

S.R.R. & CVR Government Degree College

*An Autonomous & ISO 9001: 2015 Certified Institution:: Ranked by NIRF in 101-150 band at NIRF-2020 & 151-200 band in NIRF 2019
NAAC accredited Institution with grade B+ with C.G.P.A 2.6 during March 2017*

Machavaram, Vijayawada, Krishna District, AP-520 004

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Board of Studies - AY:2021-22



**313: B.Sc., MBC
309: B.Sc., M.B.F.**

Department of Biochemistry

BIOMOLECULES-BCN-1325

Unit - I:

1. Biophysical Concepts

12 hours

Water as a biological solvent, analysis of drinking water and pond water, Introduction to Different types of waters such as Potable water, Purified Water, Distilled Water, Deionized Water, R.O. Water, Water for Injection, Different Types of Waters used in the pharmaceutical industry, water for Vaccines. Total dissolved salts (T.D.S.), B.O.D., C.O.D. Buffers, measurement of pH, and biological buffers.

Additional input: Soil analysis.

Unit - II:

2. Carbohydrates

12 hours

Carbohydrates: Classification, monosaccharides, D and L designation, open-chain and cyclic structures, epimers and anomers, mutarotation, reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde, and ketone. Amino sugars, Glycosides. Structure and biological importance of disaccharides (sucrose, lactose, maltose), structural polysaccharides (cellulose, chitin, pectin), and storage polysaccharides (starch, inulin, glycogen). Bacterial cell wall polysaccharides and Blood group substances. Galactomannans and their applications in modern foods.

Unit - III:

3. Lipids

12 hours

Lipids: Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils (acid, saponification and iodine values, rancidity). General properties and structures of phospholipids. Prostaglandins- structure, types, and biological role. Lipoproteins- types and functions, Bio Membranes-Membrane composition and organization - Fluid mosaic model.

Additional input: Micelles

Unit-IV:

4. Amino Acids and Proteins

12 hours

Amino Acids: Classification, structure, stereochemistry, chemical reactions of amino acids due to carbonyl and amino groups. Titration curve of glycine and pK values. Essential and nonessential amino acids, non-protein amino acids. Peptide bond - nature and conformation. Naturally occurring peptides - glutathione, enkephalin.

Proteins: Classification based on solubility, shape, and function. General properties of proteins, denaturation, and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary, and quaternary structures (E.g., Hemoglobin and Myoglobin). Ramachandran plot.

Unit-V:

5. Nucleic acids and porphyrins

12 hours

Types of R.N.A. and D.N.A. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali, and nucleases on D.N.A. and R.N.A. Structure of Nucleic acids- Watson-Crick D.N.A. double helix structure, denaturation and renaturation kinetics of nucleic acids-, T_m -values and their significance, cot curves and their significance.

Structure of porphyrins: Identification of Porphyrins, Structure of metalloporphyrin's-Heme, cytochromes, and chlorophylls.

Additional input: Porphobilinogen

BCN-1325P

List of experiments:

1. Preparation of buffers (acidic, neutral, and alkaline) and determination of pH.
2. Qualitative identification of carbohydrates- glucose, fructose, ribose, maltose, sucrose, lactose, starch/glycogen.
3. Qualitative identification of amino acids-histidine, tyrosine, tryptophan, cysteine, arginine.
4. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test, Lieberman-Burchard test.
5. Preparation of Osazones and their identification.
6. Absorption maxima of colored substances-p-Nitrophenol, Methyl orange.
7. Absorption spectra of protein-BSA, nucleic acids-Calf thymus D.N.A.

Recommended books:

1. Soil Testing Manual by Dr. G. S. Wagh.
2. Soil Testing and Plant Analysis: Part I Soil Testing, Volume 2, SSSA Special publications by Glenn W. Hardy.
3. Soil Analysis: An interpretation manual by K. I. Peverill, L. A. Sparrow, D. J. Reuter
4. The biochemistry of Nucleic acids; Adams et al., Chapman and Hall, 1986.
5. Proteins: A guide to study by physical & chemical methods Haschemeyer and Haschemeyer,
6. Proteins: Structure, function, and evolution. Dickerson & Geis, 2nd Edn, Benjamin/Cummings.
7. Biochemistry - Zubay C, Addison - Wesley, 1986.

