Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES & COMMERCE
Sainikpuri, Secunderabad – 500094
Reaccredited with 'A' grade by NAAC
Autonomous College - Affiliated to Osmania University

Department of Biochemistry & Nutrition

Template for B. Sc BIOCHEMISTRY under CBCS
PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)
Academic year 2025-26

FIRST YEAR – SEMESTER-I				
Course Code	**Course title**	**Course Type**	**HPW**	**CREDITS**
	Environmental Science/Computer Skills	AECC-1	2	2
	English	CC-1A	4	4
	Second Language	CC-2A	4	4
BC134/ BC134 P	**Chemistry of Biomolecules**	**DSC-1A**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2A	4T+2P=6	4+1=5
	Optional 3	DSC-3A	4T+2P=6	4+1=5
	TOTAL		**28**	**25**
SEMESTER-II				
	Environmental Science/Computer Skills	AECC-2	2	2
	English	CC-1B	4	4
	Second Language	CC-2B	4	4
BC234/ BC234 P	**Chemistry of Proteins, Nucleic acids and Bioenergetics**	**DSC-1B**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2B	4T+2P=6	4+1=5
	Optional 3	DSC-3B	4T+2P=6	4+1=5
	TOTAL		**28**	**25**
SECOND YEAR –SEMESTER-III				
	English	CC-1C	3	3
	Second Language	CC-2C	3	3
BC334/ BC334 P	**Enzymology and Metabolism of Carbohydrates and Lipids**	**DSC-1C**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2C	4T+2P=6	4+1=5
	Optional 3	DSC-3C	4T+2P=6	4+1=5
	Communicative Skills	**SEC 1**	**2**	**2**
SE334	**Basics in Biochemical calculations and Biostatistics**	**SEC 2**	**2**	**2**
	TOTAL		**28**	**25**

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SEMESTER-IV				
	English	CC-1D	3	3
	Second Language	CC-2D	3	3
BC434/ BC434 P	**Biochemical techniques and Metabolism of Amino acids and Nucleotides**	**DSC-1D**	**4T+2P=6**	**4+1=5**
	Optional 2	DSC-2D	4T+2P=6	4+1=5
	Optional 3	DSC-3D	4T+2P=6	4+1=5
	Universal Human Values	**SEC-3**	**2**	**2**
SE434	**Clinical Laboratory Diagnostics**	**SEC-4**	**2**	**2**
	TOTAL		**28**	**25**
THIRD YEAR –SEMESTER-V				
	English	CC-1E	3	3
	Second Language	CC-2E	3	3
BC534/ BC534 P **BC534A/ BC534A P**	**A. Physiologyand Clinical Biochemistry** **(or)** **B. Microbiology, Genetics and rDNA technology**	**DSE-1E**	**4T+2P=6**	**4+1=5**
	Optional 2	DSE-2E	4T+2P=6	4+1=5
	Optional 3	DSE-3E	4T+2P=6	4+1=5
GE534	**Biochemistry and Physiology**	**GE**	**4T**	**4**
	TOTAL		**28**	**25**
SEMESTER-VI				
	English	CC-1F	3	3
	Second Language	CC-2F	3	3
BC634/ BC634 P **BC634A/ BC634A P**	**A. Molecular Biology and Immunology** **(or)** **B. Cell Biology and Biotechnology**	**DSE-1F**	**4T+2P=6**	**4+1=5**
	Optional 2	DSE-2F	4T+2P=6	4+1=5
	Optional 3	DSE-3F	4T+2P=6	4+1=5
BC634_O BC634_PW	**Optional Paper Theory – Biochemistry in health and Disease / Project Work**		**4**	**4**
	TOTAL		**28**	**25**
	TOTAL CREDITS			**150**

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(Academic year 2025-26)

PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: PHYSIOLOGYAND CLINICAL BIOCHEMISTRY

PAPER CODE: BC534 **PPW: 4**
YEAR/SEMESTER: III/V **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To familiarize the students with various endocrine glands and their secretions and to understand significance of clinical biochemistry in health and disease.

UNIT-WISE COURSE OBJECTIVES:

COb1 To understand the traditional practices of health and to explain the physiology of heart beat, muscle contraction, nervous system and vision.
COb2 To discuss the organization and functions of the endocrine system.
COb3 To discuss the relationship of clinical biochemistry in health and disease.
COb4 To explain the structure of organs and their function tests.

