SRI VENKATESWARA UNIVERSITY

S.V.U COLLEGE OF SCIENCES

TIRUPATI - 517 502

DEPARTMENT OF BIOCHEMISTRY

Re-Structured P.G. Programme (CBCS) as per NEP 2020, NHEQF and Guidelines of APSCHE

(With effect from the batch of Students admitted from the academic year 2024-25)

M.Sc Biochemistry

SVU COLLEGE OF SCIENCES, Department of BIOCHEMISTRY
Re-Structured P.G. Programme (CBCS) as per NEP 2020, National Higher Education Qualification Frame Work (NHEQF) and Guidelines of APSCHE
(With effect from the batch of Students admitted from the academic year 2024-25)
M.Sc Branch II (A): M.Sc. Biochemistry

SEMESTER - I								
S. No	**Course**	**BCH Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	101	Core Course-1: Intermediary Metabolism I	4	4	70	30	100
2		102	CC – 2(A): Biochemical and Biophysical Techniques CC – 2(B): Food safety and quality management	4	3	50	25	75
3		103	CC – 3(A): Biomolecular Chemistry CC – 3(B): Plant Physiology	4	3	50	25	75
4	*P	104	Practical I (related to CC 2 & 3)	6	2	35	15	50
5	SOC	105	Skill Oriented Course – 1(A): Microbiology Skill Oriented Course – 1(B): Inheritance Biology	4	3	50	25	75
6		106	Skill Oriented Course – 2(A): Molecular Biology SOC – 2(B) : Biotechnology and Nanotechnology	4	3	50	25	75
7	*P	107	Practical II (related to SOC 1 & 2)	6	2	35	15	50
8	Audit Course	108	Indian Knowledge Systems – 1 (Indian Health Sciences)	4	0	0	100	0
			Total	**36**	**22**	**340**	**160**	**500**

- **CC (Core Courses) - 1st Core Course is mandatory and 2nd& 3rd Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Practical – I relating to 2nd& 3rd Core Courses and Practical - II relating to 1st& 2nd Skill Oriented Courses (SOC)**
- **Audit Course – Zero Credits but mandatory with only a Pass.**

SEMESTER - II								
S. No	**Course**	**BCH Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	CC	201	Core Course-4: Intermediary Metabolism II	4	4	70	30	100
2		202	CC– 5(A): Molecular Physiology CC–5(B): Molecular Signaling & Immuno-technology	4	3	50	25	75
3		203	CC – 6(A: Enzymology CC – 6(B): Ecological Principles	4	3	50	25	75
4	P	204	Practical III (related to CC 5 & 6)	6	2	35	15	50
5	SOC	205	Skill Oriented Course –3(A): Nutritional Biochemistry Skill Oriented Course – 3(B) : Nutraceuticals	4	3	50	25	75
6		206	Skill Oriented Course – 4(A) : Genetic Engineering Skill Oriented Course – 4(B) : Metabolomics	4	3	50	25	75
7	P	207	Practical IV (related to SOC 3 & 4)	6	2	35	15	50
8	OOTC	208	Open Online Trans disciplinary Course-1 (Mandatory)	-	2	-	100	100
9	Audit Course	209	Indian Knowledge Systems – 2 (Human Ethics)	4	0	0	100	0
			Total	**36**	**22**	**340**	**260**	**600**

- **CC (Core Courses) – 4th Core Course is mandatory and 5th& 6th Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Practical - III relating to 5th& 6th Core Courses and Practical - IV relating to 3rd& 4th Skill Oriented Courses (SOC)**
- ***Open Online Trans disciplinary Course (OOTC) - Students can choose any relevant course of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc.,**
- **Audit Course – Zero Credits but mandatory with only a Pass**

SEMESTER - III

S. No	Course	BCH Code	Title of the Course	H/W	C	SEE	IA	Total Marks
1	CC	301	Core course-7: Endocrine Biochemistry	4	4	70	30	100
2		302	Core Course – 8(A) : Immunology Core Course – 8(B) : Neuro-Biochemistry	4	3	50	25	75
3		303	Core Course – 9(A) : Developmental Biology Core Course – 9(B) : Cancer Biology	4	3	50	25	75
4	P	304	Practical V (related to CC 8 & 9)	6	2	35	15	50
5	SOC	305	Skill Oriented Course – 5(A) : Technical Writing, Biostatistics, Bioinformatics and Omics SOC – 5(B): Research Methodology Tools Techniques, Research Publication and Ethics	4	3	50	25	75
6		306	Skill Oriented Course –6(A): Clinical Biochemistry SOC –6(B): In Silico Drug Design and Discovery	4	3	50	25	75
7	P	307	Practical VI (related to SOC 5 & 6)	6	2	35	15	50
8	OOTC/ OE	308	Open Online Trans disciplinary Course – 2 /	-	2		100	100
			Open Elective (Offered by other Dept.) **BCH 308 Open Elective: Endocrine Biochemistry**		2	70	30	100
*	Seminar / tutorials / remedial classes and Quiz as part of internal assessment			4				
			Total	**36**	**20**	**340**	**260**	**600**

- **CC (Core Courses) – 7th Core Course is mandatory and 8th& 9th Core Courses Student can choose one from each code**
- ***SOC (Skill Oriented Courses) – Student can choose one from each code**
- ***Open Online Trans disciplinary Course (OOTC) - Students can choose any relevant course of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc.,**
- ***Practical - V relating to 5th& 6th Core Courses and Practical - VI relating to 5th& 6th Skill Oriented Courses (SOC)'**

SEMESTER - IV								
S. No	**Course**	**BCH Code**	**Title of the Course**	**H/W**	**C**	**SEE**	**IA**	**Total Marks**
1	OOSD C/SDC	401	Open Online Skill Development Courses/Two Skill Development Courses (Select Any Two out of Three Courses)	-	8			200
			401 a) Plant Biochemistry	06	4	70	30	100
			401 b) Applied Biochemistry	06	4	70	30	100
			401 c) Life style disorders and therapeutics (E)	06	4	70	30	100
2	PW	402	Project Work – Orientation classes	12	12	300	0	300
*	Conducting classes for competitive exams, communication skills, UGC / CSIR and NET / SLET examinations			12	-	-	-	-
			Total	**36**	**20**	**440**	**60**	**500**
Total Semesters				**144**	**84**	**1320**	**880**	**2200**

- Open Online Skill Development Course (OOSDC) - Students can choose any **Two** relevant courses of his / her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL, etc., **to get 8 credits (with 4 credits from each course)**

SEMESTER III

BCH 301 Core Course 7: Endocrine Biochemistry (Credits 4)

Course Objectives: The main objectives of this course are to:

1. This course presents an introduction and provides a comprehensive, balanced introduction to Endocrine glands, their secretions and functions.
2. To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various hormones.

Unit I

Endocrine system – organization of the endocrine system. General features and classification of hormones, mechanism of action of hormones, hypothalamic hormones, chemistry, biosynthesis, Secretion, physiological functions, regulation and disorders of anterior and posterior pituitary hormones, LH, FSH, Growth hormone, prolactin, oxytocin, Vasopressin. Hormones of the pineal gland – Serotonin and melatonin.