8. Biochemistry, A problem Approach, 2nd Edn. Wood, W.B. Addison Wesley 1981.
9. Biochemistry, Lehninger A.H.
10. Textbook of Biochemistry West, E.S., Todd, Mason & Vanbruggen, Macmillian &Co.
11. Principles of Biochemistry White-A, Handler, Pand Smith E.L. Mc Grew Hill.
12. Organic chemistry, I.L. Finar, ELBS. (1985).
13. Organic Chemistry by Morrison and Boyd (2000) Prentice Hall.
14. Fundamentals of Biochemistry by Donald Voet (1999).
15. Indian Pharmacopeia available in the pharmacy department

ANALYTICAL TECHNIQUES- BCN-2325

Unit-I: Cell homogenization and centrifugation 12 hours

Introduction to types of Cells & Cell Lysis, methods of tissue homogenization:(Potter-Elvehjem, mechanical blender, sonicator and enzymatic). Centrifugation techniques, principles, and applications- differential, density gradient. Ultra-centrifugation- preparative and analytical.

Unit-II: Chromatographic techniques 12 hours

Types of chromatographic techniques, Principle and applications - Paper chromatography- solvents, Rf value, applications; Thin layer chromatography- principle, choice of adsorbent and solvent, Rf value, applications; Gel filtration, Ion- exchange- principle, resins, the action of resins, experimental techniques, applications, separation of metal ions; Affinity chromatography. Introduction to HPLC.

Unit-III: Spectroscopy and tracer techniques 12 hours

Electromagnetic radiation, Beer-Lambert's law. Introduction to Absorption & Emission spectroscopy, Woodward Fieser rule.

Colorimetry and Spectrophotometry, Tracer techniques: Radioisotopes, units of radioactivity, half-life, β , and γ - emitters, use of radioactive isotopes in biology.

Unit-IV: Electrophoresis 12 hours

Electrophoresis- principles and applications of paper, polyacrylamide (native and S.D.S.) and agarose gel electrophoresis, isoelectric focusing, immune-electrophoresis-types, and applications.

Unit-V: Microbial techniques: 12 hours

Microscopy: Basic principles of light microscopy, phase contrast, electron microscope, and fluorescent microscope and their applications.

Preparation of different growth media, isolation and culturing and preservation of microbes, Gram's staining- Gram-positive and Gram-negative bacteria, motility and sporulation, Sterilization Techniques-Physical methods, chemical methods, radiation methods, ultrasonic and. Antibiotic resistance.

BCN-2325P

List of Experiments:

1. Isolation of R.N.A. and D.N.A. from tissue/culture.
2. Qualitative Identification of D.N.A., R.N.A. and Nitrogen Bases
3. Isolation of egg albumin from egg white.
4. Isolation of cholesterol from egg yolk.
5. Isolation of starch from potatoes.
6. Isolation of casein from milk.
7. Separation of amino acids by paper chromatography.
8. Separation of serum proteins by paper electrophoresis.

Recommended books:

1. Principles and Techniques of Practical Biochemistry. Eds. Williams and Wilson.
2. Techniques in Molecular biology Ed. Walker & Gastra, Croom Helm, 1983.
3. Principles of instrumental analysis, 2nd Ed, Holt-Sanders, 1980.
4. An introduction to spectroscopy for Biochemistry. Ed. Brown S.N., Academic press
5. Analytical Biochemistry, Holmes and Hazel peck, Longman, 1983.
6. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill.
7. Biophysical chemistry, Edshall & Wyman, Academic press Vol. II & I.
8. A textbook of quantitative inorganic analysis, including elementary instrumental analysis, Vogel ELBS.
9. Biochemical calculations Seigel, IH, 2nd Edit, John Wiley & Sons Inc., 1983.
10. Analytical Biochemistry by Friefelder David

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Machavaram, Vijayawada, Krishna District, AP-520 004

Department of Biochemistry

Syllabi for Courses in Semesters I, II, III&IV are under CBCS with Learning Outcomes-based Curriculum Framework (LOCF)