Unit I: -Traditional Indian systems of Health & Human Physiology **15hrs**

Folk and classical streams of medical knowledge in India, folk and tribal medicine, home remedies and primary health care. 2 hrs
āyurveda: Scope and variety of treatments in āyurveda. Eight clinical specialities of āyurveda.
Siddha: Pulse diagnosis, Varma treatment, Herbo-mineral formulations, concept of health and disease, preventive medicine. 1hr
Yoga: Health benefits of Āsanas, Prānāyāma and Meditation. Application of yoga as therapy in the modern world. 1hr
Digestion and absorption of carbohydrates, lipids and proteins. 2hrs
Hemoglobin and transport of gases in blood (oxygen and CO_2). 1hr
Heart - structure of the heart, cardiac cycle, cardiac factors controlling blood pressure. 2hrs
Physiology of vision – pigments and visual cycle. 1hr
Muscle - kinds of muscles, structure of myofibril, organization of contractile proteins and mechanism of muscle contraction. 3 hrs
Nervous system - structure of neuron, resting potential, action potential, propagation of nerve impulse, synapse, synaptic transmission, excitatory and inhibitory neurotransmitters. 2 hrs

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Unit II: - Endocrinology **15 hrs**

Organization of endocrine system. Classification of hormones. 2hrs
Mechanism of hormonal action - signal transduction pathways for adrenaline, glucocorticoids and insulin. 2hrs
Outlines of chemistry, physiological role and disorders of pituitary and hypothalamic hormones. 3hrs
Outlines of chemistry, physiological role and disorders of pancreatic hormones. 2hrs
Outlines of chemistry, physiological role and disorders of thyroid and parathyroid hormones. 2hrs
Outlines of chemistry, physiological role and disorders of hormones of gonads and placenta. 1hr
Outlines of chemistry, physiological role and disorders of adrenal hormones. 2hrs
Introduction of gastrointestinal hormones. 1hr

Unit III: - Clinical Biochemistry **15hrs**

Plasma proteins in health and disease. 3hrs
Composition of blood and coagulation of blood. 3hrs
Disorders of blood coagulation (haemophilia). Types of anaemias, Haemoglobinopathies-sickle cell anaemia and thalassemia. 3hrs
Disorders of carbohydrate metabolism - hypoglycaemia, hyperglycaemia, glycosuria, renal threshold value. Diabetes mellitus - classification, glucose tolerance test (GTT), diabetic ketoacidosis. 3hrs
Disorders of lipid metabolism- plasma lipoproteins, lipoproteinemia, fatty liver hypercholesterolemia, atherosclerosis. 3hrs

Unit IV: Organs and Functional tests **15hrs**

Structure and functions of the liver. Liver diseases - jaundice, hepatitis, cirrhosis. 2hrs
Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, hippuric acid and bromosulphthalein tests. Serum enzymes in liver diseases- SGPT, GGT and alkaline phosphatase. 2hrs
Kidneys - structure of nephron, urine formation, normal and abnormal constituents of urine. 2hrs
Biological buffers. Role of kidneys in maintaining acid-base and electrolyte balance in the body. 2hrs
Renal function tests - creatinine and urea clearance tests, phenol red test. 1hr
Biochemical tests for the diagnosis of heart diseases - HDL/LDL cholesterol, SGOT, LDH, CK, C-reactive protein, cardiac troponins. 2hrs
Brain function tests- EEG 2hrs
GI tract test-Endoscopy 2hrs

REFERENCES:

1. Textbook of Biochemistry and Human Biology- Talwar, G.P. and Srivastava. L.M., Printice Hall of India.
2. Human Physiology- Chatterjee. C.C, Medical Allied Agency.
3. Textbook of Medical Physiology – Guyton. A.G and Hall. J.E., Saunders.
4. William's Textbook of Endocrinology- Larsen, R.P. Korenberg, H. N. Melmed, S, and Polensky, K.S. Saunders.
5. Mammalian Biochemistry – White, A. Handler, P. and Smith, E. L. McGraw – Hill.
6. Tietz Fundamentals of Clinical Chemistry- Burtis, A. A and Ashwood, E.R. Saunders- Imprint Elsevier Pub.
7. Textbook of Biochemistry with Clinical Correlations- Devlin. T.M., Wiley- Liss.

8. Mahadevan, B, Bhat Vinayak Rajat, Nagendra Pavana R. N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private LTD, Delhi.
9. Dharampal, *Indian Science and Technology in the Eighteenth Century*: *Some Contemporary European Accounts,* Dharampal Classics Series, Rashtrotthana Sahitya, Bengaluru, 2021.
10. M. D. Srinivas, The methodology of Indian sciences as expounded in the disciplines of *Nyāya*, *Vyākarana*, *Ganita* and *Jyotisa*, in K. Gopinath and Shailaja D. Sharma (eds.), *The Computation Meme*: *Explorations in Indic Computational Thinking,* Indian Institute of Science, Bengaluru, 2022 (in press).
11. Bag, A. K (1997). History of Technology in India, Vol I, Indian National Science Academy, New Delhi.S

COURSE OUTCOMES:

At the end of the course students will be able to:

BC534.CO1 Implement traditional methods for a healthy life and well-being and relate physiology of heart beat, muscle contraction, nervous system and vision.
BC534.CO2 Compare the secretion and functions of various endocrine glands
BC534.CO3 Correlate the relationship of clinical biochemistry in health and disease.
BC534.CO4 To relate the structure of organs and the associated function tests.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: PHYSIOLOGYAND CLINICAL BIOCHEMISTRY

PAPER CODE: BC534P **PPW: 2**
YEAR/SEMESTER: III/V **NO.OF CREDITS: 1**

COURSE OBJECTIVES

COb1 To learn and practice yoga.
COb2 To analyze various biochemical parameters in blood and urine samples.

