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**ADIKANI NANNAYA UNIVERSITY**  
**B.SC .BIOCHEMISTRY SYLLABUS UNDER CBCS(w.e.f. 2015-16, Revised)**  
**BIOCHEMISTRY COURSE STRUCTURE UNDER CBCS**

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS	
<b>I</b>	<b>I</b>	<b>I</b>	Biomolecules	100	03	
			Practical – I	50	02	
	<b>II</b>	<b>II</b>	Nucleic acids and Biochemical Techniques	100	03	
			Practical – II	50	02	
<b>II</b>	<b>III</b>	<b>III</b>	Enzymology and bioenergetics	100	03	
			Practical – III	50	02	
	<b>IV</b>	<b>IV</b>	Intermediate metabolism	100	03	
			Practical – IV	50	02	
<b>III</b>	<b>V</b>	<b>V</b>	Physiology, Clinical Biochemistry and Immunology	100	03	
			Practical – V	50	02	
		<b>VI</b>	<b>VI</b>	Molecular Biology & Recombinant DNA Technology	100	03
				Practical – VI	50	02
	*Any one Paper from A*, B*	<b>VII (A)*</b>	<b>VII (A)*</b>	Basic Microbiology	100	03
				Practical - VII (A)	50	02
		<b>VII (B)*</b>	<b>VII (B)*</b>	Biochemical correlation and disorders	100	03
				Practical - VII (B)	50	02
	** Any one cluster from I, II (VIII-A & VIII-B)	<b>VIII-A**</b>	<b>VIII-A**</b>	<b>Cluster Electives –I :</b>		
				<b>VIII-A</b>	100	03
				I. Clinical Biochemistry	100	03
				II. Haematology	100	03
				III. Medical Microbiology		
				Practical – VIII: 1	50	02
Practical – VIII: 2		50	02			
Project Work		50	02			
<b>VIII-B**</b>	<b>VIII-B**</b>	<b>Cluster Electives –II</b>				
		<b>VIII-B :</b>				
		I. Organization of Cell structure	100	03		
		II. Genetics and Ecology	100	03		
		III . Applied Biochemistry				
		Practical – VIII: 1	50	02		
Practical – VIII: 2	50	02				
Project Work	50	02				
<b>VI</b>						

# ADIKAVI NANNAYA UNIVERSITY

## RAJAMAHENDRAVARAM

### CBCS / Semester System

(W.e.f. 2016-17 Admitted Batch)

#### I Semester Syllabus

### BIOCHEMISTRY

### BCT-101: BIOMOLECULES

#### **Unit – I: Biophysical Concepts**

**12 hours**

Water as a biological solvent and its role in biological processes. Biological relevance of pH, measurement of pH, pKa of functional groups in biopolymers such as proteins and nucleic acids. Importance of buffers in biological systems, ion selective electrodes, and oxygen electrode. Donnan membrane equilibrium. Significance of osmotic pressure in biological systems,

#### **Unit – II: 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, isomaltose, trehalose), trisaccharides (raffinose, melezitose), structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen). Glycosaminoglycans, Bacterial cell wall polysaccharides. Outlines of glycoproteins, glycolipids and blood group substances.

#### **Unit – III: 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, sphingolipids and cholesterol and lipoproteins.  
Biomembranes: Behavior of amphipathic lipids in water- formation of micelles, bilayers, vesicles, liposomes. Membrane composition and organization – Fluid mosaic model.

#### **Unit-IV: Amino Acids and Peptides**

**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 non-essential amino acids, non-protein amino acids. Peptide bond - nature and conformation. Naturally occurring peptides – glutathione, enkephalin.

#### **Unit-V: Proteins**

**12 hours**

Proteins: Classification based on solubility, shape and function. Determination of amino acid composition of proteins. General properties of proteins, denaturation and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary and quaternary structures (Eg. Hemoglobin and Myoglobin), forces stabilizing the structure of protein.

## **Practical : BCP-101: Qualitative Analysis**

(3 periods/week)

### **List of Experiments:**

1. Preparation of buffers (acidic, neutral and alkaline) and determination of  $pH$ .
2. Titration curve of glycine and determination of  $pK$  and  $pI$  values.
3. Qualitative identification of carbohydrates- glucose, fructose, ribose, maltose, sucrose, lactose, starch/glycogen.
4. Preparation of Osazones and their identification.
4. Qualitative identification of amino acids – Alanine, histidine, tyrosine, cysteine, glutamic acid.
5. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test, Acid number and Iodine number tests.

## **Recommended Books for UG Course -Biochemistry**

### **General Biochemistry**

1. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
2. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
3. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons .
4. Textbook of Biochemistry – West.E.S., Todd.W.R, Mason.H.S..and. Bruggen, J.T.V., Oxford & IBH Publishers.
5. Fundamentals of Biochemistry –Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
6. Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
7. Biochemistry – Rama Rao. A and Ratna Kumari. D, Kalyani Publishers.