Title of the Course: Enzymology, Bioenergetics, and Intermediary Metabolism - BCN-3325

Common for BCN-3325 : BSc MBC & MBF

Course Code :	BCN-3325	Continuous Internal Assessment (C.I.A.)	40
No. of Lecture Hours / Week	04	Semester End Evaluation (SEE)	60
Total Number of Lecture Hours	60	Total Marks	100
Practical Component	02 Hour/Week	Exam Hours	03

Course Outcomes (Cos) :

Enzymology, Bioenergetics, and Intermediary Metabolism

- CO1: Students will learn the basics of enzymology and will be familiar with the kinetics of enzyme action
- CO2: Students will understand the basics of enzyme action and control their activity by using inhibitors.
- CO3: Understand the use of inhibitors in designing drugs.
- CO4: Understanding the steps in metabolic pathways helps interpret inborn errors of metabolism.
- CO5: Can relate the thermodynamic principles to energy transformation in living systems

Enzymology, Bioenergetics, and Intermediary Metabolism- BCN-3325

Unit-I: Enzymology

12 hours

Introduction to Biocatalysts, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. The active site, Enzyme specificity. Principles of the energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Michaelis - Menten equation for the uni-substrate reaction (derivation not necessary), Significance of K_m and V_{max} . Enzyme inhibition –competitive and non-competitive. Factors affecting enzyme activity.

Unit-II: Carbohydrate Metabolism.

12 hours

Concept of anabolism and catabolism. Glycolytic pathway, energy yield. The fate of pyruvate-formation of lactate and ethanol, Citric acid cycle, regulation, energy yield, amphipathic role. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Inborn errors in glycogen metabolism.

Unit-III: Lipid Metabolism

12 hours

Catabolism of fatty acids (β - oxidation) with an odd number of carbon atoms, Ketogenesis, synthesis of fatty acids, biosynthesis, and triacylglycerol degradation. Biosynthesis of cholesterol, Gaucher's and Niemann-pick diseases.

Unit-IV: Metabolism of Amino acids

12 hours

General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, metabolism of aromatic amino acid-phenylalanine. Inborn errors of Albinism, Alkaptonuria. Biosynthesis and regulation of purine and pyrimidine nucleotides. (De novo and salvage pathways) Catabolism of purines and pyrimidines. Biosynthesis of deoxyribonucleotides- ribonucleotide reductase and thymidylate synthase and their significance. Disorders of nucleotide metabolism- Gout, Lesch- Nyhan syndrome

Unit-IV: Bioenergetics and Biological oxidation 12 hours

Bioenergetics: Thermodynamic principles – Chemical equilibria; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Oxidation-reduction reactions.

Organization of components of electron transport chain in mitochondria. Mechanism of oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation.

Practical

List of experiments

1. Assay of amylase.
2. Assay of urease.
3. Effect of pH, temperature, and substrate concentration on enzyme activity.
4. Estimation of glucose by DNS method
5. Estimation of total carbohydrates by Anthrone method.
6. Estimation of amino acid by Ninhydrin method.
7. Estimation of protein by Biuret method.

Recommended books:

1. Understanding enzymes: Palmer T., Ellis Harwood Ltd., 2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
4. Principles of Biochemistry, White. A Handler, P, and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A. Harper.
8. Text of Biochemistry, West, and Todd.
9. Metabolic pathways – Greenberg.
10. Mitochondria, Munn.
11. Biochemistry, 2nd Edition, G. Zubay.

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Department of Biochemistry

Syllabi for Courses in Semesters I, II, III&IV are under CBCS with Learning Outcomes-based Curriculum Framework (LOCF)

Title of the Course: Physiology, Nutritional and Clinical Biochemistry- BCN-4325

Common for BCN-4325 : BSc MBC & MBF

Course Code :	BCN-4325	Continuous Internal Assessment (C.I.A.)	40
No. of Lecture Hours / Week	04	Semester End Evaluation (SEE)	60
Total Number of Lecture Hours	60	Total Marks	100
Practical Component	02 Hour/Week	Exam Hours	03