Unit II

Thyroid hormones – chemistry, biosynthesis, secretion, physiological function, regulation and disorders, hypo and hyperthyroidism, tests for thyroid function. Antithyroid drugs and calcitonin.

Parathyroid gland – Parathormone and disorders of Parathormone. Role of calcitonin in calcium and phosphate homeostasis in blood.

Unit III

Pancreatic and gastrointestinal hormones – Biosynthesis, secretion, physiological functions and regulation of insulin and glucagon. Role of insulin and glucagon in carbohydrate, lipid and protein metabolism. Disorders of pancreas gastrointestinal hormones-. Gastrin, secretin, Cholecystokinin.

Unit IV

Adrenal hormones – Chemistry, biosynthesis and functions of adrenal medullary and adrenal cortical hormones. Cortisol, corticosterone, aldosterone, adrenaline, nor-adrenaline, Disorders of adrenal hormones.

Hormones of reproduction – Gonadal hormones (testosterone), chemistry, biosynthesis and physiological functions of androgens, estrogens and progesterone, inhibin.

Hormonal regulation of menstrual cycle, placental hormones, contraception, reproductive disorders.

Recommended Books:

1. Text book of Biochemistry and Human Biology by Talwar G.P., Prentice Hall India.
2. Human Physiology and Mechanism of distance. Guyton 3rd Ed. Igkushoen/Seunders.
3. Clinical Biochemistry, Vol. 1 and 2, Williams *et al*., Heinemann Medical, 1978.
4. Lynchs Medical Laboratory Technology by Raphael, S. S., 4th Ed. Igkushoen/Seunders.
5. Text Book of Endocrinology, William.
6. General Endocrinology – Turner.
7. Biochemical Endocrinology of the Vertebrates – E. Fruden and H. Lines.
8. Foundation of Modern Biochemical Series, Prentice Hall Inc., 1971.
9. Metabolic and Endocrine Physiology – Jay Teppermann.
10. Metabolic Pathways – Green Berg.
11. Intermediary Metabolism and its regulation – Larner
12. Principles of Biochemistry – White A., Handler P and Smith.
13. Receptors and Hormone action. Receptors and Recognition series. Medical physiology by A.C. Guytom.

Expected Course Outcomes: On the successful completion of the course, student will be able to:

Obtain a deep knowledge regarding Endocrine glands and their secretions (K1 & K2).

Gives an idea about structure and functions of endocrine glands (K1 & K2)

Provides knowledge about Hormone and its regulation (K2, K3 & K4)

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

BCH 302 Core Course 8 (A): Immunology (Credits 3)

Course Objectives: The main objectives of this course are to:

1. The study of immunology helps the students in understanding the immune system in all organisms, especially the physiological functioning of the immune system in states of both health and disease.
2. To understand the malfunctions of the immune system in immunological disorders such as autoimmune disease, hypersensitive, immune deficiency and transplant rejection.
3. To understand the physical, chemical and physiological characteristics of the components of the immune system in *in vitro*, *in situ* and *in vivo*.

Unit I

Lymphoid organs (primary and secondary), organization of the immune system, Types of immunity – Natural and acquired, specific and non-specific immune response. Cells and organs of the immune system, antigenic determinants/Epitopes.

Haptens, adjuvants, classification, structure and biological functions of immunoglobulins, Isotypes, allotypes and idiotypes. Theories of antibody formation.

Unit II

Active and passive immunity, Humoral and cell mediated immune response, T-Cell and B-Cell activation. Antigen processing and presentation.

T-Cell and B-Cell receptors, Complement system, Alternate and classical pathways of complement activation. Complement fixation tests. Types of Interferons and Cytokines. Major Histocompatability Complex: MHC in mice and HLA in man-fine structure and functions.

Unit III

Transplantation: Terminology, Auto graft, Isograft, Allograft, Xenograft, Immunological basis of transplantation reactions, GVH reaction, Immuno suppression, General mechanisms of Immune suppression, Immune suppression, drugs (azothioprine, methotrexate, cyclophosphamide, cycosporin-A, Steroids). Blood groups: AB, Rh system, Lewis-Luthern systems, significance, practical application of immuno methodology in blood transfusions, Erythoblastosis faetalis.

Disorders of immune response – Autoimmune diseases – Hashimoto's thyroiditis, Rheumatoid arthritis (RA), Systemic lupus erythematosus (SLE). Immuno deficiencies – Introduction, primary and secondary deficiencies. T-cell, B-cell and combined immune deficiencies, Compliment system deficiency. SCID, AIDS. Cancer immune therapy.

Unit IV

Hypersensitivity reactions: type I -IgE-Mediated Hypersensitivity-anaphylactic reactions, Antibody mediated, type II cytotoxic reactions, Immune complex reactions Type – III, T-cell mediated delayed type hypersensitivity Type-IV**.** Immunological tolerance and tolerance induction.

Antigen-antibody interactions, precipitation reactions – immune diffusion, radial immuno diffusion, immuno electrophoresis, immunofluorescence, Western blotting, Radioimmunoassay (RIA) and ELISA – Principle, Methodology and applications. Hybridoma Technology, Production of polyclonal and monoclonal antibodies and their application,

Recommended Books:

1) Essential immunology – Ivan M. Roitt.
2) Immunology – a short course elibezamini and Sidney Leskowitz, Alan R. Lisi Inc. New York, 1988.
3) Immunology III, Joseph A. Bellanti Igaku – Shein Saunders International Ed. 1985.
4) Immunology at a glance J.H. L. Playfeir 4th Ed. Blackwell Scientific Publication 1987.
5) Acids to Immunology D.M. Wier Churchill, Livingtons 1986.
6) Fundamentals of Immunology, Myrvik and Weiser, 1984.
7) Fundamentals of Immunology, Bier *et al*, Springer 1986
8) Textbook of Biochemistry and Human Biology, Talwar G.P. Prentice Hall, 1980.
9) Basic and Clinical Immunology – Stites et al., 4th Ed. Lange 1982.
10) The Immuno-system, Mc Connell et al., Blackwell Scientific 1981.
11) Fundamentals of Immunology – William C. Boyed (Wiley Toppan)
12) Introduction to Immunology – John W. Kinball.
13) Fundamentals of Immunology – Otto S. View and others.
14) Immunology – D.M. Weir.
15) Immunology – Janis Kuby,

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Obtain the knowledge about the immune system, as a host defense system comprising many biological structures and processes within an organism that protects against disease (K1 & K2).
2. Concentrate on the antigen and antibody reactions and immunological techniques (K1 & K2).
3. Understanding about the two branches of the immune system such as humoral immunity and cellular immunity, cytokines and complement system (K1 & K2).

4. Clear about the hypersensitivity reaction or intolerance undesirable reactions produced by the normal immune system, including allergies and autoimmunity (K1 & K2).
5. Obtain the knowledge about the hybridoma technology is to produce large numbers of identical antibodies (monoclonal antibodies) and a recombinant DNA technology that involves inserting the DNA encoding an antigen that stimulates an immune response (K1, K3 & K4).