### **Distribution of Practical Exam Marks**

Practical Exam Time: 3 Hrs

Max marks: 50

1. Major Experiment	20 (Principle -5M, Methodology-10M, Results-05)
2. Minor Experiment	10 (Principle -2M, Methodology-05M, Results-03)
3. Spotters	10 (5 nos. x 2 M)
4. Record	05
5. Viva-voce	05

### **MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS**

#### **B.Sc., Course Semester End Practical examination**

#### **B.Sc., Biochemistry**

TIME: 3 hours

Max. Marks: 50

1. Major experiment.	20 marks
2. Minor experiment	10 marks
3. Identify the given spotter and write a brief note on it- A, B, C,D,E, F (5x2M)	10 marks
4. Record	05 marks
5. Viva-voce	05 marks

### **MID TERM EXAMINATIONS**

#### **(Ist and IInd Internal Assessment Examinations)**

Internal assessment; after completion of two Units one internal test will be conducted

No. of internal tests; Two

Average two internal tests will be taken

Total no. of Marks 25

Pattern; out of five short answers three questions have to be attempted each carries 5 Marks.

In essay questions out of two questions, one has to be attempted which carries 10 marks.

**MID SEM EXAM MODEL QUESTION PAPER**  
**Ist INTERNAL ASSESMENT EXAMINATION**  
**B. Sc Degree Course (CBCS-Semester pattern)**  
**B. Sc., Biochemistry**

**Time : 1 Hr**

**Max marks : 25**

**SECTION -A**

**(3 x 5 M= 15M)**

Attempt any **THREE** short questions of the following

- 1.
- 2.
- 3.
- 4.
- 5.

**SECTION – B**

**(1x 10M = 10 marks)**

Attempt any **ONE** essay question of the following

- 6.
- 7.

# ADIKAVI NANNAYA UNIVERSITY: RAJAMAHENDRAVARAM

## CBCS/ SEMESTER SYSTEM

### II SEMESTER: B.Sc. BIO-CHEMISTRY

(w.e. from 2016-17 ADMITTED BATCH)

60 hrs

(5 periods/week)

### BCT-201 Nucleic acids and Biochemical Techniques

#### Unit-I : Nucleic Acids

12 hours

Nature of nucleic acids. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Structure of Nucleic acids- Watson-Crick DNA double helix structure, introduction to circular DNA, super coiling, helix to random coil transition, denaturation of nucleic acids- hyperchromic effect,  $T_m$ -values and their significance. Reassociation kinetics, cot curves and their significance. Types of RNA and DNA.

#### Unit-II: Porphyrins

9 hours

Structure and types of porphyrins; Protoporphyrin, porphobilinogen properties Structure, properties & biological importance of metalloporphyrins – Heme, cytochromes and chlorophylls.

#### Unit-III: Biochemical Techniques I

15 hours

Methods of tissue homogenization: (Potter-Elvehjem, mechanical blender, sonicator and enzymatic). Principle and applications of centrifugation techniques- differential, density gradient. Ultracentrifugation- preparative and analytical.. Principle and applications of chromatographic techniques- paper, thin layer, gel filtration, ion-exchange and affinity chromatography.

#### Unit-IV: Biochemical Techniques II

Electrophoresis- principles and applications of paper, agarose gel electrophoresis and polyacrylamide (native and SDS) Elementary treatment of an enzyme purification. Tracer techniques: Introduction to Radio activity Radio isotopes, units of radio activity, half life,  $\beta$  and  $\gamma$ - emitters, use of radioactive isotopes in biology

#### Unit-V: Biochemical Techniques III

12 hours

Spectrophotometry: Laws of light absorption- Beer-Lambert law, Instrumentation of UV and visible spectrophotometry, Applications of UV and visible spectrophotometry. Colorimetry: Principles and its applications, Principle of fluorimetry

**Practical BCP- 201 : Nucleic acids and Biochemical Techniques 45 hrs**

**List of Experiments:**

**(3 periods/week)**

1. Isolation of DNA from plants
2. Qualitative Identification of DNA, RNA 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. Determination of exchange capacity of resin by titrimetry ( Record with Demo)
9. Separation of proteins by Agarose electrophoresis.
10. Separation of plant pigments by TLC.



**Model question paper**  
**Sub: Biochemistry**  
**IInd Semester (Theory )**

**Time : 3hrs**

**Duration : 3hrs**

**SECTION –A**

**Answer any Five questions 5x5 =25marks**

1. Types of RNA
2. Hyper chromic effect
3. Chlorophyll B
4. Affinity chromatography
5. Tissue homogenization
6. Half –life
7. Molar Extinction co-efficient
8. Mono chromator

**SECTION-B**

Answer the questions            5x10 =50marks

9.A) Write an account of Double helical structure of DNA

Or

B) Describe the factors effecting on Nucleic acid?

10A) explain the chemistry & structure biological significance of Heme?

Or

B) Write in detail about the types of cytochromes and their chemistry?

11A) Determination of Molecular weight of Gel filtration chromatography?

Or

B) Explain in detail about ultra-centrifugation?

12A) Write an account on SDS-PAGE?

Or

B) Describe the applications of radioisotopes in biology?

13A) Write the instrumentation & biochemical applications of spectrophotometry?

Or

B) Write the principle and instrumentation of calorimetry ?

### **Recommended Books for Nucleic acids and Biochemical Techniques**

1. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M.,  
Freeman & Co.  
Biochemistry –
2. Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.  
Biochemistry – Voet.D and Voet., J.G., John Wiley & Son
- 3.Principles and Techniques of Practical Biochemistry- Wilson, K. and Walker, J.  
Cambridge Press.
- 4.The Tools of Biochemistry- Cooper, T. G. John Wiley & Sons Press.
- 5.Physical Biochemistry- Friefelder, D. W.H. Freeman Press.
- 6.Analytical Biochemistry – Holme.D.J. and Peck.H., Longman.
- 7.Biophysical Chemistry: Principle and techniques- Upadhyay A, Upadhyay K  
and Nath. N. Himalaya Publishing House.
- 8.Experimental Biochemistry- Clark Jr. J.M and Switzer, R. L. Freeman & Co..