Course Outcomes (C.O.s): Physiology, Nutritional and Clinical Biochemistry

- CO1:** The student will get knowledge of the different physiological systems and their functions in the human body. By studying blood, its composition, and its functions, the student will understand the importance of blood.
- CO2:** This course will also provide knowledge in hormones, their functions, and the diseases occurring due to alterations in the levels of hormones.
- CO3:** Students can understand the functioning of organ and organ systems and apply the knowledge in disease conditions.
- CO4:** By studying this course, the student will know the nutritional importance of proteins, carbohydrates, lipids, vitamins, and minerals. And will also come to know the R.D.A. for vitamins and minerals.
- CO5:** Clinical biochemistry unit and practical will enable the student to do diagnostic tests, making them capable of working in clinical laboratories.
- CO6:** For liver diseases, Gastrointestinal diseases, renal diseases, and nutritional deficiencies, students can diagnose the reason and assist physicians.

Physiology, Nutritional and Clinical Biochemistry- BCN-4325

Unit-I: Digestion and Absorption

12hours

Digestion and absorption of carbohydrates, lipids, and proteins. Role of enzymes and Gastrointestinal hormones indigestion. Liver functions. Transportation mechanisms such as Passive transportation, Active transportation, Facilitated Diffusion, Phagocytosis & Pinocytosis, Ionic transportation.

Unit-II: Nervous system and excretory system

12hours

Introduction to the nervous system, Neurons-structure, types, properties, and functions; Neurotransmitters. Mechanism of nerve impulse transmission. Cerebrospinal fluid composition and functions.

Introduction to the excretory system. Organization of kidney, Structure, and functions of the nephron, Urine formation, Normal and abnormal constituents of the urine. Renal function tests- urea, creatinine, Cystatin C, G.F.R.

Unit III: Endocrinology

12 hours

Endocrinology- organization of the endocrine system. Classification of hormones. Outlines of chemistry, physiological role, and disorders of hormones of thyroid, parathyroid, adrenalin glands. Reproductive hormones estrogen and testosterone. Pituitary and hypothalamus hormones. Mechanism of hormonal action- signal transduction pathway for insulin.

Unit- IV: Nutritional Biochemistry

12hours

Balanced diet. Calorific values of foods and their determination by bomb calorimeter. B.M.R. and factors affecting it. The specific dynamic action of foods. Energy requirements and recommended dietary allowance (R.D.A.) for children, adults, pregnant and lactating women. Sources of complete and incomplete proteins. The biological value of proteins. Malnutrition- Kwashiorkor, Marasmus, and P.E.M. Vitamins- sources, structure, biochemical roles, deficiency disorders of water- and fat-soluble vitamins. Introduction to nutraceutical and functional foods. Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se, and F.

Unit- V: Clinical Biochemistry

12hours

Composition of the blood, Blood groups, coagulation of blood, and disorders of blood coagulation (hemophilia). Hemoglobin and transport of gases in the blood (oxygen and CO₂). Types of anemias, hemoglobinopathies-sickle cell anemia. Plasma proteins in health and disease. Liver diseases- jaundice. Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, Serum enzymes in liver diseases-SGOT, SGPT, G.G.T., C.P.K., Acid, and alkaline phosphatases.

Physiology, Nutritional and Clinical Biochemistry- BCN-4325P

List of experiments

1. Estimation of vitamin C by 2, 6 -dichlorophenol indophenol method.
2. Determination of acid value of oil.
3. Estimation of hemoglobin in the blood.
4. Total count - R.B.C. and WBC. Differential count.
5. Determination of blood group and Rh typing.
6. Urine analysis for albumin, sugars, and ketone bodies.
7. Estimation of urinary creatinine.
8. Estimation of Blood Glucose.
9. Estimation of serum total cholesterol.

Recommended books:

1. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
2. Textbook of Biochemistry with clinical correlations. Thomas M. Devlin (John Wiley).
3. Harper's Review of Biochemistry, Murray, et al. (Longman).
4. Biochemical aspects of human disease – R.S. Elkeles and A.S. Tavit. (Blackwell Scientific Publications).
5. Clinical chemistry in diagnosis and treatment–Joan F.Zilva and P.R.Pannall (Lloyd-Luke Medical Books, 1988).
6. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London, 1988).
7. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Saunders Company, 1984).
8. Clinical Biochemistry – S.Ramakrishnan and Rajiswami.
9. Chemical Biochemistry (Metabolic and clinical aspects) by W.J.Marshall&S.K.Bangert.
10. Textbook of clinical Biochemistry by Tietz et al.

