M.Sc. (I) Biochemistry Syllabus 2023-2024 & 2024-2025 (Under National Education Policy)

S.No	Class	Semester	Course type	Course Title	Credits
1	M.Sc. First year	M.Sc. Semester 1	DSC I (Core)	Cell Biology	2
			DSC II (Core)	Human Physiology I	2
			DSC III (Core)	Bioorganic chemistry	2
			DSC IV (Core)	Biostatistics I	2
			DSE I (Option 1)	Bio-analytical Chemistry	2
			DSE II (Option 2)	Environmental Biochemistry	2
			DSE III (Option 3)	Basic Management Concepts in Bio-industries (Any 1 of the above 2 DSE options)	
2		M.Sc. Semester II	DSC I (Core)	Endocrinology	2
			DSC II (Core)	Human Physiology II	2
			DSC III (Core)	Developmental Biology	2
			DSC IV (Core)	Biostatistics II	2
			DSE I (Option 1)	Plant Biochemistry/Pharmacognosy	2
			DSE II (Option 2)	Human Dietetics and Nutraceuticals	2
			DSE III (Option 3)	Biotechnology (Any 1 of the above 2 DSE options)	2

M.Sc. (I) Semester 1 2023-2024 and 2024-2025 (Under National Education Policy)

Course Code	Title	Credits
23PS1BCHDSC1	**Discipline Specific Course – I** **Cell Biology**	**2**
		Number of Lectures
Module-I: Cellular Organization, Cell signalling and transport. • Cell as a basic Module of life: Organization and structure of prokaryotic and eukaryotic cells, Animal and plant cell. • Parts of the Cell: Plasma Membrane - Structure, functions of membrane proteins, membrane fluidity, membrane permeability, gradient and transport across the membrane. Cell wall and its function. • Plant & Animal cell organelles:- Structure & function • Cellular transport - Principles and Mechanism of Simple and Facilitated Diffusion and Active Transport (primary and secondary), Na-K ATPase, Transport of glucose (GLUT proteins) • Cellular communication - Experimental pathways -- the role of Gap junctions in extracellular communication, Adheren Junctions - Adhesion of cells to non-cellular substrates, Cellular interaction -Extracellular space, Interactions of cells with extracellular materials, Interactions of cells with other cells, Hemodesmosomes, Desmosomes, Tight junction and Plasmodesmata. • Cell Signalling: General principles of cell signalling, signalling via G protein linked cell surface receptors, Signalling via enzyme-linked cell surface receptor, Ras –Proteins and their role in signaling cascade [MAP Kinase pathway], IP3 signalling pathway.		**15**
Module-II: Cell growth • Cell division: Somatic cell division and reproductive cell division. The cell cycle - Interphase and M phase, Mitosis and Meiosis, Regulation of cell cycle, Cell cycle checkpoints and proteins associated with it. • Programmed Cell Death (apoptosis): Difference between necrosis and apoptosis. Pathways, regulators and effectors in apoptosis, onco- genes and tumour suppressor genes. • Aging: Definition, Symptoms, Aging theories (Free Radical theory, Glycation Theory). Molecular, Biochemical Mechanisms. Mitochondria and ageing protein damage & maintenance, neurodegeneration, DNA Damage & Repair, Telomeres, Telomerase. Biomarkers of aging, method to slow Aging. • Cancer:- Classification of tumours, Metastasis. Proto-oncogenes, Oncogenes and cancer induction. Tumour associated antigens. Immune		**15**

Response to tumour antigens. Diagnostic importance of various blood markers and tissue markers associated with cancer. • Stem cell: Essentials of stem cell, Basic principles and methodologies. Types of stem cells and their properties. Totipotent, multipotent, pluripotent stem cells. Sources of stem cells with advantages and disadvantages. • Cell Biology techniques:- Methods for disrupting tissues and cells, organ and tissue slicetechniques, isolation of clones.	