# ADIKAVI NANNAYA UNIVERSITY

## RAJAMAHENDRAVARAM

### CBCS / Semester System

(W.e.f. 2015-16 Admitted Batch)

#### III Semester Syllabus

#### BIOCHEMISTRY

#### **BCT-301 Enzymology and Bioenergetics**

##### **Unit-I: Classification of Enzymes and Structure**

**12 hours**

Introduction to biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Enzyme specificity. Active site. Principles of energy of activation, transition state. Interaction between enzyme and substrate- lock and key, induced fit models. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Fundamentals of enzyme assay, enzyme units.

##### **Unit II: Influence of Physical factors and Inhibitors on Enzyme activity.**

**12 hours**

Factors affecting the catalysis- substrate concentration,  $pH$ , temperature. Michaelis - Menten equation for uni-substrate reaction (derivation not necessary), significance of  $K_M$  and  $V_{max}$ . Enzyme inhibition- irreversible and reversible, types of reversible inhibitions- competitive and non-competitive.

##### **Unit-III: Mechanism of enzyme action**

**12 hours**

Outline of mechanism of enzyme action - acid-base catalysis, covalent catalysis, electrostatic catalysis, and metal ion catalysis. Regulation of enzyme activity- allosterism and cooperativity, ATCase as an allosteric enzyme, covalent modulation - covalent phosphorylation of phosphorylase, zymogen activation - activation of trypsinogen and chymotrypsinogen. Isoenzymes (LDH). Multienzyme complexes (PDH). Ribozyme .

##### **Unit- IV: Bioenergetics**

**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. Energy, change, oxidation-reduction reactions.

##### **Unit V : Biological Oxidations in Mitochondria**

**12 hours**

Organization of electron transport chain and enzyme complexes, inhibitors of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation. Mechanism of oxidative phosphorylation.

## **Practical – BCP-301: Enzymology**

### **List of Experiments:**

1. Assay of amylase
2. Assay of urease
3. Assay of catalase.
4. Assay of phosphatase
5. Determination of optimum temperature for amylase.
6. Determination of optimum *pH* for phosphatase.

**45 hrs**  
**(3 periods/week)**

### **Recommended books for Enzymology & Bioenergetics**

1. Fundamentals of Enzymology – Price.N.C.and Stevens.L., Oxford University Press.
2. Understanding Enzymes – Palmer.T., Ellis Harwood.
3. Enzymes – Biochemistry, Biotechnology, Clinical Chemistry – Palmer.T., Affiliated East-West Press.
4. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
5. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
6. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons

### **Distribution of Practical Exam Marks**

Practical Exam Time: 3 Hrs

Max marks: 50

1. Major Experiment	20 (Principle -5M, Methodology-10M, Results-05)
2. Minor Experiment	10 (Principle -2M, Methodology-05M, Results-03)
3. Spotters	10 (5 nos. x 2 M)
4. Record	05
5. Viva-voce	05

### **MODEL QUESTION PAPER FOR SEMESTER END PRACTICAL EXAMINATIONS**

**B.Sc., Course Semester End Practical examination**

**B.Sc., Biochemistry**

TIME: 3 hours

Max. Marks: 50

1. Major experiment.	20 marks
2. Minor experiment	10 marks
3. Identify the given spotter and write a brief note on it- A, B, C,D,E, F (5x2M)	10 marks
4. Record	05 marks
5. Viva-voce	05 marks

### **MID TERM EXAMINATIONS**

**(Ist and IInd Internal Assessment Examinations)**

Internal assessment; after completion of two Units one internal test will be conducted

No. of internal tests; Two

Average two internal tests will be taken

Total no. of Marks 25

Pattern; out of five short answers three questions have to be attempted each carries 5 Marks.

In essay questions out of two questions, one has to be attempted which carries 10 marks.

**MID SEM EXAM MODEL QUESTION PAPER**  
**Ist INTERNAL ASSESMENT EXAMINATION**  
**B. Sc Degree Course (CBCS-Semester pattern)**  
**B. Sc., Biochemistry**

**Time : 1 Hr**

**Max marks : 25**

**SECTION -A**

**(3 x 5 M= 15M)**

Attempt any **THREE** short questions of the following

- 1.
- 2.
- 3.
- 4.
- 5.

**SECTION – B**

**(1x 10M = 10 marks)**

Attempt any **ONE** essay question of the following

- 6.
- 7.

**ADIKAVI NANNAYA UNIVERSITY**  
**CBCS/SEMSTER SYSTEM**  
**IV SEMSTER: B.Sc, BIOCHEMISTRY**  
**W.E.FROM 2015-16 AB**

**BCT- 401 Intermediary Metabolism**

**60 hrs**

**Unit- I : Carbohydrate Metabolism**

**12 hours**

Concept of anabolism and catabolism. Glycolytic pathway, energy yield. Fate of pyruvate-formation of lactate and ethanol, Pasteur effect. Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C<sub>4</sub> Pathway.

**Unit- II : Lipid Metabolism**

**12 hours**

Catabolism of fatty acids ( $\beta$ - oxidation) with even and odd number of carbon atoms, Ketogenesis, *de novo* synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacyl glycerol and lecithin. Biosynthesis of cholesterol.