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Department of Biochemistry

*Syllabi for Courses in Semesters I, II, III&IV are under CBCS with Learning
Outcomes-based Curriculum Framework (LOCF)*

Title of the Course: Microbiology & Immunology- BCN-5325

Common for BCN-5325 : BSc MBC & MBF

Course Code :	BCN-5325	Continuous Internal Assessment (C.I.A.)	40
No. of Lecture Hours / Week	04	Semester End Evaluation (SEE)	60
Total Number of Lecture Hours	60	Total Marks	100
Practical Component	02 Hour/Week	Exam Hours	03

Course Outcomes (C.O.s) : Microbiology & Immunology

- CO1: The understanding of immunology concepts involves in-depth knowledge of tissues, cells, and molecules involved in host defense mechanisms.
- CO2: It helps understand types of immunity, antigens-antibodies, and their properties, complement system, MHCs, and immune responses.
- CO3: Understanding of pathology of diseases caused by various microorganisms such as bacteria, virus, parasites, and fungus, immune mechanisms in disease control, vaccination, the process of immune interactions in clinical science.
- CO5: Provides basic knowledge about the immune system and allows the student to create insight as to how to improve their immune system and good health
- CO6: Understanding of types of hypersensitivity reactions and autoimmune diseases can be used to interpret the diseased conditions in the laboratory. Students will enhance their ability to understand tumor immunology and transplantation immunology concepts.

Microbiology & Immunology- BCN-5325

Unit-I: Microbiology

12 hours

Introduction to microbiology and microbial diversity. Classification of microorganisms- prokaryotic and eukaryotic microorganisms. Bacterial structure, growth curve, and kinetics of growth. Introduction to viruses, cultivation of viruses, structure and life cycle of -plant virus (ex: TMV Virus) and animal virus (ex: SARS CoV2).

Unit-II: Photosynthesis and Nitrogen Fixation

12hours

Photosynthesis- Light and Dark reactions, Calvin cycle, C4 cycle, Nitrogen cycle, non-biological and biological nitrogen fixation, Nitrogenase system. Utilization of nitrate ion, Ammonia incorporation into organic compounds. Synthesis of glutamine and regulatory mechanism of glutamine synthase.

Unit-III: Applied Biochemistry

12 hours

Fermentation Technology: Batch, continuous culture techniques, principle, types of fermenters. Pasteur effect. Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin), Enzyme Technology: Immobilization of enzymes and cells, industrial applications, enzymes in Bioremediation.

Unit-IV: Immunology-1

12hours

Organs and cells of the immune system. Innate and acquired immunity, Cell-mediated and humoral immunity (T-cells and B-cells). Classification of immunoglobulins, the structure of IgG. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Monoclonal antibodies

Additional input: Cocktail monoclonal antibody therapy for Covid 19

Unit V: Immunology-2

Antigen-antibody reactions- agglutination, precipitation, immunodiffusion, and complement fixation reactions. Blood group antigens. Immunodiagnosics- ELISA and R.I.A. Vaccines and their classification. Traditional vaccines live and attenuated Modern vaccines- recombinant and peptide vaccines: hypersensitivity reactions and types of Autoimmune diseases.

Microbiology & Immunology- BCN-5325P

List of experiments

1. Biosafety and good laboratory practices (G.L.P.) of Microbiology.
2. Sterilization of microbial media by autoclave.
3. Antibiotic sensitivity test
4. Isolation of pure cultures: (i) Streak plate method. (ii) Serial dilution method.
5. Demonstration of alcohol fermentation.
6. Antibiotic sensitivity by paper disc method.
7. Effect of nitrogen sources on growth of E. coli

Recommended books:

1. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGraw-Hill.
2. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
3. Pelczar MJ, Chan ECS and Krieg NR. (1993).