1. Practical session on Yoga- Asanas and pranayama
2. Estimation of hemoglobin in blood.Total count - RBC and WBC. Differential count.
3. Urine analysis for abnormal constituents like albumin, sugars and ketone bodies.
4. Estimation of urinary creatinine.
5. Estimation of blood urea.
6. Estimation of serum total cholesterol.
7. Estimation of SGOT, SGPT
8. Determination of glycosylated hemoglobin.
9. Determination of blood glucose by POD/ GOD method.
10. Determination of serum lipid profile.

REFERENCES:

1. Practical Clinical Biochemistry- Varley, H. CBS Publishers.
2. Practical Clinical Biochemistry- Methods and Interpretations- Ranjna Chawla- Jaypee.
3. ManipalManual of Clinical Biochemistry-Shivande Naik, B- Jaypee Brother medical Publications, New Delhi.
4. Laboratory manual in practical biochemistry- T. N Pattabhiraman
5. Lab manual in Biochemistry, Immunology and Biotechnology-Arti Nigam and Archana Ayyagari- Tata McGraw – Hill New Delhi.
6. Experimental Biochemistry: A Student Companion- Sashidhar Rao, B and Deshpande, V. IK International (P) LTD Pub.

COURSE OUTCOMES:

At the end of the course students will be able to:
BC534P.CO1 implement the knowledge of yoga in daily life.

BC534P.CO2 distinguish the different types of biological samples used and tests done for various biochemical investigations.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: MICROBIOLOGY, GENETICS AND rDNA TECHNOLOGY

PAPER CODE: BC534A **PPW: 4**
YEAR/SEMESTER: III/V **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To discuss the characteristic features of bacteria and viruses, to make understand basics of Mendelian and non-Mendelian inheritance and tools, techniques and applications of rDNA technology.

UNIT-WISE COURSE OBJECTIVES:

CObl To describe the isolation, cultivation and identification of bacteria and viruses.
COb2 To discuss the concepts of Mendelian, Non-Mendelian inheritance.
COb3 To explain the tools and techniques in rDNA technology.
COb4 To discuss the principle of PCR, blotting methods and applications of rDNA technology.

Unit I: - Microbiology	**15 hrs**
Classification of microorganisms - prokaryotic and eukaryotic microorganisms.	1hr
Isolation and cultivation of bacteria. Selective and enriched media.	2hrs
Bacterial growth curve and kinetics of growth.	1hr
Batch, continuous and synchronous cultures.	2hrs
Gram's staining: Gram positive & Gram-negative bacteria, motility & sporulation.	2hrs
Structure and composition of viruses.	1hr
Isolation and cultivation of bacterial plaques.	2hrs
Lytic and lysogenic life cycle of λ phage.	2hrs
Life cycle of TMV and Retro virus (HIV).	2hrs

Unit II: - Genetics	**15 hrs**
Basic concepts of Mendelian inheritance (Mendel's work, Monohybrid & Dihybrid cross)	2hrs
Non-Mendelian inheritance: Extra chromosomal inheritance (paramecium).	2hr
Maternal inheritance (Coiling in snails).	1hr
Importance of meiosis in heredity.	1hr
Sex linked inheritance. X-linked recessive inheritance (color blindness).	2hrs
Polygenic inheritance (Introduction to quantitative traits).	2hr
Mutations: spontaneous/induced, forward/reverse, transition/transversion, Silent, missense, nonsense& Frame shift mutations.	3hrs
Mutagens- physical and chemical.	2hr

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Unit III: - Recombinant DNA technology-I **15hrs**

Outlines of cloning strategies. 1hr

DNA sequencing- Maxam Gilbert and Sanger's methods. 3hrs

Tools of r-DNA technology: Enzymes- Restriction endonucleases, ligase, phosphatases, reverse transcriptase, polynucleotide kinases, terminal transferase nucleases-S1 and RNase H. 3hrs

Restriction mapping. 1hr

Cloning vectors - Plasmids, Ti plasmids, Cosmids, λ phages, shuttle & expression vectors.3hrs

Host- *E. coli*, *Saccharomycescerevisiae*, *Agrobacterium tumifaciens*. 2hrs

Construction of cDNA and genomic libraries. 2hrs

Unit IV: -Recombinant DNA technology-II **15 hrs**

Isolation and sequencing of cloned genes - colony hybridization, nucleic acid hybridization.2hrs

Hybrid released translation (HRT) and hybrid arrested and released translation (HART) using reporter genes [β- galactosidase, green fluorescent proteins (GFP). 3hrs