Course Code	Title	Credits
23PS1BCHDSC2	**Discipline Specific Course – II Human Physiology I**	**2**
		Number of Lectures
Module I – Blood, Cardiovascular & Respiratory System (Lungs). • Blood: Composition, functions and physical characteristics. Formation of blood cells. Blood clotting - mechanism, role of Vitamin K & anticoagulants. Blood groups and their types. Plasma proteins-composition & their functions. Disorders of blood • Heart: Cardiophysiology- functional anatomy/structure of heart, cardiac cycle, heart sounds, cardiac output, basic E.C.G (elementary knowledge), vasomotor circulation, coronary circulation, bloodpressure. Heart Disorders Aging and heart tissue. • Respiratory system: Functions of - Nose, pharynx, larynx, trachea, bronchi, pleural fluid, lungs. Structure of lungs, mechanism and regulation of respiration. Transport of blood gases - O_2 and CO_2. Acid-base balance - Role of blood buffers, respiratory system and kidneys in maintaining acid-base balance, Bohr & Haldane effect, Role of chloride ions in oxygen transport (Chloride shift). Effect of 2,3- BPG on O_2 affinity of Hb. Acidosis and alkalosis - metabolic and respiratory. Respiratory Disorders, Aging and respiratory system.		**15**
Module II – Digestive System, Muscles and Bones. • Digestive system - Basic structure and organization, processes & functions of the digestive system. Digestion, absorption in the GI tract. • Digestive processes at various regions of digestive system and digestive secretions, their composition, functions and regulation. Role of gastrointestinal hormones. • Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. Physiologic Anatomy and functions of the liver, Pancreas & gall bladder. Secretion, composition & functions of bile & pancreatic juice. Concentration of bile by gall bladder. Aging and digestive system. • Disorders of digestive system		**15**

• Muscles: Types, functions & properties of muscular tissue. Structure and composition of muscle fibers. Thick and thin filaments. Actin, myosin, tropomyosin, troponin, Z disc and H line components. Mechanism of smooth muscle contraction and relaxation - Interaction of actin and myosin muscle contraction, energy source for muscular work. Role of calcium/calmodulin and regulation of muscle contraction. Neuro-muscular transmission • Disorders of muscle, Aging and muscle tissue. • Bones: Functions of Bones & Skeletal system, Structure of Bone, Histology of bone tissue (hydroxyapatite, calcification, osteogenic cells, osteoblasts, osteocytes, osteoclasts). Compact & spongy bone tissue. Synovial fluid - Composition & functions. Bone formation & bone growth. Bone remodelling. Factors affecting bone growth & bone remodelling. Role of bones in calcium homeostasis. Aging and bone tissue. • Disorders of Bone.	

Course Code	Title	Credits
23PS1BCHDSC3	**Discipline Specific Course – III Bioorganic Chemistry**	**2**
		Number of Lectures
Module I: Biochemical basis of evolution and Protein chemistry Origin of life •Theories of origin of life: Theory of chemical evolution and spontaneous origin of molecular level. Overview of creation myths/Divine creation, Oparin's Hypothesis, Miller Experiment, Smith's Model, RNA first model Process or Origin of life of Eukaryotes, Molecular Evolution of Protein. Evolution •Pre Darwin ideas, Darwin's theory of natural selection, evidences and objections, •Speciation: Concept of species • Polypeptide backbone, covalent and non-covalent interactions, end-group analysis by chemical and enzymatic methods, Conformation, Configuration Details of 1°,2°, 3° and 4° structures, problems based on determination of 1°structure, Ramchandran Plot, structure-function relation of protein (eg. Haemoglobin), Haemoglobin - structure, functions, synthesis ,derivatives. Chemical modification and cross-linking in proteins, dynamic properties and mechanisms of protein folding		**15**
Module II: Enzymology. • IUB/EC Enzymes classification active site identification and		**15**

conformation

• Michaelis - Menten Kinetics of monosubstrate enzyme reaction, LB Plot, Einsethal Cornish Bowden Plots • Enzyme Inhibition - Reversible - competitive, non-competitive, uncompetitive, Partial, Mixed, Allosteric, Irreversible and Feedback Inhibition. • Allosteric Enzymes-Kinetics Significance of Sigmoidal Behaviour, Role in Metabolic Regulation. • Iso-enzymes – separation and significance • Enzyme Immobilization and Applications Clinical Enzymology- Enzymes as therapeutic agents, diagnostic tools and laboratory agents.	