SRR & CVR GOVERNMENT DEGREE COLLEGE (AUTONOMOUS)
Vijayawada 520004
BIOCHEMISTRY SYLLABUS FOR V SEMESTER
PAPER – V
IMMUNOLOGY & ENDOCRINOLOGY

Periods: 60

Max. Marks: 60

Programme Objective :

- Understanding of the overview of immune system of including cells, organs and receptors
- To learn structure and functions of different classes of immunoglobulins, mechanisms involved in different types of hypersensitivity and the importance of conventional vs. Recombinant vaccines
- To get acquainted with the importance of antigen –antibody interaction in disease diagnosis, autoimmunity
- To understand the structure, properties and physiological functions and effects of each of the endocrine glands and their hormones
- To understand the causes, Clinical manifestations, management and nursing, investigation of hormones

Course Outcome:

- Will be able to know about endocrine glands, their secretions and functions
- Will be able to know the role of hormones in body metabolic functions
- Will be able to establish a Diagnostic and research Laboratory
- Will be able to get knowledge on various disorders caused by the imbalance of endocrine secretions.

UNIT – I Overview of Immune system

- 1.1 Introduction to basic concepts in Immunology.
- 1.2 Innate immunity-mechanism and types of acquired immunity.
- 1.3 Cells of immune system.
- 1.4 Organs of immune system, immune response

UNIT – II Antigens and Antibodies & Immune system in Health and Disease

- 2.1 Basic properties of antigens, factors influencing immunogenicity.
- 2.2 Haptens and adjuvants.
- 2.3 Structure of antibody, classes and functions of antibodies.
- 2.4 Classification and brief description of various types of hyper sensitivities.
- 2.5 Types of autoimmunity.

Unit – III Immunological techniques

- 3.1 Major histocompatibility complexes.
- 3.2 Monoclonal antibodies.
- 3.3 General introduction to Vaccines, Types of vaccines.

3.4 Antigen-antibody reactions-Agglutination, Precipitation, ELISA, RIA.

Unit – IV Endocrinology I

4.1 Organization of endocrine system.

4.2 Classification of hormones.

4.3 Mechanism of hormonal action, signal transduction pathways.

4.4 Pituitary hormones - GH, TSH, LH, FSH, oxytocin and vasopressin (physiological role).

Unit –V Endocrinology II

Structure, physiological role and disorders of:

5.1 Hormones of pancreas- insulin, glucagon.

5.2 Thyroid, parathyroid hormones.

5.3 Hormones of Adrenal glands.

5.4 Introduction to gastrointestinal hormones.

5.5 Reproductive hormones-Estrogen,progesterone.

BIOCHEMISTRY PRACTICAL SYLLABUS FOR V SEMESTER BIOCHEMISTRY - PAPER – V IMMUNOLOGY & ENDOCRINOLOGY

List of Experiments:

1. Collection of serum from blood.
2. Determination of blood group and Rh typing.
3. HCG based pregnancy test.
4. Glucose tolerance test.
5. Indirect ELISA
6. Sandwich ELISA
7. Direct ELISA
8. Purification of IgG Antibodies with Ammonium Sulphate
9. Ouchterlony Double Diffusion –Titration
10. Ouchterlony Double Diffusion - Patterns

SRR & CVR GOVERNMENT DEGREE COLLEGE (AUTONOMOUS)
Vijayawada520004
BIOCHEMISTRY SYLLABUS FOR V SEMESTER

PAPER – VI

MOLECULAR BIOLOGY & r DNA TECHNOLOGY

Periods: 60

Max. Marks: 60

Programme objective:

- To gain knowledge on Central Dogma- Process of replication
- To gain knowledge in MolecularBiology, the process of Protein synthesis
- Ability to gain knowledge on Molecular tools necessary for rDNA technology
- Exposure with the importance of E.coli lac operon, PCR, expression vectors and their importance in Biotechnology
- To use the technique and modern tools necessary for Research methodology and can apply the technique of rDNA technology in various fields
- Acquaintance with the merits and demerits of transgenic crops

Course Outcomes:

- Will be able to understand the mechanism of Replication
- Will be able to understand the process of Protein synthesis
- Will be able to understand the tools involved in Recombinant DNA technology
- Will be able to become a Molecular Biologist
- will be able to establish Molecular Biotechnology Laboratory.