Polymerase chain reaction- Principle and applications. 2hr

Outlines of blotting techniques-Southern, Northern and Western. 2hrs

Applications of gene cloning- production of insulin and human growth hormone. 2hr

Production of Bt cotton and edible vaccines. 2hrs

Introduction to Bioinformatics- definitions of proteomics and genomics. Gene bank, NCBI, DDBJ, Swissprot, PDB. Sequence alignments- BLAST and FASTA. 2hrs

REFERENCES:

1. Microbiology- Prescott., Harley P & Klein. D. A, McGraw –Hill.
2. Microbiology- Pelczar Jr., M.J., Chan. E and Krieg. N. R, Tata McGraw-Hill.
3. Principles of Gene Manipulation- An Introduction to GE- Old, R.V. and Primrose, S. B. Blackwell Sci Pub.
4. Instant Notes –Bioinformatics-West head *et al,* ViVa Books (P) Ltd.
5. Introduction to Bioinformatics- Attwood T.K and Parry-Smith, D. J. Pearson Education.
6. Principles of Genetics- Snustad and Simmons.
7. Principles of Genetics- Anthony J.F. Griffiths, Jefferey H. Miller, David. T. Suzuki, Richard L. Lewontin, William. M. Gelbart. W.H. Freeman.
8. Concepts of Genetics- William S. Klug and Michael R. Cummings.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC534A.CO1 Apply suitable methods in cultivation, identification and characterization of microorganisms.

BC534A.CO2 Relate the significance of heredity and variation and link with genetic diseases.

BC534A.CO3 Apply the basic knowledge of tools and techniques in gene cloning experiments.

BC534A.CO4 Implement the various rDNA methods in production of biotechnological products.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: MICROBIOLOGY, GENETICS AND rDNA TECHNOLOGY

PAPER CODE: BC534AP **PPW: 2**
YEAR/SEMESTER: III/V **NO.OF CREDITS: 1**

COURSE OBJECTIVES

COb1 Tooutline the methods of sterilization, isolation, growth curve and morphology of bacterial cultures.
COb2 To explain the inheritance of traits using monohybrid and dihybrid crosses, proteins sequence alignment.

1. Preparation of culture media and sterilization methods.
2. Isolation of pure cultures: (i) Streak plate method. (ii) Serial dilution method
3. Gram staining.
4. Motility of bacteria by hanging drop method.
5. Bacterial growth curve.
6. Problems in monohybrid crosses.
7. Problems in dihybrid crosses.
8. Sequence alignments of insulin/BSA with other proteins using BLAST and FASTA.
9. Restriction Digestion- λ DNA with any two restriction enzymes.

REFERENCES:
1. Biotechnology: A Laboratory Project in Molecular Biology- Thiel, Bissen and Lyons. Tata McGraw- Hill.
2. Methods in Biotechnology-Hans-Peter Schmauder. Taylor & Francis.
3. Laboratory Experiments in Microbiology- Gopal Reddy, M. Reddy, M.N. Sai Gopal D. V.R and Mallaiah, K.V.
4. Practical Microbiology- Dubey, R.C and Maheshwari D.K.S Chand & Co.

COURSE OUTCOMES:
At the end of the course students will be able to:
BC534AP.CO1 isolate, categorize and identify specific bacteria by using appropriate bacterial culturing methods.
BC534AP.CO2 apply the knowledge of Mendel's laws to understand inheritance patterns,able to use BLAST and FASTA for protein sequence comparison in projects and research.

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COURSE NAME: BIOCHEMISTRY AND PHYSIOLOGY

PAPER CODE: GE534 **PPW: 4**
YEAR/SEMESTER: III/V **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To familiarize students with various biomolecules, their metabolism and to understand physiology and significance of endocrine hormones.

UNIT-WISE COURSE OBJECTIVES:

COb1 To identify and learn various biomolecules.
COb2 To explain the significance of metabolism of biomolecules.
COb3 To explain the physiology of heart beat, muscle contraction, nervous system and vision.
COb4 To discuss the organization and functions of the endocrine system.

Unit-I: Biomolecules **15hrs**

Water properties, pH and buffers.	2hrs
Carbohydrates-classification (mono, di, oligo and poly), properties and importance.	2hrs
Amino acids-classification, properties and importance. Structure of proteins.	2hrs
Lipids- classification, properties and importance.	2hrs
Nucleic acids-purines, pyrimidines, nucleosides, nucleotides. Structure and types of DNA and RNA and denaturation.	3hrs
Enzymes- classification, factors affecting enzyme activity, clinically important enzymes (SGOT, SGPT, LDH and CPK).	2hrs
Vitamins (fat soluble and water soluble) and Trace elements.	2hrs