**Unit- III: Metabolism of Amino acids**

**12 hours**

General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids. Metabolism of glycine, serine, aspartic acid, methionine, phenylalanine and leucine. Biosynthesis of creatine.

**Unit- IV: Metabolism of Nucleic acid, heme, nitrogen fixation:**

**12 hours**

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..Biosynthesis and degradation of heme.

**Unit- V : Integration and Inborn Errors of Metabolism:**

Out lines of Metabolism, Integration of Major organs in metabolic pathway of carbohydrate, lipid. Protein metabolisms, Starvation.

Disorders of carbohydrate Metabolism : hypoglycemias, hyperglycemia, glycosuria, renal threshold value. *Diabetes mellitus*-classification, glucose tolerance test (GTT), diabetic ketoacidosis.

Disorders of Amino acid metabolism: Phenylketonuria, Alkaptonuria, Albinism, Maple syrup urine disease (MSUD).

Disorders of nucleotide metabolism- Gout, Lesch- Nyhan syndrome, Reye syndrome.

Disorders of Lipid Metabolism: lipoproteinemias, , hyper cholesterolemia, atherosclerosis

**Practical – BCP-401: Quantitative Analysis 45 hrs**

**List of Experiments:**

**(3 periods/week)**

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of protein by Lowry method.
4. Estimation of glucose by DNS method.
5. Estimation of glucose by Benedict's titrimetric method.
6. Estimation of total carbohydrates by Anthrone method.

**Model question paper  
Sub: Biochemistry  
IV Semester (Theory)**

**Time : 3hrs**

**Duration : 3hrs**

**SECTION –A**

**Answer any Five questions 5x5 =25marks**

1. Anaplerosis
2. Pasteur Effect
3. Ketone bodies formation
4. Lecithin biosynthesis
5. Salvage pathway
6. Ribonucleotide reductase
7. Alkaptonuria
8. Starvation

**SECTION-B**

**Answer the questions 5x10 =50marks**

9.A) Write about pentose phosphate pathway?

Or

B) Write about Calvin cycle ?

10A) write an essay about fatty acid biosynthesis?

Or

B) Explain in details about cholesterol biosynthesis?



11A) Explain the Krebs's Citric acid cycle ?

Or

B) Write the details of branched amino acids metabolism?

12A) Describe the Mechanism of nitrogen cycle?

Or

B) Explain the de novo synthesis of Purines?

13A) Explain the mechanism of which organs are involved in to control the blood glucose level in our body?

Or

B) Write a short note on Gout and Lesch Nyan Syndrome ?

### **Recommended Books for Intermediary Metabolisms**

1. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
2. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
3. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons
4. Biochemistry-Lippincott's Illustrated Reviews. Champe, P.C. and Harvey, R. A. Lippincott
5. Fundamentals of Biochemistry –Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
6. Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt. Ltd.
7. Biochemistry – Rama Rao. A and Ratna Kumari. D, Kalyani Publishers.
8. Harpers -Biochemistry
9. Strayer - Biochemistry

# ADIKAVI NANNAYA UNIVERSITY

## CBCS SEMESTER PATTERN

### Semester-V : BIO-CHEMISTRY

#### PAPER -V

Theory: BCT-501-Physiology, Clinical Biochemistry and Immunology 60 hrs

(5periods/12 hours week)

#### **Unit- I : Physiology**

Digestion and absorption of carbohydrates, lipids and proteins. Composition of blood and coagulation of blood. Transport of gases in blood (oxygen and CO<sub>2</sub>). Muscle: Structure of myofibril and mechanism of muscle contraction.

#### **Unit II: Endocrinology**

**12 hours**

Endocrinology- organization of endocrine system. Classification of hormones. Outlines of chemistry, physiological role and disorders of hormones of hypothalamus, pituitary, thyroid, parathyroid, adrenal gland, pancreatic hormones and gonads. . Introduction of hormones of gastrointestinal tract and placenta.

#### **Unit- III : Nutritional Biochemistry**

**12 hours**

Classification of Nutrients, calorific values of foods and their determination by bomb calorimeter. BMR and factors affecting it. Significance of BMR. Specific dynamic action of foods[SDA]. Energy requirements and recommended dietary allowance (RDA) for pregnant and lactating women. Biological value of proteins. . Sources of complete and incomplete proteins, Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se and F.

#### **Unit- IV : Clinical Biochemistry**

**12 hours**

Disorders of blood coagulation (haemophilia). Types of anemias, haemoglobinopathies-sickle cell anemia.

Liver : Structure and functions of Liver, jaundice . Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, Hippuric acid , Rose Bengal dye ,Serum enzymes in liver diseases- SGPT, GGT and alkaline phosphatase.

Kidneys-structure of nephron, urine formation, normal and abnormal constituents of urine. Biological buffers. Role of kidneys in maintaining acid-base and electrolyte balance in the body.

#### **Unit- V : Immunology**

**12 hours**

Organization of immune system. Innate and acquired immunity. Organs and cells of immune system. Cell mediated and humoral immunity . structure of Ig G , Classification of immunoglobulins,. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Monoclonal antibodies. Antigen-antibody reactions- agglutination, Precipitation immunoprecipitation, immunodiffusion. . Immunodiagnosics- ELISA,RIA. Vaccines and their classification. Traditional vaccines-live and attenuated. Modern vaccines- recombinant and DNA vaccines.