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Practicals: Immunology (Credit 1)

1. Separation of serum and plasma
2. Lymphocyte separation and identification of viable lymphocytes.
3. Fluorescent antibody technique
4. Rising of antibodies to soluble antigen in rabbits.
5. Single Radial Immunodiffusion.
6. Ouchterlony Double Immunodiffusion.
7. Rocket immunoelectrophoroesis.
8. Cross over Immunoelectrophoresis.
9. Graber and Williams Immunoelectrophoresis.
10. Haemeagglutination tests for identification of human blood groups.

BCH 302 Core Course 8 (B): Neuro-Biochemistry (Credits 3)

Course Objectives:

The objective of the course is:

1. To introduce students to the field of neurobiology. Neurobiology touches upon many diverse areas -- from molecular organization of the nerve cells to the philosophy of mind.
2. To understand the various aspects of neurotransmitters.
3. To understand the diseases related to nervous system.

Unit I

Developmental Neurobiology: Organogenesis and neuronal multiplication, axonal and dendritic growth, glial multiplication and myelination, growth in size, regeneration and repair mechanisms, plasticity. Neuromorphology and neurocellular anatomy: Central nervous system (CNS) and peripheral nervous system (PNS), autonomous nervous system, somatic nervous system, dendritis and axons, neurofilaments. Sensory receptor and effector endings; peripheral nerves, spinal and cranial nerves: Plexuses ganglia, afferent pathways and sense organs.

Unit II

Neurophysiology: Resting Potential & Action potential, Propagation of Nerve Impulses, Degeneration & regeneration /repair of nerve fibers, Nerve growth factors. Synaptic & neuro-muscular transmission, Muscle tone, posture, Equilibrium & their regulation. Pain production, pathways and analgesics, head ach & referred pain. Vestibular apparatus & motion sickness. Integrative functions of thalamus, cerebellum, basal ganglia & Cerebral cortex. Blood brain barrier, Blood CSF barrier, Spit Brain, EEG.

Unit III

Neurotransmitters: Acetylcholine, dopamine, norepinephrine, etc., chemistry, synthesis, storage and release of neurotransmitters, transmission, synaptic modulation, receptors involved and mechanism of neuronal integration. Electrical and chemical synapses, temporal and spatial summation, voltage dependent calcium channel and their blockers. Secondary Messengers: Importance of cyclic nucleotides and protein phosphorylation in nervous system. Involvement of protein kinases and calcium in neuronal metabolism. Neuropeptides: classes of neuropeptides, mode of action, role of neuropeptides in obesity and pain neuropeptide receptors.

Unit IV

Stem cells: Principles in stem cell biology, pluripotency, totipotency, multipotency; Brain stem cells – Embryonic & adult stem cells. Introduction to brain development – evolution of brain – the principles of use it – Nature vs nurture: role of epigenetics – brain cells and functions, Brain morphogenesis – mechanisms involving neural tube formation, neuronal migration etc. Neuronal differentiation – mechanisms involving axonal growth, dendritic spine formation – Growth cones in axonal path finding – Synaptogenesis, Myelinogenesis – Pruning of brain: apoptotic mechanisms involved.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Explain principles and concepts of chemical and functional organization of the nervous system at the cellular and molecular levels.
2. Understand about chemical neurotransmitters, presynaptic proteins and cell adhesion molecules, chemically mediated synaptic transmission, neurotransmitter receptors etc.,
3. Understand about neurodegenerative diseases.

Practical: Neuro-Biochemistry (Credit 1)

1. Study of cells of the nervous system using microscope
2. Study of permanent slides of histology of nervous system
3. Preparation of stained sections of brain / spinal cord of any vertebrate tissue.
4. Silver staining of neuronal cell / tissue
5. Whole mount of neurons of invertebrates
6. Whole mount of vertebrate medullary fibres
7. Whole mount of vertebrate non-medullary fibres
8. Haematoxylin and eosin staining of neuronal / glial cultured cells
9. Biochemical estimations / Histo-chemical localizations in brain tissue

Recommended books

1) Siegel et al., Basic Neurochemistry, 6th Edition, Lippincott -Williams- Wilkins, 1999
2) Kandel et al., Principles of Neural science, 4 Edition, McGraw-Hill Medical, 2000.
3) Zegmond, Fundamentals of Neuroscience, 1st Edition, Academic Press, 1999
4) Bear: Neuroscience: Exploring the Brain, 2nd edition, Lippincott Williams & Wilkins, 2001.

BCH 303 Core Course 9(A): Developmental Biology (Credits-3)

Course Objectives:

1. The main objectives of this course are to:
2. Understand the molecular and cellular mechanisms of development and learnabout basic embryology.
3. The main objective of this course is to introduce concepts in Genetics and Developmental Biology.
4. The course aims to give exposure to learn the basic concepts involved in developmental biology such as Potency, commitment, specification, induction, competence, determination and differentiations and morphogenetic gradients.
5. This course also provides knowledge about Cell division in cleavage, Rudimental organs, Gametogenesis and Fertilization approaches.

Unit I

Concepts of development Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

Unit II

Fertilisation in animals and plants Gametogenesis, Fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilisation in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

Unit III

Development of animals Morphogenesis and organogenesis in animals: Cell aggregation and differentiation; axes and pattern formation in Drosophila, organogenesis – vulva formation in *Caenorhabditis elagans*; eye lense induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic developmentlarval formation, metamorphosis; environmental regulation of normal development; sex determination.

Unit IV

Development of plants Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; lead development and phyllotaxy; transition to flowering, floral development in Arabidopsis and Antirrhinum.

Expected Course Outcomes:

Upon completion of this course, students should be able to:

1. Acquire knowledge on basic concepts of Developmental Biology.
2. Gain the proficient knowledge about zygote formation, blastula formation, gastrulation and many events in early development of life and seed formation and germination.
3. Understand morphogenesis and Organogenesis in animals and Plants.

Recommended books

1) Developmental Biology (Looseleaf), 10th Edition, Scott F. Gilbert, Sinauer Associates, Inc., 2013, ISBN: 978-1605351926.
2) Principles of Development. 3rdedition, by L. Wolpert, 2006, Oxford University press, incorporated; ISBN: 9780198709886.
3) Developmental Biology. 3rdedition, by Lewis Wolpert, 2006, Oxford University Press, USA; ISBN: 1405122161
4) Developmental Biology, 6th ed. by Scott Gillbert, 2000, Sunderland (MA): Sinauer Associates; ISBN-10: 0-87893-243-7
5) Evolutionary developmental biology, 2ndedition by Brain K. Hall.1998, Springer; ISBN-10: 0412785803

Practical: Developmental Biology (Credit-1)

1. Observation of living chick embryo
2. Culture of early chick embryo
3. Larval developmental stages of drosophila (Demonstration).

BCH 303 Core Course 9 (B): Cancer Biology (Credits-3)

Course Objectives:

The objective of this course is:

1. To learn the principles of cancer biology and identify the main cellular and molecular mechanisms underlying the initiation and progression of neoplastic growth.
2. The focus of this course is on the difference between malignant cells and normal cells.
3. It explores the animal models of cancer study and the multi-step process of tumor progression leading to invasive metastatic growth.
4. The course will also examine the role of stem cells and their potential for differentiation in different types of malignancies and it includes recent advances in molecular diagnostics and therapy of cancer.