Unit II: - Metabolism **15hrs**

Inborn errors of amino acid metabolism.	1hr
Carbohydrate metabolism- glycolysis and TCA cycle.	2hrs
Gluconeogenesis and glycogen metabolism.	3hrs
Lipid metabolism-β-oxidation of fatty acids.	2hrs
Role of ketone bodies in health and disease.	2hrs
Disorders associated with nucleic acid metabolism.	1hr
Liver function tests (Bilirubin, GGT, SGPT)	1hr
Kidney function test (Serum Creatinine, Urea)	1hr

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Obesity, hypertension and diabetes mellitus. 2hrs

Unit III: -Physiology **15hrs**

Physiology of digestion. 2hrs
Physiology of vision. 2hrs
Physiology of muscle. 3hrs
Physiology of nerve and mechanism of nerve impulse transmission. 2hrs
Composition of blood and blood coagulation. 2hrs
Structure of heart and cardiac cycle. 2hrs
Factors controlling blood pressure. 2hrs

Unit IV: -Endocrinology **15hrs**

Introduction to endocrinology and organization of endocrine system. 2hrs
Hormones of hypothalamus. 2hrs
Hormones of pituitary. 3hrs
Hormones of thyroid and clinical relevance. 2hrs
Hormones of pancreas and clinical relevance. 2hrs
Hormones of adrenal gland. 2hrs
Hormones of gonads. 2hrs

REFERENCES:

1. Lehninger, Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W.H. Freeman
2. Biochemistry, 4th Edition- Donald Voet, Judith G. Voet. - Publisher John Wiley & Sons.
3. Principles of Biochemistry: General Aspects- Smith, E. L., Hill, R.L. Lehman, I.R. Lefkowitz, R. J. Handler, P., and White, A. McGraw- Hill.
4. Textbook of Biochemistry and Human Biology- Talwar, G.P. and Srivastava. L.M., Printice Hall of India.

COURSE OUTCOMES:

At the end of the course students will be able to:

GE534.CO1 Differentiate the various biomolecules with respect to structure and function.
GE534.CO2 Correlate the metabolism of biomolecules and disorders associated with them.
GE534.CO3 Relate physiology of heart beat, muscle contraction, nervous system and vision.
GE534.CO4 Compare the secretion and functions of various endocrine glands

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PROGRAM NAME:BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: MOLECULAR BIOLOGY AND IMMUNOLOGY

PAPER CODE: BC634 **PPW: 4**
YEAR/SEMESTER: III/VI **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To describe various events involved in replication, transcription, translation and regulation of gene expression and to familiarize the students with the significance of immune system and immunodiagnostics.

UNIT-WISE COURSE OBJECTIVES:
COb1 To discuss the mechanism of DNA replication in prokaryotes.
COb2 To understand the process of transcription, translation and regulation of gene expression.
COb3 To discuss the components of the immune system and its functions.
COb4 To explain the methods of immunodiagnostics and understand about vaccines.

Unit l: - DNA Replication	**15hrs**
Organization of genome in prokaryotes and eukaryotes.	2hrs
Nature and structure of the gene.	1hr
DNA replication- models of replication, Meselson-Stahl's experimental proof for semi-conservative model.	2hrs
Replication in Prokaryotes- DNA polymerases I, II and III of *E coli*.	2hrs
Helicase, topoisomerases, primase, ligase.	2hrs
Bidirectional replication model, Okazaki fragments.	1hr
Leading and lagging strand of DNA synthesis.	2hrs
Replication in Eukaryotes.	2hrs
Inhibitors of DNA replication.	1hr

Unit II: -Transcription and Translation	**15 hrs**
Transcription- RNA synthesis, RNA polymerases of prokaryotes and Eukaryotes.	2hrs
Promoters, Initiation, Elongation, Termination - rho dependent and rho independent.	2hrs
Transcriptional events in eukaryotic m-RNA synthesis.	1hr
Post-transcriptional modifications of eukaryotic m-RNA. Inhibitors of RNA synthesis	2hrs
Genetic code. Deciphering of genetic code. Nirenberg's and Khorana's experiments.	2hrs
Wobble hypothesis, degeneracy of genetic code.	1hr
Protein synthesis- Activation of amino acids (aminoacyl t-RNA synthetases). Ribosome structure.	1hr
Initiation, elongation and termination of protein synthesis. Post- translational modifications and Inhibitors of protein synthesis.	2hrs

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Regulation of prokaryotic gene expression- Induction and repression. Lac operon. 2hrs

Unit III:- Immunology **15hrs**

Organization of immune system 1hr
Organs and cells of immune system. 1hr
Innate and acquired immunity. 2hrs
Cell mediated & humoral immunity 1hr
Activation of T& B - cells. 2hrs
Classification and structure of immunoglobulins. Structure of IgG. 2hrs
Epitopes / antigenic determinants. Concept of haptens. Adjuvants. 2hrs
Theories of antibody formation- clonal selection theory. 2hrs
Monoclonal antibodies and their applications. 2hrs