Course Code	Title	Credits
23PS1BCHDSC4	**Discipline Specific Course – IV Biostatistics I**	**2**
		Number of Lectures
Module I: Presentation and Processing of Data. • Terms and Definitions in Statistics: Population, Sample, Raw Data. • Types of variables: Numerical variable (Continuous and discrete), Categorical variables (Nominal and ordinal) • Application of Biostatistics Presentation and Processing of Data. • Presentation of Data- Graphical presentation. Tabular, chart, Diagrammatic presentation. • Processing of Data - Measures of Central Tendency (Mean, Mode, Median). • Measures of Dispersion (Quartile deviation, Mean Deviation, Standard Deviation, Coefficient of Variation) • Measures of location (Quartiles, percentiles).		**15**
Module II: Sampling and estimating population parameters • Sampling - Representation sample, sample bias. Sampling Techniques – Simple random, systematic, stratified, multistage, cluster and multiphase. Sampling distribution. • Demography & Vital Statistics: Demography – collection of demographic data, collection of vital statistics at state & National levels, records of vital statistics, reports of special demographic surveys. Measures of vital statistics of population such as growth and density of population; Rates of facility, reproduction, morbidity, mortality, comprehensive indicators /		**15**

indices of health • Probability Definition and basic formula, Probability of an event not occurring, Multiplicative rule to calculate the probability of occurrence of both of two events. Independent events, Non independent events (conditional probability), Additive rule to calculate the probability of occurrence of at least one of two events, mutually exclusive events, Non-exclusive events, Concept of odds, Applications of probability in biology • Permutations: Definition and basic formula, Permutations with repetition, Application of permutations in biology (The genetic code) • Combinations: Definition and basic formula, Applications in biology (pedigree analysis), Problems involving Permutations, Combinations and Probability	

Course Code	Title	Credits
23PS1BCHDSE1	**Discipline Specific Elective – III** **Bio-analytical Techniques**	**2**
		Number of Lectures
Module I : Chromatography, Centrifugation & Radioisotopic Techniques • Chromatography - Basic Principles, Instrumentation, working and applications of partition chromatography (Paper), Absorption/Adsorption Chromatography (TLC, HPTLC, Column), Affinity Chromatography, Ion Exchange Chromatography, Gel filtration Chromatography, Gas-Liquid Chromatography (GLC), High Pressure Liquid Chromatography (HPLC), LC-MS • Centrifugation - Basic principles of sedimentation, relation between rcf and rpm. Principle, Instrumentation, Working and Applications of Preparative and Analytical Ultracentrifugation, Isopycnic Centrifugation, Rate Zonal Centrifugation, Differential centrifugation. • Radioisotopic Techniques - Nature of radioactivity & its detection and measurements of Radioactivity, GM Counter, Scintillation Counter, Pulse Height Analyser. Isotope Dilution, Analysis, Autoradiography, Application of Radioisotopes in Biological Science. Safety Measures in Handling Isotopes.		**15**
• **Module II : Electrophoresis, Spectroscopic techniques** • Electrophoresis - Basic principles, factors affecting electrophoresis, support mediums used. Principle, instrumentation, working and applications of electrophoretic techniques(Zone, Discountinous, Capillary, 2-D, Pulsed Field Gel, Isoelectric Focussing, immune electrophoresis, PAGE)		**15**

Gel Documentation System, Isolation and purification of proteins and enzymes, Sequencing and Blotting Techniques: Protein, DNA and RNA. Spectroscopic: Beer-Lamberts Law, Its verifications and Deviation, Concept of Absorptions, Transmission, Scattering, Phosphorescence, Fluorescence, Luminescence, Diffraction Spectra • Principle, Instrumentation, working and application of – UV, Visible and IR Spectroscopy, Turbidometry, Nephelometry., Spectrofluorimetry, Flame Spectrophotometry, Atomic Absorption Spectrometry, Luminometry, Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR), Mossbauer Spectroscopy, Matrix Assisted LASER Desorption, ionization, Time of Flight-Mass Spectroscopy (MALDI-TOFMS) • X-Ray Diffraction Spectra, Optical Rotatory Dispersion, (ORD), Circular Dichroism (CD) • LASER- Principle, applications in Medicine and Biological Sciences.	