Unit I

Introduction to Cancer Biology: Definition and classification; evolution of cancer cells; cellular oncogenes; oncogene, viral-oncogene, tumorigenicity, tumor suppressor genes; p53, Rb and PTEN. Cancer metastasis, migration & invasion, metastasis steps, epithelial to mesenchymal transition, angiogenesis.

Unit II

Microenvironment of Tumor cells: Stroma interaction, adipose stromal cells, cancer associated fibroblast, tumor associated macrophages, mesenchymal stem cells, impact of tumor-stroma interaction on tumor development, tumor immunology; interferons, T cells, cancer stem cells; origin, isolation and culture of cancer stem cells, animal models of cancer study; xenograft and metastasis models.

Unit III

The difference between Normal cell versus Cancer cell. Cell immortalization and tumorigenesis, Oncogenes and tumor suppressor genes, Maintenance of Genomic integrity and development of cancer, Invasion and metastasis- Epithelial to Mesenchymal transition, Cancer stem cells-Basics and how to targeting cancer stem cells, Rationale treatment of cancer and Special emphasis on few imp cancers which are prevalent in India- Breast cancer, Oral cancer, etc

Unit IV

Cancer growth and metastasis: Growth factor, receptors and cancer; in vitro testing of stemness property of cancer stem cells; detection and monitoring of metastasis process in animal models; osteoblastic & osteolytic metastasis.

Success and failure of chemotherapy, targeted specific therapy, monoclonal antibody for cancer treatment, micro-RNA mediated cancer treatment and targeted drug delivery, drug resistance, molecular diagnosis and stem cell therapy.

Expected Course Outcomes:

Upon successful completion of this course students should be able to:

1. Identify the main cellular mechanisms leading to initiation and progression of cancer growth. Describe the characteristics of cancer cells that explain high mortality rate.
2. Define the role of oncogenes and mutations in cancer and explain why several types of cancer have heritable traits and family history.
3. Define the main factors contributing to metastatic growth. Identify the role of stem-like cells, their properties and contribution to tumor progression. List and describe the main factors controlling the evolution of cancer cell populations.
4. Develop a solid understanding of the main methods used in the modern studies of cellular and molecular mechanisms of cancer.
5. Demonstrate core knowledge of the cellular targets and molecular mechanisms of traditional and novel cancer therapies.

Practicals: Cancer biology (Credit-1)

1. Preparation of culture media.
2. Establishment of primary cell culture: mouse splenocyte culture.
3. Handling mammalian cell lines: thawing, culture maintenance and cryopreservation.
4. Cell counting using hemocytometer.
5. Cell viability and proliferation assays: i. Trypan blue exclusion test, ii. MTT assay, iii. Propidium Iodide staining, iv. CFSC labelling.
6. Mammalian cell transfection (transient).
7. Immuno fluorescence detection to check transfection efficiency (using fluorescence and confocal microscopes).

Recommended books:

1. Biology of Cancer by Robert Weinberg 2.Principles Of Cancer Biology - Lewis J Kleinsmith
2. Oxford Textbook of Cancer Biology. Edited by Francesco Pezzella, Mahvash Tavassoli and David Kerr.
3. Cancer Biology by Raymond Ruddon.

BCH 305 Skill Oriented Course 5 (A): Technical writing, Biostatistics, Bioinformatics and Omics

Course Objectives: The main objectives of this course are to:

1. Know the nuances of technical writing of scientific documents like thesis, project proposals and journal articles.
2. Understand the statistical tools commonly used in biological research.
3. Know the aspects fundamental to research and to understand the methods of research
4. Assimilate the concepts of hypothesis testing and its importance in research
5. Improve computer based skills for analyzing biological data.

Unit I

Technical Writing: Sentence writing, paragraph writing, story writing, review writing, various types of letters writing.

Preparation of a research project proposal: Selection of appropriate funding agency, Informal proposal, formal proposal, submission of technical report (format: title page, introduction, aims of the proposal/research, methodology, results, interpretation of results, references, acknowledgments, budgetary allocations), execution of results, submission of progress report (year wise), scientific communications (Articles, papers, reviews etc.,) and critical comments writing.

Unit II

Scope of statistical methods in life sciences. Variables, Measure of central tendency: Mean, median and mode, Measuring Dispersion: Standard deviation, co-efficient of variation, probability, probability distributions, test of significance, Linear regression and correlation, the chi-square test, ANOVA, t-Test and F-Test.

Unit III

Bioinformatics: Branches of Bioinformatics, scope of bioinformatics, useful sites on the internet: Data bases and search tools: NCBI (http://www.ncbi.nlm.nih.gov/), EMBL serve: (http://www2.ebi.ac.uk/services.html), sequence alignment: multiple sequence alignment (http://www.genebee.msu.su.), Tree view (http://taxnomy. zoology.gla.ac.uk/rod/treeview.html), Gene doc (http://www.cris.com/ketchup/genedoc.shtml). Sequence analysis, repetitive elements, Image analysis, office applications, logic development. Introduction to Proteomics and genomics.

Unit IV

Genomics, Transcriptomics, proteomics, metabolomics and omic data bases. Sequencing by conventional, automated and next generation sequencing approaches-advantages and limitations. ARDRA, RISA, DGGE/TGGE, Multiple Displacement Amplification (MDA). Whole genome analysis. Advantages and limitation of Metagenomics approach. Culturomics. Proteome, Functional proteomics, metaproteome. Proteome tools – 2-DE Mass spectrometry analysis. Identification of post-translational modifications: Phosphorylation, Glycosylation, Acetylation. Sequence based protein prediction: Homology or comparative modeling, Remote homology (Threading), Protein function prediction. Application of omic technologies in Bioprospecting. Integration of omic platforms, interactomics, Systems biology.

Recommended Books:

1) Bio-statistics, A foundation for analysis in the Health (7th Ed. 1999) by WWW Daniel and Sons Inc., New York.
2) Introduction to Bio-statistics and Research Methods by P.S.S. Sundar Rao and Richard.
3) Bio-statistics by Sokal and Rolf.
4) Bioinformatics, Sequence, Structure and Databanks by Des Higgins Willie Taylor (2000).
5) Introduction to Bioinformatics by T.K. Altwood and D.J Parry- Smith (Oearson Edu. Asia 1999).
6) UGC-MRP guidelines and format, DST and DBT guidelines and formats for project praposals.
7) Authour guidelines of any UGC recognized journals.
8) English grammar books for formal and informal letter writing.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Gives an idea about thesis writing, funding agencies and patenting (K3 & K4).
2. Helps to collect data and organize the data (K1 & K2).
3. Gives a clear understanding about the basic statistical analysis (K1 & K2).
4. A Clear Knowledge of probability and its application (K2 & K3).
5. Provides the sampling distribution techniques and its analysis (K2 & K3).
6. Expertise in computer based analysis of biological data (bioinformatics) (K4, K5 & K6).