Unit IV: -Immunotechnology **15hrs**

Antigen-antibody reactions -Introduction, Agglutination, immunoprecipitation, immunodiffusion. 3hrs
Blood group antigens. 1hr
Immunodiagnostics-RIA, ELISA. 2hr
Vaccines and their classification. 1hr
Traditional vaccines-live and attenuated, toxoids. 1hr
Modern vaccines - recombinant and peptide vaccine. 1hr
Outlines of hypersensitivity reactions 2hrs
Autoimmune diseases. 1hr
Fundamentals of graft rejection and MHC proteins. 3hrs

REFERENCES:

1. Molecular biology- Freifelder. D. Naroasa Pub. House.
2. Genes VIII- Lewin. B, Oxford University Press.
3. Molecular Cell Biology- Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A., Krieger, M. Scott M.P., Zipursky, S.L. and Sarnell, Freeman & Co.
4. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox Publisher: W.H. Freeman
5. Molecular Biology of Cell- Alberts, B. Bray, D. Lewis, J. Raff, M. Roberts, K and Watson, J. D. Garland Publishing.
6. Biochemistry, 4th Edition- Donald Voet, Judith G. Voet. - Publisher John Wiley & Sons.
7. Immunology- Tizard, I. R. Thomson Press.
8. Kuby Immunology- Kindt. T.J., Goldsby. R.A and Osborne. B.A., Freeman & Co.
9. Roitt's Essential Immunology- Roitt. I.M and Delves. P. J., Blackwell Science.
10. Immune System- Parham., Garland Publishing.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC634.CO1 Relate the importance of proteins involved in replication in maintaining its fidelity.
BC634.CO2 Correlate the significance of genetic material to the synthesis of normal proteins and also appreciate the adaptability of microorganisms to the changed environment.
BC634.CO3 Compare the basic mechanisms and functional interplay of innate and adaptive immunity.
BC634.CO4 Relate to the basic immunological principles involved in clinical and applied science.

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(Academic year 2025-26)

PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: MOLECULAR BIOLOGY AND IMMUNOLOGY

PAPER CODE: BC634P **PPW: 2**
YEAR/SEMESTER: III/VI **NO.OF CREDITS: 1**

COURSE OBJECTIVES

COb1 To explain the isolation of DNA and check its purity, quantitative analysis of nucleic acids and demonstrate agarose gel electrophoresis.
COb2 To familiarize the students with various immunodiagnostic tests done in the clinical laboratories.

1. Isolation of DNA from onion/liver/coconut endosperm.
2. Determination of purity of nucleic acids by UV-Vis spectrophotometric method.
3. Estimation of DNA by diphenylamine method.
4. Estimation of RNA by orcinol method.
5. Estimation of DNA and RNA by Spectrophotometric method.
6. Agarose gel electrophoresis of DNA and visualization by methylene blue staining.
7. Determination of blood group and Rh typing.
8. Visualization of antigen antibody reactions by immune diffusion methods.
9. Determination of TSH by ELISA.
10. Determination of Ag-Ab specificity by Dot-blot method.

REFERENCES:
1. Experimental Biochemistry: A Student Companion-Shashidhar Rao, B and Deshpande, V. IK International (P) LTD Pub.
2. Biochemical Methods- Sadasivam, S and Manickam, A. New Age International Publishers.
3. An Introduction to Practical Biochemistry-Plummer, D. T. Tata McGraw –Hill.
4. Introductory Practical Biochemistry (ed) Sawhney, S. K. Randhir Singh-Narosa Publications House.
5. Laboratory Manual in Biochemistry- Jayaraman, J. Wiley Eastern.
6. Lab manual In Biochemistry, Immunology and Biotechnology-Arti Nigam and Archana Ayyagari- Tata McGraw – Hill New Delhi.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC634P.CO1 apply the various isolation methods and compare and analyse nucleic acids quantitatively to work in molecular biology/diagnostic labs/ biotech labs or industry.
BC634P.CO2 use and interpret the results of different types of immunodiagnostic tests.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: CELL BIOLOGY AND BIOTECHNOLOGY

PAPER CODE: BC634A **PPW: 4**
YEAR/SEMESTER: III/VI **NO.OF CREDITS: 4**

COURSE OBJECTIVE: To describe the structure, function, culturing and maintenance of cells and to introduce various bioinformatics tool for data analysis.

UNIT-WISE COURSE OBJECTIVES:

COb1 To discuss the structure and functions of sub cellular organelles.
COb2 To explain the various bioinformatics tools and different analysis methods.
COb3 To describe the different culture media, maintenance and characterize type of cell generated.
COb4 To understand the applications of biotechnology, drug designing and concept of nanotechnology.

Unit I: - Cell Biology	**15hrs**
Composition & functions of cell organelles.	3hrs
Cytoskeleton- Microfilaments, Microtubules & Intermediate filament.	2hrs
Extracellular matrix.	2hrs
Structure of chromosomes. Mitosis and meiosis.	3hrs
Cell cycle and cell death.	3hrs
Types of cancer, morphological changes of tissue and causative agents.	