Course Code	Title	Credits
23PS1BCHDSE2	**Discipline Specific Elective – II Environmental Biochemistry**	**2**
		Number of Lectures
Module I: Types of Pollution • Air Pollution: Classification & effects of air pollutants on human health, Gases containing the oxides of carbon, sulphur and nitrogen, ozone and CFC. Measures to control air pollution and suspended particulate matters in air. • Green-house effect & Global warming: sources, consequences & remedial measures. • Water Pollution: Sources and effects of water pollutants on human health, quality standards for drinking water, waste water treatment and recycling. • Noise Pollution**:** Sources, measurement, health hazards, prevention & control of noise pollution.		**15**
Module II: Basic Concepts of Ecology and Environment • Atmosphere; Hydrosphere; Lithosphere- Principles and Concepts of ecosystem- Structure of ecosystem, use of cybernetics in environmental science, • Biogeochemical cycles (N, C, P,S cycles). • Ecology of populations: Concept of population and meta-population; r- and K-selection; characteristics of population: density, dispersion, natality, mortality, life tables, survivorship curves, age structure; population growth: geometric, exponential, logistic, • Ecology of communities Discrete versus continuum community view;		**15**

community structure and organization: physiognomy, sociability, species associations, periodicity, biomass, stability, keystone species, ecotone and edge effect; species interactions: mutualism, symbiotic relationships, commensalism, amensalism, protocooperation, predation, competition, parasitism, mimicry, herbivory • Properties of water- water quality parameters- pH, Dissolved Oxygen (DO),Chemical Oxygen demand (COD); Biological Oxygen demand(BOD); Atmospheric toxicants- CO, NO_2, CO_2, SO_2-; Toxic heavy metals- Radionuclides -Sampling of air and water pollutants- Monitoring techniques and methodology.	

Course Code	Title	Credits
23PS1BCHDSE3	**Discipline Specific Elective – III** **Basic Management Concepts in Bio-industries**	**2**
		Number of Lectures
Module-I: Management processes Management processes • Understanding an organisation, definition, concept of organisation, social system, goal, organisational process- vision and mission • BHAG – Big Hairy audacious goal • Organisation process – strategy (corporate, business) structure, system, processes, job, task • Definition and important of management, Evolution of management thought, principles of management • Definition and importance of planning, steps in planning • Decision making • SWOT analysis • Definition and importance of organizing • Staffing and its importance in organization • Directing and leading- Characteristics and importance of leading, role and functions of leading • Definition, importance & process of Controlling. Effective controlling techniques.		**15**
Module-II: Organizational behaviour and Communication Skills Organizational behaviour • Etiquettes and manners • Stress and time management • Definition, importance of values • Attitudes, its function and component • Emotional intelligence		**15**

• Motivation:- definition and importance • Group, Team :- definition , overview & benefits Communication Skills • Communication: definition, characteristics, process, barriers, overcoming barriers, classification, importance of communication, types and channels. • Business communication • Principles of writing business letters, types of business letter • Letters: Job Application Letter, Acceptance of Job Offer, Letter of Resignation, Letter of Recommendation, Letter of Appointment, Promotion and Termination, Letters under Right to Information (RTI) Act, Letters of Complaints, Consumer Grievance Letters etc. Listening: • Overview, importance, types, barriers of listening, strategies of effectivelistening.Effective questioning: types of questioning. Reading: • Definition, purpose (extensive, intensive), skimming, scanning, SQ3R technique of reading Group Discussion: • Skills required for GD, types of GD's, strategies for GD's, Job interviews.	