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Practicals: Technical writing, Biostatistics, Bioinformatics and Omics (Credits 1)

1. Article writing
2. Standard Deviation
3. Mean, Median and Mode
4. ANOVA
5. Survey of some genome, metagenome, proteome data bases.
6. nBLAST, pBLAST, Multiple Sequence Analysis
7. Gene Annotation of genome sequences (ORF finding)
8. Amplification of 16S DNA
9. Phylogenetic analysis using 16S rDNA typing
10. Native gel, SDS PAGE and 2D gel Electrophoresis.

BCH 305 Skill Oriented Course 5(B): Research methodology tools techniques, Research Publication and Ethics

Course Objectives:

1. The primary objective of this course is to enable the students, irrespective of their disciplines, in developing the most appropriate methodology for their research studies; and
2. To make them familiar with the art of exploiting different research methods and techniques.
3. Students should obtain a guideline on how to write, publish, present, and review scientific papers.
4. The course aims to guide the students regarding the publication ethics and misconducts. It is expected that the course will assist in the accomplishment of exploratory as well as result-oriented research studies.

Unit I

Research Methodology- Definition and significance- Types of research - Exploratory research, Conclusive research, Modeling research, Algorithmic research, Casual research, Theoretical and Empirical research, Cross-Sectional research and Time Series research, Research process-, Research problem- Objectives, Characteristics, Hypothesis and research in evolutionary perspective. Research Design- Definition, Types- Descriptive and Experimental Questionnaire preparation- prerequisites of a good questionnaire, Data Collection methods in research -Primary data and Secondary data.

An overview and implications of translational research. Rationale and implications of Intellectual property rights (IPR) and Patenting. Fundamentals of IPR; Basics understanding about Patentability. Innovation & Knowledge management; Translating Ideas to Entrepreneurship and Startups

Unit II

Validity and Reliability-Definition, importance, types of validity, types of reliability-- Construction and Validation of questionnaire, Cronbach alpha test, Measurement – definition- significance – types Nominal, Ordinal, Interval and Ratio ,Scaling- Importance, Scaling techniques. Sampling methods- Probability sampling methods and Non - Probability sampling methods, Report writing – importance , guideline to write an academic report, Basics of report presentation- Content of an Academic Research report, Content on a Research Article, Steps to publish an article, Research Metrics: Significance of Journal Impact Factor, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g index, i10 index.

Unit III

Non parametric tests- One sample tests- one sample sign test. Kolmogorov- Smirnov test, Run test for randomness, two sample tests- tow sample sign test, Mann-Whitney U test, K sample test- Kruskal Wallis test (H- test). Hypothesis testing – Testing of hypothesis concerning means (one mean and difference between two means – one tailed and two tailed tests), Concerning Variance – One tailed Chi square test, Analysis of Variance (anova). Introduction to Discriminant.

Unit IV

Introduction to philosophy: definition, nature and scope, concept, branches, Ethics: definition, moral philosophy, nature of moral judgments and reactions', Ethics with respect to science and research, Intellectual honest and research integrity, Scientific misconduct: falsification, fabrication, and plagiarism, Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

Publication ethics: definition, introduction and importance, Best practices/standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behavior and vice verse, types, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Learn about research methodology, statistical methods, research plan and implementation.
2. The knowledge will be utilized for improving the quality of research practice and education.

Practicals: Research methodology tools techniques, Research Publication and Ethics

1. Open access publishing and initiatives, SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies.
2. Software tool to identify predatory publications developed by SPPU, Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.,
3. Publication misconduct (Group Discussion): Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad.
4. Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools.
5. Databases: Indexing databases, Citation databases: Web of Science, Scopus, etc.
6. Research Metrics: Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g index, i10 index, altmetrics.

Recommended Books:

1. Ana smith Iltis," Research Ethics", Publisher: Routledge, ISBN: 0415701589, 2016 by HAN LUO - 2012 2. Dr.Tripathi, P.C, Research Methodology, 1st Edition, Prentice Hall Inc., 2009.
3. Garg, B.L.Karadia, R.Agarwal, &F.Agarwal, U.K 2002. An introduction to research methodology, RBSA Publishers
4. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project by FLICK, UWE. HAN LUO. Northwestern University.
5. Kothari, K.C. and Gaurav Garg Research Methodology: Methods and Techniques (Multi Colour Edition, 6. Mr.Suber Peter, Open Access (MIT Press Essential Knowledge series), New age international publishers, 2019
7. Oliver Paul, "The Student's guide to research ethics", McGraw-Hill Education (UK), Second edition 2010
8. The Ethics of Online Research (Advances in Research Ethics and Integrity Book) Kindle Edition by Kandy Woodfield (Editor), 2017.
9. William G.Zikmund, Business Research Methods, 7th Edition, Tata Mc Graw Hill, 2009.

BCH 306 Skill Oriented Course 6 (A): Clinical Biochemistry (Credits 3)

Course Objectives: The main objectives of this course are to:

1. Provide knowledge about carbohydrate, lipid and nucleic acid metabolic disorders.
2. Offer knowledge about hemoglobin metabolism and associated diseases.
3. Give knowledge about functional tests of organs and clinical diagnosis of diseases by enzymatic assays.
4. Give basic knowledge about free radicals and diseases.
5. Provide awareness about application of Artificial Intelligence in health and medicine.

Unit I

The place of clinical Biochemistry in medicine, the use of Biochemical tests and the clinical biochemistry laboratory, Specimen collection, reference values, Automation and autoanalyzers, quality assurance in clinical laboratory – internal and external quality control. Investigation of disorders of carbohydrate metabolism: Hypoglycemia, Hyperglycemia. Diabetes mellitus – classification, clinical and metabolic features and management. Laboratory diagnosis of diabetes mellitus – glucose tolerance test (GTT), Random, Fasting, post prandial (PP) blood glucose levels, glycosuria, ketones, glycosylated hemoglobin (GHb), metabolic complications of diabetes – Diabetic keto acidosis (DKA), glycogen storage diseases,

Plasma proteins – functions and their alterations in disease, paraproteinemias.

Unit II

Kidney function: Formation of urine, Normal and abnormal constituents of urine, Glomerular and tubular function, renal function tests, nephrotic syndrome and CRF.

Liver function: structure and function of liver, liver function tests, Bilirubin metabolism and Jaundice, kernicterus, liver diseases - hepatitis, gall stones, cirrhosis.

Gastric and pancreatic function: Gastric function tests - Penta gastrin test, insulin stimulation test, hyper chlorhydria, achlorhydria, pancreatic diseases – acute pancreatitis, Malabsorption syndrome.

Unit III

Fluid and electrolyte balance – hyponatremia and hypernatremia, hyperkalemia, acid-base balance in the body fluids - Blood buffers, role of kidney and lungs, metabolic acidosis and alkalosis.

Plasma Lipids and lipoproteins and their functions – lipid profile, clinical disorder of lipid metabolism - hyperlipidemias and management, Atherosclerosis. Molecular diagnosis – HIV, thalassemia, tumor markers. Cerebrospinal fluid analysis (CSF)

Unit IV

Plasma enzymes in diagnosis and prognosis: Transaminases (SGOT & SGPT), alkaline and acid phosphatase, lactate dehydrogenase (LDH), creatine kinase (CK), α-amylase, acid phosphatase, γ –glutamyl transferase, acetyl Cholinesterase, Isoenzymes of clinical importance, Plasma enzyme pattern in myocardial infarction, liver disease and muscle disease.