Unit- I: Gene & genome

- 1.1 Organisation of genetic material ,
- 1.2 Experiments to prove DNA as genetic material
- 1.3 Concept of gene, Nature and structure of gene.
- 1.4 DNA replication- models of replication, Meselson-Stahl's experimental proof for semi conservative model. DNA polymerases I, II and III of E.coli, helicase, topoisomerases, primase, ligase.
- 1.5 Mechanism of DNA Replication. Bidirectional replication model. Okazaki fragments, leading and lagging strands of DNA synthesis.
- 1.6 Inhibitors of DNA replication.

UNIT- II: DNA Replication and Transcription in prokaryotes

- 2.1 Transcription - RNA synthesis, RNA polymerases of prokaryotes. Promoters, Initiation sigma factors and their recognition sites. Elongation- role of core enzyme Termination- rho dependent and rho-independent.
- 2.2 Regulation of prokaryotic gene expression at transcriptional level- Lac operon concept.
- 2.3 Introduction to post transcriptional modifications-mRNA capping, polyadenylation, splicing.

Unit- III Protein Synthesis and Regulation of Gene Expression

- 3.1 Genetic code, deciphering of genetic code.
- 3.2 Wobble hypothesis, degeneracy of genetic code.

- 3.3 Protein synthesis- activation of amino acids (aminoacyl t-RNA synthetase).
- 3.4 Ribosome structure. Initiation, elongation and termination of protein synthesis.
- 3.5 Introduction to Post- translational modifications.
- 3.6 Inhibitors of protein synthesis.

Unit-IV: Recombinant DNA Technology

- 4.1 Outlines of cloning strategies.
- 4.2 Tools of r-DNA technology: Enzymes- Restriction endonucleases, T4 DNA ligase, Ecoli DNA ligase phosphatases, reverse transcriptase, polynucleotide kinases, terminal transferases.
- 4.3 Cloning vectors- Plasmids, λ phage vectors, cosmids. Expression vectors-E.coli.
- 4.4 Construction of c-DNA and Genomic libraries. Isolation of cloned genes- Colony hybridization.

Unit V -Applied Biochemistry

- 5.1 DNA sequencing- Maxam Gilbert and Sanger's method.
 - 5.2 Polymerase chain reaction- principle and applications.
 - 5.3 Outlines of blotting techniques-Southern, Northern and Western.
 - 5.4 Applications of gene cloning- production of insulin and human growth hormone, production of Bt cotton and golden rice.
- Additional inputs: C-Value paradox, Telomerase. Signal hypothesis.

BIOCHEMISTRY - PAPER – VI

MOLECULAR BIOLOGY & rDNA TECHNOLOGY

List of Experiments:

2. Estimation of DNA by diphenylamine method.
3. Estimation of RNA by orcinol method.
4. Preparation of Buffer stocks (TBE, TE and TAE)
5. Agarose Gel Electrophoresis (AGE).
6. Extraction of DNA from Agarose gel
7. Plasmid Isolation (Mini prep)
8. Extraction of DNA from Fish Fins
9. Isolation of RNA
10. Restriction Digestion

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**BIOCHEMISTRY SYLLABUS FOR VI SEMESTER BIOCHEMISTRY CLUSTER
PAPER: VIII-B-1 CELL BIOLOGY**

Periods: 45

Max. Marks: 60

UNIT-I INTRODUCTION TO CELL BIOLOGY

- Origin of life, Cell theory.
- Structure of prokaryotic and eukaryotic cell.
- Differences between Animal and Plantcell.
- Mycoplasma.
- Viruses and prions.