#### **Practical: BCP-501-Nutritional and Clinical Biochemistry**

**45 hrs**

#### **List of Experiments:**

**(3 periods/week)**

1. Estimation of vitamin C by 2, 6 -dichlorophenol indophenol method
2. Estimation of hemoglobin in blood.
3. Total count - RBC and WBC.
4. Differential count Of WBC
5. Determination of blood group and Rh typing. .

6. Urine analysis for albumin, sugars and ketone bodies.
7. Estimation of Serum creatinine.
8. Estimation of blood Glucose Folin-wu method.
9. Estimation of serum total cholesterol.

MODEL PAPER

**Sub: Biochemistry**  
**Vth Semester (Theory )**

**Time : 3hrs**  
**3hrs**

**Duration :**

**SECTION –A**

**Answer any Five questions 5x5 =25marks**

1. Myofibril
2. parathyroid gland
3. Bomb calorimeter
4. RDA
5. Sickle cell anaemia
6. Jaundice
7. Nephron
8. IgA

**SECTION-B**

**Answer the questions 5x10 =50marks**

9 .A) Write the digestion and absorption of lipids

Or

B) Write in detail extrinsic and intrinsic pathway of blood coagulation process?

10A) why pituitary called as Master gland explain in detail?

Or

B) Write about adrenaline hormones ?

11A) what is BMR explain the factors effecting BMR?

Or

B) Write the biological significance of calcium and copper?

12A) Write the structure and functions of liver?

Or

B) Write the homeostasis mechanism of kidneys?

13A) What is immunity and write about different types of immunity?

Or

B) Write in detail antigen-antibody reactions?

**ADIKAVI NANNAYA UNIVERSITY**  
**CBCS SEMESTER PATTERN**  
**Semester-V : BIO-CHEMISTRY**  
**PAPER -VI**

**Theory: BCT-601- Molecular Biology and Recombinant DNA technology**

**Unit- I : DNA Replication and Transcription**

**12 hours**

Nature and structure of the gene. DNA as genetic material . 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. Mechanism DNA Replication in *E.Coli* . Inhibitors of DNA replication.

Transcription - RNA polymerases of prokaryotes, Mechanism of Transcription -. Initiation-sigma factors and their recognition sites, Promoters,. Elongation, Termination- rho dependent and rho independent. Inhibitors of Transcription .

**Unit- II: Protein Synthesis and Regulation of Gene Expression**

**12 hours**

Genetic code : features of genetic code, wobble hypothesis, degeneracy of genetic code.

Protein synthesis- Ribosome structure,t-RNA , activation of amino acids (aminoacyl t-RNA synthetases). Initiation, elongation and termination of protein synthesis.

Post- translational modifications, signal hypothesis. Inhibitors of protein synthesis.

Regulation of prokaryotic gene expression- induction and repression. Ex: Lac operon in *E.coli*

**Unit- III: Recombinant DNA technology**

**12 hours**

Basic steps in r-DNA technology. Tools of r-DNA technology: Enzymes- Restriction endonucleases, ligase, phosphatases, reverse transcriptase, polynucleotide kinases, terminal transferase nucleases- $S_1$  and RNAase H. Restriction mapping. Cloning vectors- Plasmids, Cosmids,  $\lambda$  phages vectors

Applications of gene cloning- production of insulin and human growth hormone, production of Bt cotton and edible vaccines.

**Unit-IV Molecular biology Techniques and Bioinformatics**

Construction of c-DNA and genomic libraries. Isolation and sequencing of cloned genes- colony hybridization, nucleic acid hybridization, using  $\beta$ - galactosidases, green fluorescent proteins (GFP) DNA sequencing- Maxam Gilbert and Sanger's methods. Polymerase chain reaction- principle and applications. Outlines of blotting techniques-Southern, Northern and Western.

DNA Fingerfrinting .

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

**Unit V-Applied Biochemistry**

**12 hours**

Fermentation Technology: types of fermentations .Batch, continuous culture techniques, design of fermentor, principle types of fermentors. . Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin)

Enzyme Technology: Immobilization of enzymes and cells, different methods. Industrial applications of immobilization

**Practical: BCP-601: Molecular Biology & Recombinant DNA technology**

**45 hrs**

**List of Experiments:**

**(3 periods/week)**

1. Isolation of DNA from onion/liver/coconut endosperm.
2. Estimation of DNA by diphenylamine method.
3. Estimation of RNA by orcinol method.
4. Sequence alignments of insulin/BSA with other proteins using BLAST and FASTA.
5. Immobilization of microorganisms.
6. Ethyl alcohol production from grapes.

MODEL PAPER

**Sub: Biochemistry**

**Vth Semester (Theory )**

**Time : 3hrs**

**Duration :**

**3hrs**

**SECTION –A**

**Answer any Five questions 5x5 =25marks**

1. Okazaki fragments
2. DNA polymerase –I
3. Amin acyl t-RNA synthetase
4. Inhibitors of transcription
5. Edible vaccines
6. Growth hormones
7. PCR
8. Application of immobilized enzyme

**SECTION-B**

**Answer the questions 5x10 =50marks**

9 .A) Write the mechanism of semi conservative process of replication

Or

B) Write in detail about the transcription of prokaryotes?

10A) explain in detail about gene expression

Or

B) Write an account of genetic code and degeneracy of genetic code

11A) what is r-DNA technology and its applications?