Inborn errors of amino acid metabolism - Phenylketonuria, alkaptonuria and Maple-Syrup urine disease. Hemoglobinopathies.

Recommended Books

1. Text book of Biochemistry with Clinical Correlations. Thomas M. Devlin (John Wily).
2. Harper's Review of Biochemistry, Murray *et al* (Longman) Investigation of lipoproteinemias and lipidemias. Renal function: Glomerular and tubular functions.
3. Biochemical Aspects of Human Disease – R.S. Elkeles and A.S. Tavil. (Blackwell Scientific Publications, 1993)
4. Clinical Chemistry in Diagnosis and Treatment – Joan F. Zilva and P.R. Pannall (Lloyd Luke medical Books, London, (1988).
5. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowen Lock (Heinemann Medical Books, London (1988)
6. Clinical diagnosis and management by Lab. Methods (John Bernard Henry, W.B Saunders Co, 1984)
7. Clinical Biochemistry – S. Ramakrishnan and Rajiswami.
8. Chemical Biochemistry (Metabolic and Clinical Aspects) by W.J. Marshall & S.K. Bangert.
9. Text book of Clinical Biochemistry by Tietz et al.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

Students will acquire insight into disorders of carbohydrates, lipids and nucleic acid (K2).

Students will learn about functional tests and enzymatic assays to diagnose the function of liver, kidney, thyroid, gastrointestinal and pancreas (K4).

Students will gain knowledge about disorders of nitrogen metabolism (K3).

Students will learn about the disorders of hemoglobin metabolism (K3).

Students will learn about the applications of Artificial Intelligence in health and medicine (K3).

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Practicals: Clinical Biochemistry (Credits 1)

1. Determination of SGOT.
2. Determination of SGPT.
3. Estimation of serum phosphate.
4. Estimation of serum bilirubin
5. Estimation of creatinine in serum
6. Determination of urine Protein
7. Tests for abnormal constituents in urine
8. Field visit–Hospital visits to learn the blood collection and processing.

BCH 306 Skill Oriented Course 6 (B): *In Silico* Drug Design and Discovery

Course Objectives: The main objectives of this course are to:

1. Provide basic principle of pharmacology and Molecular interactions with drugs
2. Theories of receptors and enzyme inhibition
3. Biotransformation of drugs

Unit I

Introduction to Pharmacology: Basic principles of pharmacology, including receptor mechanisms, drug distribution and metabolism, and pharmacokinetics. Interactions Inter- and intramolecular interactions. Weak interactions in drug molecules. Chirality and drug action. Covalent, ion-ion, ion-dipole, Hydrogen bonding, C-H hydrogen bonding, dihydrogen bonding, Van der Waals interactions and the associated energies.

Unit II

Receptorology Drug-receptor interactions, Receptor theories and drug action: Occupancy Theory, Rate Theory, Induced Fit Theory, Macromolecular perturbation theory, Activation-Aggregation theory. Topological and stereochemical consideration.

Unit III

Enzyme Inhibition Drug action through enzyme inhibition. Examples based on PDE4, GSK3, etc. Theories of enzyme inhibition and inactivation. Enzyme activation of drugs prodrugs.

Unit IV

Drug likeness Drug like molecules and theories associated with the recognition of drug like properties. Physical organic chemistry of Drug metabolism, drug deactivation and elimination.

Drug action after Metabolism: Phase I and Phase II transformations. Concept of hard and soft drugs. Chemistry of ADME and Toxicity properties of drugs.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Gain knowledge about principles of pharmacology and interaction of drug and receptor.
2. Develop skills relevant for the medical and pharmaceutical industries.

Practical: *In Silico* Drug Design and Discovery (Credits 1)

In silico prediction: signal peptide, transmembrane domains.

Recommended Books

1) The Organic Chemistry of Drug Design and Drug Action by R.B. Silverman
2) C.J. Coulson, Molecular Mechanism of Drug Action by C.J. Coulson
3) A primer of Drug Action by R.M. Julien
4) Drug-Receptor Thermodynamics by R.B. Raffa
5) Principles of Drug Action by W.B. Pratt, P. Taylor
6) Medicinal Chemistry How Drugs Act and Why by A. Gringauz
7) Principles of Molecular recognition by A.D. Buckingham
8) Quantitative molecular pharmacology and Informatics by M. Lutz
9) Physical Biochemistry by K.E.V. Holde
10) Free energy calculations in rational drug design by M. Rami Reddy.

BCH 308 OPEN ONLINE TRANS DISCIPLINARY COURSE – 2 (Or)

BCH 308 Open Elective: Endocrine Biochemistry (Offered to other Departments)

Course Objectives: The main objectives of this course are to:

1. This course presents an introduction and provides a comprehensive, balanced introduction to Endocrine glands, their secretions and functions.
2. To enable the students to learn or to know the biological, physiological activities along with the mechanism of action of various hormones.

Unit I

Endocrine system – organization of the endocrine system. General features and classification of hormones, mechanism of action of hormones, hypothalamic hormones, chemistry, biosynthesis, Secretion, physiological functions, regulation and disorders of anterior and posterior pituitary hormones, LH, FSH, Growth hormone, prolactin, oxytocin, Vasopressin. Hormones of the pineal gland – Serotonin and melatonin.

Unit II

Thyroid hormones – chemistry, biosynthesis, secretion, physiological function, regulation and disorders, hypo and hyperthyroidism, tests for thyroid function. Antithyroid drugs and calcitonin.

Parathyroid gland – Parathormone and disorders of Parathormone. Role of calcitonin in calcium and phosphate homeostasis in blood.

Unit III

Pancreatic and gastrointestinal hormones – Biosynthesis, secretion, physiological functions and regulation of insulin and glucagon. Role of insulin and glucagon in carbohydrate, lipid and protein metabolism. Disorders of pancreas gastrointestinal hormones-. Gastrin, secretin, Cholecystokinin.

Unit IV

Adrenal hormones – Chemistry, biosynthesis and functions of adrenal medullary and adrenal cortical hormones. Cortisol, corticosterone, aldosterone, adrenaline, nor-adrenaline, Disorders of adrenal hormones.

Hormones of reproduction – Gonadal hormones (testosterone), chemistry, biosynthesis and physiological functions of androgens, estrogens and progesterone, inhibin.

Hormonal regulation of menstrual cycle, placental hormones, contraception, reproductive disorders.

Recommended Books:

1. Text book of Biochemistry and Human Biology by Talwar G.P., Prentice Hall India.
2. Human Physiology and Mechanism of distance. Guyton 3rd Ed. Igkushoen/Seunders.
3. Clinical Biochemistry, Vol. 1 and 2, Williams *et al*., Heinemann Medical, 1978.
4. Lynchs Medical Laboratory Technology by Raphael, S. S., 4th Ed. Igkushoen/Seunders.
5. Text Book of Endocrinology, William.
6. General Endocrinology – Turner.
7. Biochemical Endocrinology of the Vertebrates – E. Fruden and H. Lines.
8. Metabolic and Endocrine Physiology – Jay Teppermann.
9. Metabolic Pathways – Green Berg.
10. Intermediary Metabolism and its regulation – Larner
11. Principles of Biochemistry – White A., Handler P and Smith.
12. Receptors and Hormone action. Receptors and Recognition series. Medical physiology by A.C. Guytom.