UNIT-II STRUCTURE AND FUNCTION OF SUBCELLULAR ORGANELLES –

- Composition of biological membranes.
- Nucleus: Structure of nuclear envelope, nuclear pore complex nucleolus and chromatin.
- Endoplasmic Reticulum: RER - Brief overview of protein synthesis.
- SER – Lipid synthesis, brief overview of export of proteins from ER.
- Golgi apparatus: organization, brief overview of glycosylation of proteins

UNIT-III- CELL ORGANELLS

- Lysosomes: Different forms of lysosomes, role in cellular digestion
- Peroxisomes: assembly, functions and Glyoxysomes.
- Mitochondria: structure, endosymbiont theory
- Chloroplast: structure, endosymbiont theory
- Cell Wall: Structure of prokaryotic and eukaryotic cellwall.
- ECM components and adhesion proteins; anchoring junctions, tight junctions and communication junctions

UNIT-IV CELL CYTOSKELETON

- Microtubules: Axonemal and cytoplasmic microtubules (cilia, flagella, centrioles, basal bodies).
- Microfilaments: Actin and Myosin filaments.
- Cell Cycle, Cell Division (Mitosis and Meiosis).
- Apoptosis and necrosis (brief introduction).

UNIT-V CELL SEPERATION AND VISUALIZATION TECHNIQUES:

- Centrifugation, Sedimentation Coefficient, Differential and Density Gradient (isopycnic and rate zonal) centrifugation.

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER
BIOCHEMISTRY CLUSTER PAPER: VIII-B-2
BIOTECHNOLOGY

Periods:45

Max. Marks:60

UNIT I: PLANT GENETIC ENGINEERING:

Gene isolation, gene transfer systems
Plant virus vectors: Tiplasmid
Gene transfer methods: Electroporation, microinjection, micro projectile technology
Selection and identification of transformed cells.

UNIT II: UPTAKE OF DNA BY CELLS

Transduction and transfection.
Chemical and physical methods of DNA introduction into cells.
cDNA and Genomic libraries.
Southern and Northern hybridization.

UNIT III: PRINCIPLES OF GENE CLONING

Restriction and modification systems, restriction endonucleases and other enzymes used in manipulating DNA molecules.
DNA ligases, linkers and adapters.
Vectors and characteristics of Plasmids and bacteriophages,
Cloning vectors based on E. coli plasmids-pBR322.
Viruses as vectors, cloning vectors - M13 and λ bacteriophage

UNIT IV: PROTEIN ENGINEERING

Production of recombinant pharmaceuticals such as insulin, human growth hormone.
Recombinant vaccines.
Yeast two hybrid systems,
Production of recombinant proteins by eukaryotic cells.

UNIT V: APPLIED BIOTECHNOLOGY

Tissue culture – brief introduction about Plant tissue culture, anther and pollen culture, protoplast culture, animal cell lines and organ culture.
Transgenic plants and animals
Fermentation technology production of alcohols, antibiotics.
Immobilized enzymes (short notes)
Brief introduction on Enzyme electrodes, biosensors.

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER
BIOCHEMISTRY CLUSTER PAPER: VIII-B-3
BIOINFORMATICS AND BIOSTATISTICS

UNIT- I INTRODUCTION

Basics of Computer, Operating systems, Hardware and Software
Introduction to programming Languages and Paradigms
Role of supercomputers in biology
Introductions to bioinformatics
Applications of bioinformatics

UNIT- II SCOPE OF BIOINFORMATICS

Genomics and Proteomics
Comparative and functional genomics
Genome annotation
Gene prediction approaches and tools.
DNA microarray

UNIT-III BIOLOGICAL DATABASES

Primary, secondary and composite databases
Nucleic acid databases (GenBank, EMBL, DDBJ)
Protein databases (PIR, Swiss-Prot, PDB)
Metabolic pathway database ((KEGG, EcoCyc)
Sequence alignment types and tools-BLAST

UNIT -IV DATA COLLECTION AND PRESENTATION

Concepts of population and sample, advantages of sampling
Basic concepts in sampling
Designing experiments
Mean, median, mode, range and standard deviation
Probability

**UNIT -V INTRODUCTION HYPOTHESIS TESTING & REGRESSION AND
CORRELATION:**

General concepts – Null hypothesis, alternative hypothesis.
P value and its significance
Student's t-test. Chi Square Test – Observed and expected frequencies,
Calculating p values – Pearson's correlation coefficient
Regression- Concepts, simple linear regression; ANOVA