Unit II: Bioinformatics	**15hrs**
Introduction to Bioinformatics.	2hrs
Biological databases.	3hrs
Concept of DNA and protein sequence alignment and their importance.	2hrs
Dot matrix analysis.	2hrs
Scoring schemes and substitution matrices.	2hrs
Principles of multiple alignments.	2hrs
Phylogenetic analysis.	2hrs

Unit III: Biotechnology-I	**15hrs**
Introduction to bioreactor.	1hr
Downstream processing.	2hrs
Animal cell culture methods, media, establishment and maintenance of cell culture.	2hrs
Characteristics of normal and transformed cell.	2hrs

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Stem cells and tissue regeneration. 2hrs
Plant cell cultures, callus culture and protoplast fusion. 3hrs
Biosensors -Principles and applications. 3hrs

Unit IV: Biotechnology-II **15hrs**
Bioremediation. 2hrs
Biogas and biofuel production. 2hrs
Production of high value therapeutics- Insulin and tissue plasminogen activator and interferons. 3hrs
Genetically modified plants and animals and their applications. 3hrs
Methods of Drug design and delivery. 3hrs
Introduction to Nano biotechnology& its applications. 2hrs

REFERENCES:

1. Molecular Biotechnology- Glick, B.R and Pasternak, J.J.ASM Press.
2. Principles of Gene Manipulation- An Introduction to GE- Old, R.V. and Primrose, S. B. Black well Sci Pub.
3. A Textbook of Biotechnology- Dubey, R.C.S Chand & Co.
4. Gene Biotechnology- Jogd and. Himalaya Pub House.
5. Instant Notes –Bioinformatics-Westhead *et al.,* ViVa Books (P) Ltd.
6. Introduction to Bioinformatics- Attwood T. K and Parry-Smith, D. J. Pearson Education.
7. Introduction to Bioinformatics- Lesk, A. M. Oxford University Press.
8. Cell Biology- Fundamentals and applications- Gupta and Jangir, Agrobio publishers.
9. Cell and Molecular Biology- E.O.P. De Robertis and E.M.F. De Robertis Jr, Lippincott Williams and Wilkins- VIIIth Edition.
10. Cell Biology- S.C. Rastogi, New age international publishers.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC634A.CO1 Relate the structure and function of a normal to an abnormal cell.
BC634A.CO2 Retrieve, analyse and apply various bioinformatics tools in *in silico* studies.
BC634A.CO3 Apply the knowledge in culturing, maintenance of cell cultures in research.
BC634A.CO4 Apply the concept of transgenesis and drug designing in production of pharmacological products.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: CELL BIOLOGY AND BIOTECHNOLOGY

PAPER CODE: BC634AP **PPW: 2**
YEAR/SEMESTER: III/VI **NO.OF CREDITS: 1**

COURSE OBJECTIVES

COb1 To explain about pure culturing methods and identification of bacteria by Gram staining and also to discuss karyotyping.

COb2 To familiarize the students about databases, pairwise and multiple sequence alignment with phylogenetic tree construction.

1. Preparation of culture media and sterilization methods.
2. Isolation of pure cultures: (i) Streak plate method. (ii) Serial dilution method
3. Gram staining.
4. Introduction to mitosis & study of mitotic chromosomes.
5. Introduction to meiosis & study of meiotic chromosomes.
6. Identification of Barr bodies from buccal cavity.
7. Karyotyping of Human chromosomes.
8. Bioinformatics- Types of Databases.
9. Pairwise alignment – BLAST and CLUSTAL-W
10. Phylogenetic tree construction.

REFERENCES:

1. Introductory Practical Biochemistry (ed) Sawhney, S. K. Randhir Singh-Narosa Publications House.
2. Experimental Biochemistry-A student companion-BeeduSashidhar Rao and Vijay Deshpande.
3. An Introduction to Practical Biochemistry-Plummer, D.T. Tata McGraw –Hill.
4. Modern Genetic Analysis Anthony JF Griffiths, William M Gelbart, Jeffrey H Miller, and Richard C Lewontin. Pub. W. H. Freeman.
5. Principles of Genetics by Eldon John Gardner, Michael J. Simmons, D. Peter Snustad; John Wiley.

COURSE OUTCOMES:

At the end of the course students will be able to:

BC634AP.CO1 isolate and screen the microorganisms from various samples and analyze the position of chromosomes during cell division and karyotyping of human chromosomes helps them in genetics lab.

BC634AP.CO2 compare the sequences of different organisms to determine their evolutionary relationship using bioinformatics tools.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

COURSE NAME: BIOCHEMISTRY IN HEALTH AND DISEASE

PAPER CODE: BC634_O **PPW: 4**
YEAR/SEMESTER: III/VI **NO.OF CREDITS: 4**

COURSE OBJECTIVES: To familiarize the students about the metabolic, genetic and the molecular basis of cancer.