Expected Course Outcomes: On the successful completion of the course, student will be able to:

Obtain a deep knowledge regarding Endocrine glands and their secretions (K1 & K2).

Gives an idea about structure and functions of endocrine glands (K1 & K2)

Provides knowledge about Hormone and its regulation (K2, K3 & K4)

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

SEMESTER: IV

Open Online Skill Development Course's MOOCS / SWAYAM; Course No: **OOSDC/ BCH 401 SDC courses**

BCH 401 Core Course 4 (A): Plant Biochemistry (Credits-4)

Course Objectives:

1. To illustrates knowledge of structure and functions of plant cell and cell organelles
2. To understand the on plant hormones biosynthesis and physiological actions and
3. To learn Photosynthesis and types of Photosynthesis in biological systems.
4. To deliver molecular understanding of biosynthesis and functions of secondary metabolic process.
5. To present perspectives of the for plant stress responses in biotic and abiotic stress for research projects.

Unit I

Structure and functions of plant cell: cell Composition and functions of nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, Lysosomes, vacuoles and chloroplast. Isolation and characterization of sub-cellular organelles.

Plant hormones: Types of Plant Hormones and their Functions. Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

Unit II

Photosynthesis: Types of Photosynthesis, Photosynthetic, Light dependent reactions (Cyclic and non-cyclic electron flow); Calvin cycle (C3 plants), Hatch slack (C4 plants)

Unit III

Secondary metabolites: Introduction to primary and secondary plant metabolites. Classification of secondary metabolites. Biosynthesis of terpenes, phenols, nitrogenous compounds and their roles.

Functions of secondary metabolites

UNIT IV

Stress physiology**:** Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses. Stress and determined hormones ABA as a signaling molecule Cytokinin as a negative signal. Oxidative stress: Relative Oxygen Species (ROS), role of scavenging systems (SOD catalase etc.).

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Helps to understand about plant hormones synthesis, transport and physiological functions (K1 & K2).
2. Gives a clear understanding about the role of plant hormone on growth and abscission of plant growth with their mechanism of action at molecular level (K1 & K2).
3. Knowledge of plant respiration and its end products transport through cell membranes and pith (K2 & K3).
4. Helps to understand about the structure and functions of secondary metabolites (K2 & K3)
5. Gives an idea about of biotic and abiotic stress adaptations (K1, K2 & K3).

Recommended Books:

1) Biochemistry & Molecular Biology of Plants. Authors: Buchanan BB, Gruissem W and Jones RL (2000), American Society of Plant Physiologists.
2) Lehninger Principles of Biochemistry, Authors: David L. Nelson and Michael M.Cox.
3) Plant Physiology. Authors: Taiz L, and Zeizer E, (2006), Sinauer Associates, Inc. Biochemistry. Authors: Berg JM, Tymoczko, JL, and Stryer L (2006). W. H. Freeman.
4) Plant Pathology. Authors: Agrios GN 5 ed; 2005, Elsevier Academic Press.

BCH 401: Core Course 4 (B): Applied Biochemistry

Course Objectives:

1. Providing students with a strong foundation in the principles and application of fermentation technology.
2. Providing an importance of enzyme technology in medicine and industries.
3. Give the knowledge about immunotechnology in biochemical research, clinical diagnosis and treatment.
4. To understand the concept of plant and animal cell culture.

Unit I

Fermentation Technology: Batch, continuous culture techniques, principle types of fermentors. Industrial production of chemicals- alcohol, acids (Lactic and Acetic acids), solvents (acetone and butanol), antibiotics (penicillin and streptomycin), Vitamins (Riboflavin and Vitamin B12), amino acids (Lysine and glutamic acid), Single Cell Protein (SCP) and Biopesticides (Toxins of *Bacillus thuringenesis*).

Unit II

Enzyme Technology: Immobilization of enzymes and cells, different methods. Industrial applications (Production of glucose from starch, Use of glucose isomerase in confectionary industry, Use of lactase in Dairy Industry, Production of invert sugar from sucrose, Use of protease in food, detergent and leather Industries, Medical applications of enzymes). Low calorie sweeteners.

Unit III

Immuno Technology: Hybridoma technique, monoclonal antibodies production, myeloma cell lines, fusion of myeloma cells, selection of hybridomas, protoplast fusion and HAT medium. Screening, purification and application (biochemical research, clinical diagnosis and treatment) of monoclonal antibodies.

Subunit vaccines-against Herpes Simplex virus. Foot and Mouth disease, Live recombinant vaccines attenuated (Cholera, Salmonella), Vector vaccines directed against viruses and bacteria.

Unit IV

Plant and animal cell culture: Micro propagation, Somatic cell culture, Somaclonal variations, Somatic cell hybridization, Protoplast fusion, genetic transformation, methods of gene transfer (vector and vector less methods).

Production of transgenic plants, animals and their applications. Plant tissue culture clonal propagation and transgenic plants as bioreactors. Outlines of Bioremediation and its importance. Development of mapping population in plants.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Knows the importance of fermentation technology.
2. Understands the application of enzymes and immobilized enzymes in medicine and industries.
3. Gains the knowledge about hybridoma technology and subunit vaccines against bacteria and viruses.
4. Knows the applications of various gene transfer methods of both plant and animals.

Recommended Books:

1. Fermentation Technology (2nd ed.) Standury (Pergman press)
2. Biotechnology: Textbook of Industrial microbiology 2nd Edit. By Crueger and Crueger (2000).
3. Principles of Gene manipulation: An Introduction to genetic Engineering (5th). R.V.Old and S.B.Primrose.
4. Concepts in Biotechnology (1996) Ed., D.Balasubramaian, K.Dharmalingam, J.Green, K.Jayaraman (Univ. Press).
5. Industrial Microbiology, L.E.Casida, JR. New Age International (1995).
6. Industrial Microbiology (Prescott & Dunn), Ed by G.Reed, CBS Publishers.
7. Immobilized enzymes (1978) by Ichiro Chibata, Halsted Press Book.

BCH 401: Core Course 4(C): C: LIFE STYLE DISORDERS AND THERAPAUTICS

Course Objectives:

1. Students able to understand the concept of life style diseases and their prevention.
2. Provide the knowledge about types, diagnosis and prevention of Diabetes.
3. To give the importance in management of cardiovascular diseases.
4. To gain the knowledge about cancer and their treatment.

UNIT I

Definition of health, outlines of life style disorders- Diabetes, Obesity, Hypertension, Cardiovascular diseases and Cancer. Causes - Sedentary life style, smoking, alcohol and Impact of junk foods. Importance of lifestyle factors -Diet, exercise, role of antioxidants, fibre foods and PUFAs.