M.Sc. (I) Semester II 2023-2024 and 2024-2025 (Under National Education Policy)

Course Code	Title	Credits
23PS2BCHDSC1	**Discipline Specific Course – I Endocrinology**	**2**
		Number of Lectures
Module-I: Overview of Endocrinology; Hormones of Hypothalamus, Pituitary, Thyroid and Parathyroid glands. • Organization of Mammalian Endocrine System, Endocrine hierarchy Classification of hormones, Overview of circulation, modification and degradation, Target tissue, feed-back control. • Hormone receptors, Mechanism of action of steroid hormones and protein hormones. Role of Secondary Messengers-cAMP, cGMP, Ca and Calmodulin. • Role of hormones from Hypothalamus • Posterior Pituitary hormones: Functions, Regulation of synthesis and secretion. Hypo and hyper activity of posterior pituitary hormones- Diabetes insipidus, syndrome of inappropriate ADH secretion. • Anterior Pituitary hormones: Growth hormone- Functions, Regulation of synthesis and secretion. Hypo and hyper activity of posterior pituitary hormones- gigantism, dwarfism, acromegaly. • Adrenal cortex- Glucocorticoids andmineralocorticoids-synthesis, secretion, transport and mechanism of action. Metabolic fate, biological actions and disorders - Addison's disease, Cushing's syndrome, Congenital adrenal hyperplasia. • Thyroid hormones: synthesis, secretion, transport and mechanism of action. Metabolic fate and biological actions. Antithyroid agents. Thyroid diseases, thyrotoxicosis, goiter, hypothyroidism, Graves' disease, Hashimoto's disease. Thyroid function tests.		**15**
Module-II: Hormones of Adrenal Medulla, Pancreas, Parathyroid gland and Other hormones • Adrenal Medulla hormones: Adrenal androgens- metabolic effect and functions. Adrenal medulla- catecholamines- synthesis, secretion, transport and mechanism of action. Metabolic fate and biological actions. Abnormal secretion of adrenal hormones- phaeochromocytoma. • Pancreatic hormones: Islets of Langerhans and Hormone secretion. Biosynthesis, secretion and mechanism of action. Biological actions. Receptors, intracellular mediators and signalling pathways of insulin and glucagon. Somatostatin, Pancreatic polypeptide and insulin like growth factors. • Parathyroid Hormone: Biological actions, regulation of calcium and		**15**

phosphorus metabolism. Calcitriol. Pathophysiology. • Biochemical assessment of endocrine glands. • Gastrointestinal hormones: producing cells, synthesis, structure, secretion and functions, GIP, VIP, gastrin, CCK and other peptides. • Hormones secreted from other organs and tissues: liver, kidney, heart, thymus and pineal gland. • Feel good hormones: Dopamine, serotonin, endorphins, and oxytocin	

Course Code	Title	Credits
23PS2BCHDSC2	**Discipline Specific Course – II Human Physiology II**	**2**
		Number of Lectures
Module I – Organization of Nervous system. • Organization & Functions of nervous system: Structure and function of the brain. Central Nervous System, Peripheral and Autonomic Nervous system. CSF - Composition & function. • Chemical composition of brain – Chemical composition of nerve tissue, Blood – Brain barrier. • Cells of Nervous System – Types of neuronal cells – Glial cells (neuroglia, microglia) astrocytes, oligodendrocytes, Schwann cells, satellite and epididymal cells. Structure and function of nerves, physiology/structure/organisation of neuron, dendrites, axons and synapse. • Neurotransmitters & Neurotransmission - Neurotransmitters: neuromediator, neuromodulators, neuropeptides. Types, Characteristics and action of neurotransmitters (acetyl choline, GABA, Glutamate), and its action, Role of Ca^{+2} in release of neurotransmitter from pre-synaptic membrane. Neuroreceptors – various types. • Mechanism of synaptic transmission: Transmission of nerve impulse, Membrane potentials-Resting potential and Action potential. • Membrane channels – Types of channels, ion gated, voltage gated, chemically gated, mechanically gated and responsive to intracellular messengers, compounds affecting synaptic transmission, neuromuscular junction. Electrical synapse and giant neurons. • Aging and Nervous system, Disorders of Nervous system		**15**
Module IV - Special Senses and Excretory system • Special senses: Olfaction and Gustation - Physiology & Olfactory receptors; Taste buds & Gustation. • Olfactory and Gustatory dysfunction and disorders • Vision - Physiology of an eye, accessory structures. Physiology of Vision, light/dark adaptations, Rod and cone cells, Visual cycle, mechanism, regulation and disorders of vision.		