Or

B) Write a history about gene cloning?

12A) illustrate the construction of c-DNA libraries ?

Or

B) write an account DNA sequencing ?

13A) write the various types of fermentations and their applications?

Or

B) discuss the immobilization of the enzymes ?

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**VI th SEMESTER**

**Elective –A : Basic Microbiology 60 hrs**  
**(5 periods/weeks)**

**Unit –I: History of Development of Microbiology** **12hrs**

- 1.1 Development of microbiology as a discipline, Spontaneous generation vs. biogenesis.
- 1.2 Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming.
- 1.3 Role of microorganisms in fermentation,
- 1.4 Germ theory of disease
- 1.5 Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Elie Metchnikoff, Edward Jenner

**Unit-II: Diversity of Microbial world** **12hrs**

- 2.1 classifications of microorganisms [Whittaker's five kingdoms and Carl Woese's three kingdom]
- 2.2 Difference between prokaryotic and eukaryotic microorganisms.
- 2.3 General characteristics of different groups: a cellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence and mode of reproduction.

**Unit-III : Viruses, Bacteria and Protozoa** **12hrs**

- 3.1 An introduction to viruses with special reference to the structure and replication of the following: Poxvirus and Poliovirus.
- 3.2 Bacterial Diseases- Cholera and Typhoid.
- 3.3 Viruses: TMV and T<sub>4</sub> .
- 3.4 Protozoan Diseases- Amebiasis and Malaria.

**Unit- IV: Algae** **12hrs**

- 4.1 History of phycology;
- 4.2 General characteristics of algae: occurrence, thallus organization
- 4.3 Algae cell ultra structure, pigments, flagella, eyespot food reserves
- 4.4 Vegetative, asexual and sexual reproduction.
- 4.5 Applications of Algae in agriculture, industry, environment and food.

**Unit- V: Fungi** **12hrs**

- 5.1 General characteristics of fungi - habitat, distribution, nutritional requirements,
- 5.2 fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and synthesis,
- 5.3 Asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism.
- 5.4 Economic Importance of Fungi in Agriculture, environment, Industry, medicine, food, biodeterioration, mycotoxins

## **ELECTIVE PRACTICAL : BASIC MICROBIOLOGY**

**45 hrs**

### **(3 per/week) List of Experiments:**

1. Microbiology Laboratory Practices and Bio safety.
2. To study the principle and applications of important instruments Autoclave, Incubator, , hot air oven, light microscope, laminar air flow )
3. Preparation and sterilization of culture media for bacterial cultivation
4. Study of different shapes of bacteria, fungi, algae, protozoa using permanent slides/ pictographs
5. Staining of bacteria using Gram stain
6. Isolation of pure cultures of bacteria by streaking method.
7. WIDAL test

### **SUGGESTED READINGS**

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W M.T.Brown Publishers.
2. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company
3. Prescott, Harley, Klein's Microbiology (2008) 7<sup>th</sup> Ed., Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York) ISBN: 978-007126727.
4. Mandell, Douglas and Bennett.S, Principles and practices of Infectious diseases, 7<sup>th</sup> edition, Volume, 2. Churchill Livingstone Elsevier. \
5. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J.Ryan, C. George Ray, Publisher: McGraw-Hill
6. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences



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**Cluster Elective : VIII-A-I**  
**CLINICAL BIOCHEMISTRY**

Hours 60

Marks 100

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**UNIT – I: Basic Medical Laboratory Principles and Procedures: 10 Hours**

- 1.1 Introduction to clinical biochemistry.
- 1.2 Glassware. Solutions and Reagents – Normal, Molar, percent, buffer solutions and indicators.
- 1.3 Equipments and Instruments – Centrifuges, Hot air oven, Incubator, Water bath, Photometer, Spectrophotometer, Analyzers.
- 1.4 Quality Control.

**UNIT – II: Clinical Biochemistry of Carbohydrates, Proteins & Lipids: 20 Hours**

- 2.1 Elementary classification and metabolism of carbohydrates.
- 2.2 Regulation of blood sugar and Diabetes.
- 2.3 Glucose Tolerance Test, Glycosylated Hemoglobin.
- 2.4 General classification of proteins. Structure of proteins.
- 2.5 Summary of protein digestion and amino acid metabolism.
- 2.6 Determination of plasma proteins and its importance
- 2.7 General lipid metabolism, functions and disorders of plasma lipoproteins

**UNIT – III: Clinical Biochemistry of Enzymes: 10 Hours**

- 3.1 Enzymes as catalysts.
- 3.2 structure and Functions of Isoenzymes.( LDH, CK, ALP)
- 3.3 Enzymes classification and nomenclature.
- 3.4 Enzymes in clinical diagnosis.
- 3.5 Laboratory determinations of enzymes in diagnosis of Liver, Kidney, Heart, brain disorders
- 3.6 Clinical significance of SGOT, SGPT, S.ALP, S.ACP, Serum Amylase etc

**UNIT- IV: Water & Mineral Metabolism and Acid-Base Balance: 10 Hours**

- 4.1 Body fluid distribution (Electrolyte and Water)
- 4.2 Factors which influence the distribution of body water.
- 4.3 Mineral metabolism- Importance of the trace elements (Cobalt, Molybdenum, Selenium and Chromium)
- 4.4 Acid-Base balance in body
- 4.5 Buffer systems in body to regulate acid-base balance