UNIT II

Diabetes**:** causes, types and Symptoms (Polyuria, Polydypsia, Polyphagia). Diagnosis**:** Fasting blood sugar, GTT, Post prandial blood sugar, random blood sugar and lipid Profiles. Prevention, management and treatment using synthetic and natural therapeutics.

UNIT III

Arteriosclerosis and cardiovascular diseases like Angina, Myocardial infarction and congenital heart failure. Diagnosis, prevention, management and treatment using synthetic and natural therapeutics

UNIT IV

Cancer types (benign and malignant). Certain cancers like Colo-rectal, lung, prostate and breast. Causes and Risk factors like tobacco, alcohol abuse, lack of physical activity and unhealthy food habits. Diagnosis using blood tests, X-rays, CT scan, Endoscopy and PAP smear test. Prevention, management and treatment modalities like Chemotherapy, radiation and Surgery.

Expected Course Outcomes: On the successful completion of the course, students will be able to:

1. Maintenance of health by adapting good life style.
2. Know the causes, diagnosis, prevention and management of diabetes.
3. Know the knowledge about different types of cancer and their prevention and treatment.
4. Gives an idea about importance of factors and importance in management of Cardio vascular diseases.

Books Suggested: Human Diseases by Neighbors and Tannehill Jones

1. Lifestyle Diseases by Gattani and Kshirsagar
2. Lifestyle Diseases and Ayurvedic Herbal Drugs by K. Nishteswar
3. Lifestyle Diseases; Lifestyle Disease Management by Cliff Nyambichu
4. Lifestyle Medicines by Mechanick and Kusher
5. Textbook of Lifestyle Medicine- Labros Sidossis and Stefanos Kales,
6. Food Facts and Principles, Shakuntala Manay N., 2005, New Age International Publishers, New Delhi
7. Food Science, Norman Potter N. 2007, CBS Publishers and Distributors, New Delhi.

M.Sc. Biochemistry Project: Multi-Disciplinary Project Course No.: BCH PW402.
Project work under the supervision of respective faculty.
Dissertation – Thesis Submission, Project Evaluation and Viva-voce
Project work carries 300 Marks (Dissertation -200, Seminar- 50 marks, Viva voice – 50 marks).
*Conducting classes for competitive exams, communication skills, UGC/ CSIR/ NET/ SLET examinations.

S.V.U .College of Sciences, M.Sc Biochemistry:
Model Question paper; Semester- III
CORE BCH 301 and BCH OE 308 Papers

Time 3 Hrs **Max marks 70**

PART A (5 X 4 = 20 marks) Answer any Five (05) of the following questions?

1. Unit 1
2. Unit 1
3. Unit 2
4. Unit 2
5. Unit 3
6. Unit 3
7. Unit 4
8. Unit 4

PART B (4 X 12.5 = 50 marks) Answer any ALL of the following questions?

9. Unit 1 A or B
10. Unit 2 A or B
11. Unit 3 A or B
12. Unit 4 A or B

S.V.U .College of Sciences, M.Sc Biochemistry:
Model Question paper; Semester- III
CORE BCH CC 302, BCH CC 303, BCH SOC 305 and BCH SOC 306 Papers

Time 2 Hrs **Max marks: 50**

PART A (5 X 4 = 20 marks) Answer any Five (05) of the following questions?

1. Unit 1
2. Unit 1
3. Unit 2
4. Unit 2
5. Unit 3
6. Unit 3
7. Unit 4
8. Unit 4

PART B (4 X 10 = 40 marks) Answer any ALL of the following questions?

9. Unit 1 A or B
10. Unit 2 A or B
11. Unit 3 A or B
12. Unit 4 A or B

S.V.U. College of Sciences, M.Sc Biochemistry:
Model Question paper; Semester- IV
CORE BCH 401 paper

Time 3 Hrs **Max marks 70**

PART A (5 X 4 = 20 marks) Answer any Five (05) of the following questions?

1. Unit 1
2. Unit 1
3. Unit 2
4. Unit 2
5. Unit 3
6. Unit 3
7. Unit 4
8. Unit 4

PART B (4 X 12.5 = 50 marks) Answer any ALL of the following questions?

9. Unit 1 A or B

10. Unit 2 A or B
11. Unit 3 A or B
12. Unit 4 A or B

SRI VENKATESWARA UNIVERSITY
S.V.U. College of Sciences
TIRUPATI-517 502, (A.P.), INDIA

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Dt: 25-08-2025

To
The Registrar
Sri Venkateswara University,
Tirupati – 517 502

Respected Sir

Sub: M. Sc. Biochemistry Programme- Meeting of the Board of Studies (combined) - Submission of Syllabus, Model Question Papers and Reference Books of Re-Structured M.Sc. Biochemistry Programme in consonance with NEP – 2020, as per the levels prescribed by NHEQF - Reg.

Ref: 1. No.CII(A&F)–Restructuring/P.G./Arts/Sciences/Commerce/2024 Dated: 14-08-2024.
2. No.CII(A&F)–/3rd&4th sem. Amed/2025 Dated: 25-07-2025

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I am to inform you that Minutes of the meeting of Board of Studies in Biochemistry (combined) held on 11-08-2025 at3.30 P.M. The resolutions of the meeting are enclosed for your kind reference and record. Therefore, I request you to kindly accord necessary approval for implementation of the syllabi for the M.Sc. Biochemistry Branch II (A) Programme from the academic year 2024-25.

Further, the Syllabi, Reference Books, Scheme of Examinations, Eligibility and Credit Requirement for admission in M.Sc. Biochemistry Branch II (A) Multiple Entry and Exit Options duly recommended by the Board of Studies in Biochemistry (combined) are enclosed here with, for your kind reference and record. The receipt of this letter together with its enclosures may kindly be acknowledged.

Yours faithfully

Chairman BOS

SRI VENKATESWARA UNIVERSITY
Department of Biochemistry
Tirupati-517 502, Andhra Pradesh, India

Minutes of the meeting of Board of Studies in Biochemistry (combined) held on 11-08-2025 at3.30 P.M.

MEMBERS PRESENT

S. No.	Name of the Faculty, Department, College	Chairman/ Members	SIGNATURE
1	Prof. Vijaya Sarathi Reddy Dept. of Biochemistry SVU College of Sciences, Tirupati Mobile: 9440046293 Email: ovsreddy@gmail.com	Chairman	
2	The Head Dept. of Biochemistry SVU College of Sciences, Tirupati	Ex-Officio Member	
3	Prof. M.Balaji Department of Biochemistry SVU College of Sciences, Tirupati Mobile: 9849086856 Email: balaji.meriga@gmail.com	Member	
4	Dr. Y. Sireesha, Dept. of Biochemistry S.P.W Degree & P.G. College, Tirupati Mobile: 9246997116 Email: drsireeshay@gmail.com	Member	
5	Prof. Rayala Suresh Kumar, Department of Biotechnology, Indian Institute of Technology Madras (IITM), Chennai - 600 036, Mobile: 9840885870 Email: sureshkumarrayala@gmail.com	External Member	
6	Prof.Chandrakant S. Karigar Dept. of Biochemistry Bangalore University, Bangalore Mobile: 9480617964 Email: cskarigar@gmail.com	External Member	