• Hearing - Anatomy of ear, physiology of hearing equilibrium and disorders. • Aging and sensory system • Kidney - Structure of nephron. Formation and composition of urine (normal & abnormal constituents) . Urine transport, storage and elimination. Role of kidneys in maintenance of electrolyte and water balance. Aging and urinary system. Disorders of Kidney and urinary tract • Skin/Connective Tissue**:** Skin structure, functions, types and disorders. • Sweat - composition & function. Elastin , Melanin, Collagen (Functions and disorders). Aging and skin.	

Course Code	Title	Credits
23PS2BCHDSC3	**Discipline Specific Course – III Developmental Biology**	**2**
		Number of Lectures
Module I: Organs and overview of Reproductive system • Organs of the male and female reproductive system • Spermatogenesis and oogenesis. • Androgens and estrogens- synthesis, secretion, transport, mechanism of action, Metabolic fate and biological actions of Sex hormones (Testosterone, Progesterone, androgens, gonadotropins) • Function and mode of action of LH, FSH,GRH • Reproductive cycle. • Methods of contraception. • Clinical disorders associated with reproduction (male and female infertility, PCOD) • The Menopause		**15**
Module II: Pregnancy & fetal development • Physiology of pregnancy and parturition • Maturation of the Ovum, Fertilization and Implantation, • Early intrauterine Nutrition of Embryo, Function of Placenta • Hormonal Factors in Pregnancy:- HCG, Estrogen, Progesterone, etc, • Embryonic Period:- First week of development, Second week of development, Third week of development, Fourth week of development, Fifth week of development to Eight week of development, Fetal period, teratogens • Maternal changes during pregnancy • Exercise & Pregnancy • The Physiology of Lactation • Adjustments of the Infant at Birth		**15**

• Relation of blood group between parent and foetus	

Course Code	Title	Credits
23PS2BCHDSC4	**Discipline Specific Course – IV Biostatistics II**	**2**
		Number of Lectures
Module I: Analysis of Data • Estimating Population Parameters - Testing of Hypothesis – Type I and Type II errors, Level of significance • Z – test: Paired & Unpaired • Student's t-test for testing population mean (s) & proportion (s). • Correlation analysis - Simple correlation analysis, Multiple correlation analysis. • Regression analysis - Simple regression analysis and Multiple regression analysis.		**15**
Module II: Chi Square & ANOVA • Chi – square - Test of goodness of fit. • Test for independence of attributes & yate's correction. • Analysis of Variance (ANOVA) - CRD: Completely Randomized Design; 1-way ANOVA; RCBD: Randomized Complete Block Design; 2-way ANOVA • Non-parametric tests - Introduction to non-parametric tests, Importance of non – parametric tests. • Statistical softwares- Basic concepts		**15**

Course Code	Title	Credits
23PS2BCHDSE1	**Discipline Specific Elective – I Plant Biochemistry/ Pharmacognosy**	**2**
		Number of Lectures
Module I: Plant Biochemistry. • Plant cell organelles:- Structure & function • Cell Inclusions:- Reserve food & Excretory products • Cell wall and its function. • Plant tissues:- Merismetic & Permanent tissue • Simple Permanent tissue :-Epidermis, Parenchyma, Sclerenchyma, Collenchyma & Cork • Complex Permanent tissue :- Xylem, Phloem, Secretory structure • Plant parts:- Leaves, Stems, Flowers, Fruits, Seeds, Barks, Woods,		**15**

