Markov Model): Introduction to HMM, its application in Sequence alignment and Structure prediction, HMM based Softwares (HMMER and HMMSTR)

Books recommended:

1. Baxevanis & Ouellette 2001. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins 2nd Edition. John Wiley Publishing.

2. Gibas & Jambeck 2001. Developing Bioinformatics Computer Skills. O'Reilly.

3. Bioinformatics: Genome Sequence Analysis Mount 2001

4. Bioinformatics For Dummies – Claverie & Notredame 2003

5. Introduction to Bioinformatics – Lesk 2002 7. Fundamental Concepts of Bioinformatics Krane & Raymer 2003

Bioinformatics BSBSMN-606-P (PRACTICALS)

TOTAL HOURS: 30 CREDITS: 1

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, GENSCAN), 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

Course Outcome:

After the course students will be able to grasp various aspects of bioinformatics and molecular biology. Familiarize students with bioinformatics which will provide a basic understanding that can be used for further study and research. The achievement of above objectives along with periodic class discussions of current events in science, will benefit students in their further studies in biotechnology, bioinformatics & molecular Biology