**UNIT - V: Function Tests:****10 Hours**

5.1 Diseases of the kidneys.

5.2 Creatine metabolism.

5.3 Bile pigment metabolism.

5.4 Disordered Bilirubin metabolism.

5.5 Hepatic Jaundice and Post hepatic jaundice. Ischemic heart disease.

5.6 Clinical significance of gastric analysis.

**Practicals:**

1. Glucose Tolerance Test

2. Determination of Glycosylated Hemoglobin

3. Determination of serum protein levels

4. Assay of SGOT

5. Assay of SGPT

6. Determination of serum bilirubin

7. Gastric analysis [demo with record]

**SUGGESTED READINGS**

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

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**Cluster Elective Paper: VIII-A-II**  
**HAEMATOLOGY**

Hours 60

Marks 100

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**UNIT – I: Laboratory Preparation in Hematology: 10 Hours**

- 1.1 Introduction to practical's in clinical laboratory
- 1.2 Basic requirements & principle in clinical laboratory
- 1.3 Collection of blood sample (phlebotomy)
- 1.4 Anticoagulants and effects of anticoagulants on blood cells.
- 1.5 Blood smear preparation, effects of storage of blood.

**UNIT – II: Hematology: 15 Hours**

- 2.1 Composition of blood.
- 2.2 Haemoglobin synthesis. Various haemoglobins.
- 2.3 Haemopoietic system of the body. . Erythropoiesis, Leucopoiesis and development of blood corpuscles. Thrombopoiesis.
- 2.4 Blood cell counts: Clinical significance of Total erythrocyte count, total leucocyte count, differential count
- 2.5 Erythrocyte sedimentation rate and platelet count.

**UNIT – III: Haemostasis and Hematological Disorders: 15 Hours**

- 3.1 General consideration of blood coagulation.
- 3.2 Mechanism of coagulation. The fibrinolytic mechanism. Clinical significance of routine coagulation tests.
- 3.3 Anaemia. Various types of anaemias – Iron deficiency anemia, Aplastic anemia, Perinicious anemia, Sideroblastic anemia and Sickel cell anemia.
- 3.4 Other hematological diseases – HDNB, Thalassaemia, Leukemia

**UNIT- IV: Automation in Hematology: 10 Hours**

- 4.1 General consideration- Blood cell counters.
- 4.2 Flow through cytochemical differential counter.
- 4.3 Automated coagulated systems.
- 4.4 automation in serum analysis

**UNIT - V: Immuno hematology and Blood banking: 10 Hours**

- 5.1 Human Blood Group Systems (random and cross check).
- 5.2 Inheritance of blood group systems.
- 5.3 Transfusion and blood components
- 5.4 Platelets separation, plasma separation

**CLUSTER ELECTIVE PRACTICAL : HAEMATOLOGY**

**45 hrs**

**(3 per/week)**

**List of Experiments:**

1. Separation of Serum
2. Separation of plasma
3. Erythrocyte sedimentation Rate SR
4. Platelet counting
5. Total count of RBC
6. Total count of WBC
7. Differential Count of WBC

**Note: \*\* FIELD VISIT TO NEAREST DIAGNOSTIC CENTER & BLOOD BANK**

**SUGGESTED READINGS**

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Medical laboratory technology by Mukaraje

**Cluster Elective Paper: VIII-A-III**

**MEDICAL MICROBIOLOGY**

Hours 60

Marks 100

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**Unit –I Beneficial Microbial Interactions with Human:** Normal microbial population of healthy human body - Skin, mouth, upper respiratory tract, intestinal tract, urino-genital tract, eye.

**Unit –II Harmful Microbial Interactions with Human :** Entry of pathogens into the host, types of bacterial pathogens, Mechanism of bacterial pathogenicity, colonization and growth, Virulence, Virulence factors – exotoxins, enterotoxins, endotoxins, neurotoxins

**Unit –III General Account of Epidemiology:** Principles of epidemiology, Current epidemics (AIDS, Nosocomial, Acute respiratory Syndrome,) Measures for prevention of epidemics –Global health consideration, Emerging and reemerging infectious diseases Biological warfare and biological weapons.

**Unit –IV Person to person Microbial disease:** Names of pathogen, disease symptoms, and preventive measures **airborne transmission of diseases by airborne pathogens:** Streptococcal diseases, Corynebacterium Diphtheria, and Whooping cough, Mycobacterium Tuberculosis

**Direct contact transmission of diseases:** Staphylococcus, Hepatitis viruses.

**Sexually transmitted diseases:** Gonorrhoea and syphilis

**Unit –V Animal transmitted, Artropod transmitted, Soil borne and Water borne microbial diseases:**

**Animal transmitted disease:** Rabies

**Artropod transmitted disease:** Malaria

**Soil borne diseases:** Tetanus

**Water borne microbial diseases:** Cholera, Giardiasis,.

**List of Experiments:**

**Project work**

**SUGGESTED READINGS**

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

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**VI TH SEMESTER**

**Elective B : Biochemical Correlations in Disorders**

**60 hrs (5 periods/week)**

**Unit- I: Hormonal Imbalances and Autoimmune diseases** **No. of Hours : 12**

- 1.1 Outline of hormone action and imbalances leading to disease - precocious puberty, hyper and hypo pituitarism.
- 1.2 Hyper and hypo thyroidism.
- 1.3 Hyper and hypo disorders of adrenal gland.