Roots. • Chlorophylls and accessary pigments. • Photosynthesis-Light and Dark Phases, Schemes-I, II & Z. • Cyclic and Non-cyclic Photophosphorylation, C-3 & C-4Pathways. • Biosynthesis of Starch Sugars and Cellulose from Glucose. • Photorespiration and photoperiodism. • Plant growth hormones**:** Auxins - Gibberellins, Cytokines, Abscisic Acid and Ethylene.	
Module II: Secondary Metabolites • A brief account of the following classes: Alkaloids, terpenoids, flavonoids, Phenolics and phenolic acids, steroids, coumarins, quinines, acetylenes, cyanogenic glycosides, amines and nonprotein amino acids, gums, mucilages, resins etc. (Structures not necessary. Give examples of the compounds and the plants in which present and their importance). • Importance of secondary metabolites: Protection of the producer plant from predators and insects; physiological effects to mammalian systems. • Uses of secondary metabolites: as drugs, precursors of drugs in pharmaceutical industry, as natural pesticides/insecticides; other uses of secondary metabolites. • Classification of crude drugs:- Alphabetical, Taxonomical, Morphological, Chemical, Pharmacological, Chemotaxonomic classification • Plant pathology- Symptoms, etiology, epidemiology and management of the following plant diseases: mosaic disease of tobacco, bunchy top of banana, bacterial blight of paddy, damping off of tobacco, blight of maize/sorghum, leaf spot of paddy and citrus canker.	**15**

Course Code	Title	Credits
23PS2BCHDSE2	**Discipline Specific Elective – II** **Human Dietetics and Nutraceuticals**	**2**
		Number of Lectures
Module I: Life span nutrition and Nutraceutical Science Life span nutrition • Diet at various stages of life: Infancy, Childhood, Adulthood, Old age, Pregnancy and Lactation Nutraceuticals • Classification and applications of Nutraceuticals. • Properties, structure and functions of various Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha		**15**

ketoglutarate • Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals.	
Module II: Diet for lifestyle disorders • Diabetes • CVD • GI disorders • Liver • Kidney • Nutrition for weight management (Underweight and Ob • esity). • Menu planning	**15**

Course Code	Title	Credits
23PS2BCHDSE3	**Discipline Specific Elective – III Biotechnology**	**2**
		Number of Lectures
Module I : Bio process technology and Fermentation • **Bioprocess Technology:** Types of Bioreactors: Stirred Tank, Recycle reactors, discontinuous, semi continuous and continuous. Parameters for Bio process: Bio mass, Substrates, product, $O_2$and CO_2, Temperature, agitation. Bio process monitoring with respect to O_2 transfer, energy transfer, rate of utilization, efficiency and computer base monitoring Downstream processing: process for product recovery, recycling of residual raw, by product recovery, waste/effluent treatment • **Fermentation** Primary and secondary of microbes, inoculums preparation, fermentation media, industrial sterilization, strain improvement, metabolic and genetic regulations during fermentations, pure and mix culture fermentations. Products from microorganisms: enzymes (Amylases, Proteases, Pectinases), Primary metabolites (Glutamic acid, vitamin B_{12}), Antibiotics(Penicillin), Pigments (Carotenoids), Sweeteners, Beverages (wine, Beer) Fuels from microbes, microbial polymers and microbial steroid bio transformations.	**15**
Module II : Tissue culture and Marine Biotechnology. • Plant Tissue Culture (PTC): Principles, Techniques, Methodology and Application of PTC. Micropropogation and Protoplast fusion. Suspension Cultures for production and secondary metabolites. Gene Transfer and Transgenic for crop improvement • Animal Tissue Culture (ATC): Principles, Techniques, Methodology and	**15**

Application of ATC. Transfection using eggs, cultured stem cells and nuclei in development of transgenic animals. Frontiers of contraceptive research, cryopreservation of sex gametes& embryos, Ethical issues in embryo research. • Microbial Culture (MC): Principles, Techniques, Methodology and Application of MC. Microbes as products, Single Cell Protein (SCP) and Yeast(nutrient). Bioremediation, Oil spills, Degradation of waste water, Chemicals and heavy metals, microbial leaching (Cu, Zn, Fe, Ag, Mn, Hg, As, Sb) • Marine Bio Technology: Medical Application of Marine resources – Anticancer and Antiviral compounds, Antimicrobial agents, Marine Toxins. Marine natural product: production of Agar and Carageenan from sea weeds and their application.	