UNIT-WISE COURSE OBJECTIVES:
COb1 To understand the metabolism of biomolecules and its related metabolic disorders.
COb2 To explain the causes, diagnosis and therapies about the abnormalities of genetic disorders.
COb3 To learn the collection and composition of various biological samples and their examination.
COb4 To understand the causative agents, genes, biomarkers, mechanism and therapies of cancer.

Unit I: - Metabolic disorders	**15hrs**
Amino acid metabolism	2hrs
Phenylketonuria, Alkaptonuria	2hrs
Carbohydrate metabolism	2hrs
Galactosemia, Pentosuria	2hrs
Nucleic acid metabolism	2hrs
Gout, LeschNyhan Syndrome	1hr
Lipid metabolism	2hrs
Gaucher's disease, Tay-Sach's disease	2hrs

Unit II: - Genetic disorders	**15hrs**
Introduction to genetic diseases	1hr
Chromosomal disorders – Down's syndrome, Turner syndrome	3hrs
Hemoglobinopathies, Sickle cell anaemia	2hrs
Thalassemia	2hrs
Genetic counselling	2hrs
Prenatal diagnosis	2hrs
Gene therapy	3hrs

Unit III: -Clinical Diagnosis	**15hrs**
Sample collection and preservation	2hrs
Examination of biological samples: blood, sputum and CSF	3hrs

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Urine analysis: physical, chemical and microscopic	2hrs
Reference values and their establishment	2hrs
Clinical informatics	2hrs
Laboratory automation	2hrs
Quality assurance	2hrs

Unit IV: - Molecular basis of Cancer **15hrs**

Chemical carcinogens	2hrs
Fundamental features of carcinogenesis	2hrs
Oncogenes, Tumor suppressor genes causing cancer	2hrs
Tumor biomarkers in body fluids	2hrs
Mechanism of carcinogenesis	3hrs
New therapies in cancer	2hrs
Epigenetic mechanism in cancer	2hrs

REFERENCES:

1. Textbook of Biochemistry and Human Biology- Talwar, G.P. and Srivastava. L.M., Printice Hall of India.
2. Review of Medical Physiology- Ganong. McGraw – Hill.
3. Human Physiology- Chatterjee. C. C, Medical Allied Agency.
4. Textbook of Medical Physiology – Guyton. A.G and Hall. J.E., Saunders.
5. Tietz Fundamentals of Clinical Chemistry- Burtis, A.A and Ashwood, E.R. Saunders- Imprint Elsevier Pub.
6. Textbook of Biochemistry with Clinical Correlations- Devlin. T.M., Wiley- Liss.
7. Biochemistry, 4th Edition- Donald Voet, Judith G. Voet. - Publisher John Wiley & Sons.
8. Harper's illustrated Biochemistry

COURSE OUTCOMES:

At the end of the course students will be able to:

BC634_O.CO1 Analyze the underlying biochemical defect in various metabolic diseases.
BC634_O.CO2 Relate the chromosomal abnormalities with different genetic disorders.
BC634_O.CO3 Relate the various biological samples with respect to their examination and reference values.
BC634_O.CO4 Analyze and find possible therapies at molecular level to treat cancer.

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PROGRAM NAME: BCNDC (BIOCHEMISTRY, NUTRITION & DIETETICS, CHEMISTRY)

CHOICE BASED CREDIT SYSTEM (CBCS syllabus)

COURSE NAME: PROJECT WORK

PAPER CODE: BC634_PW **PPW: 4**
YEAR/SEMESTER: III/VI **NO.OF CREDITS: 4**

COURSE OBJECTIVES
COb1: To select a research topic and execute the planned work using correct methodology.
COb2: To organize the completed work in the form of project dissertation and submit.

1. Project work will involve experimental work/data collection and it has to be completed in the stipulated time by the student.
2. Students will be asked their choice for Project work at the beginning of Semester VI and all formalities of topic and mentor selection will be completed. Project work will be offered as per the expertise and infrastructural facilities available in the department.
3. Project work may be allotted to students as individual or as group project (not exceeding5 students per group).
4. The completed work and compiled data would be presented in the form of results and submitted in the form of a dissertation/project report.
5. Final evaluation of the project work will be through a panel consisting of internal and external examiners.
6. Guidelines provided for execution and evaluation of project work would be strictly adhered.
7. The grading would be based on evaluation of punctuality, experimental work, record keeping, academic inputs, data presentation, interpretation etc.

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Basic concepts of Project planning

a) Selection of Project topic and defining objectives

b) Planning of methods/approaches

Guidelines for Project writing

Title of the Project, Name of the Student & Supervisor

Declaration by the Student & Supervisor

Objectives of the project

Introduction & Review of Literature

Methodology

Results and Discussion

Conclusion

References

Course Outcomes

At the end of the course, students will be able to

BC634_PW.CO1: Plan and execute a project effectively in the stipulated time.
BC634_PW.CO2: develop analytical skills, statistical data handling skills, paper writing and oral presentation skills.

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