Practical Syllabus

M.Sc. I Sem I
Sem I based on Cell Biology, Human physiology I, Bioorganic Chemistry and Biostatistics I

1.Calibration of Micropipettes
2. Preparation of Solutions of different molarity and Normality

3. Microscopic techniques -
Gram Staining
Spores Staining
Capsule Staining
Acid Fast Staining

4. Blood experiments :
1. Blood grouping analysis and Rh typing
2. Bleeding time
3. clotting time
4. PCV
5. Hb by Sahli's method and Drabkin's method
6. ESR
7. Preparation of Blood Smear.
8. Complete blood Count (CBC) WBC/RBC/Total and differential

Colorimetric estimations :-

1. Estimation of Proteins by Biuret, Bradford
2. Estimation of Proteins by Folin-Lowry methods.
3. Estimation of amino acids by Ninhydrin method.

Others
Circular paper chromatography for Amino Acids and Sugars
pKa values of Alanine or Glycine by Titration Curve.
Immobilization using calcium alginate & invertase assay.

Biostatistics I
Numerical problem each on Measurement of Central Tendency (Mean, Median, Mode)
Numerical problem each on Measurement of Dispersion/variability(Mean Deviation, Standard Deviation, Co efficient of variation)

DSE 1 :- **Bioanalytical Chemistry**

Chromatography

1. Ascending paper chromatography for Amino Acids and Sugars
2. HPTLC (Demonstration)
3. Separation of Glucose and Starch (Gel Filtration)
4. Separation of Starch and Casein (Gel Filtration)

Electrophoresis

1. Serum Proteins Electrophoresis(Agar/Agarose)
2. Haemoglobin Electrophoresis (Normal/Abnormal)
3. Separation of Proteins using PAGE.
4. Southern/Northern/Western Blotting. (Demonstration)

DSE 2 :- Environmental Biochemistry

Estimation of -

1. Total Alkalinity of Effluent
2. COD of Waste Water
3. BOD of water sample
4. Total Hardness of Well Water
5. Chlorides from Water Sample by Schales & Schales Method
6. Determination of total organic matter in soil.
7. Determination of pH value of different types of soil.

DSE 3 :-Management in Biochemical industries

Assignment based on :-

1. Management processes and organizational behavior
2. Mock Interview
3. Reading & Listening
4. All types of Letter writing
5. Group Discussion
7. Group assignments/ Activities based on various theory topics

M.Sc. I Sem II

Enzymology:

Amylase (Km, optimum pH, optimum temperature).
Urease (Km, optimum pH, optimum temperature).

Function Tests:

1. Normal and Abnormal constituents of urine ,
2. Urea and Creatinine Clearance Test with Clinical Interpretation
3. Estimation of serum Electrolytes (Na & K)
4. Gastric Function Tests: Gastric Juice- Total and Free Acidity
5. CSF analysis : Proteins, Glucose and Chlorides

Others

Total Alkalinity of Water
Total Hardness of Well Water
TLC of Oils
Isolation of pectin from apple
Isolation of cellulose from grass

Biostatistics II

Numerical problem each on
a. Z-Test
b. T-Test
c. Chi-Squares Test
d. Correlation
e. Regression

DSE 1 : Plant Biochemistry :

1. Study of mitosis from onion root tip.
2. Chloride uptake by potato
3. Isolation of Chloroplast/ Mitochondria.
4. Isolation of pectin
5. Isolation of cellulose from grass

DSE 2 : Human Dietetics and Nutraceuticals :

1. Preparation of Diet chart
2. Menu planning
3. Recipe food Product development - foods rich in
   i. Calcium
   ii. Iron

iii. Proteins
iv. Fibres
v. Vitamins
vi. Minerals
vii. High medium and low energy content.

DSE 3 : Biotechnology

Microbial analysis

1. Preparation of Microbial Media
2. Sterilization of culture media, glassware by hot air oven
3. Isolation of Microbes and plating techniques

Fermentation

1. Wine preparation
2. Fermentation of sugar from yeast