**Unit- II: Nutritional Deficiency and Life style Disorders** **No. of Hours : 12**

- 2.1 **Protein calorie malnutrition** - Kwashiorkar, Marasmus,
- 2.2 **DISORDERS OF VITAMINS WATER SOLUBLE:** Beri-beri, Scurvy, Pellagra, Pernicious anaemia,
- 2.3 **DISORDERS OF VITAMINS FAT SOLUBLE:** Night blind ness, Rickets, Osteomalacia, and Osteoporosis
- 2.4 Obesity, Cardiovascular diseases, Inflammatory Bowel Disease (IBD).

**Unit- IV: Disorders caused due to misfolded proteins And deficiency of minerals**

**No. of Hours : 12**

- 3.1 Alzheimer's, Huntington's disease,
- 3.2 Creutzfeldt-Jakob disease,
- 3.3 Haemoglobinopathies : Sickle cell anaemia, Thalassemia.
- 3.4 Wilson's disease, Menkes' disease, Goitre

**Unit- IV: Autoimmune disorders**

**No. of Hours : 12**

- 4.1 Concepts in immune recognition - self and non self discrimination,
- 4.2 organ specific autoimmune diseases – Hashimoto's thyroiditis, Grave's disease,
- 4.3 myasthenia gravis
- 4.4; Systemic diseases - SLE, rheumatoid arthritis; Diabetes Mellitus-I.

**Unit- IV: Organ Specific disorders** \

- 5.1 Digestive system: Gastritis, peptic ulcers, pancreatitis, steatorrhea, cirrhosis of liver, gallstones, appendicitis
- 5.2 Renal Disorders: Acute and chronic renal failure, kidney stones [Renal calculi ] Acute and Chronic Glomerular nephritis
- 5.3 Cancer: Types, mechanism, Etiology, metabolic changes, treatment (drugs, chemotherapy and radio therapy)

## **Elective Practical BCP- 602: Biochemical Correlations in Diseases**

**45 hrs**  
**(3 per/week)**

1. Glucose tolerance test.
2. Lipid profile: triglycerides and total cholesterol.
3. Obesity parameters.
4. RBC counting and haemoglobin estimation.
5. Blood pressure measurements.
6. Bone density measurements (visit to a nearby clinic).
7. T<sub>4</sub>/TSH assays.
8. Tridot Test/ Lateral flow test for viral diseases

### **SUGGESTED READINGS**

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc.  
(New York), ISBN: 978-0-4710-28173-4.
2. Immunology: A Short Course (2009) 6<sup>th</sup> ed., Coico, R and Sunshine, G., John Wiley & sons, Inc (New Jersey), ISBN: 978-0-470-08158-7
3. Biochemistry (2012) 7<sup>th</sup> ed., Berg, J.M., Tymoczko, J.L. and Stryer, L., W.H Freeman and Company (New York), ISBN: 13:978-1-4292-7635-1.
4. Genetics (2012) 6<sup>th</sup> ed., Snustad, D.P. and Simmons, M.J., John Wiley & Sons. (Singapore), ISBN: 978-1-118-09242-2.

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**VI TH SEMESTER**

**Elective cluster-602**  
**Cluster Electives –VIII-B-I**  
**Organization of cell structure**

**Unit-I Basics of Cell Biology (structure & function)**

- 1.1 Discovery of cell and Cell Theory.
- 1.2 Comparison between plant and animal cells.
- 1.3 Comparison between of prokaryotic And eukaryotic cell
- 1.4 Membrane structure & transport – Models of membrane structure, Membrane lipids, proteins and carbohydrates.
- 1.5 Solute transport by Simple diffusion, Facilitated diffusion and Active transport

**Unit- II: CELL SIGNALING**

- 2.1 Introduction to types of cell signalling (exocrine, endocrine and paracrine) ,
- 2.2 types of cell membrane receptors: G-Protein linked receptors.
- 2.3 Secondary messengers - cAMP, cGMP, IP<sub>3</sub>, , diacyl glycerol, Ca<sup>2+</sup>, NO.
- 2.4 Enzyme linked receptors
- 2.5 Ion-channel linked receptors

**Unit –III STRUCTURE OF CELL ORGANELLES**

- 3.1 structure and functions of cell organelles - Endoplasmic reticulum, Golgi complex, glycosylation of proteins
- 3.2 Lysosomes, ribosomes, peroxisomes
- 3.3 Mitochondria: Structure and Functions. Oxidative Metabolisms in the Mitochondrion, The Role of Mitochondria in the formation of ATP .
- 3.4 Chloroplast: structure and functions & an overview of photosynthesis.

**Unit-IV CYTOSKELETON & Nucleus**

- 3.1 Cytoskeleton – components of Cytoskeleton, Microtubule and Microfilaments
- 3.2 Structure of nucleus
- 3.3 Extracellular matrix
- 3.4 Cell-cell interactions



## **Unit –V Organization of genes and chromosomes**

5.1 Organization of genes and chromosomes (definitions of unique and repetitive DNA, interrupted genes, gene families)

5.2 cell division: Mitosis and meiosis, their regulation,

5.3 steps in cell cycle, regulation and control of cell cycle

5.4 Programmed cell death (Apoptosis)

### **PRACTICALS:**

1. Mitosis in onion root tip

2. Cell Meiosis in onion flower buds

3. Karyotyping

4. Problems on monohybrid ratio, dihybrid ratio, gene interaction, linkage and crossing over – 2 point test crossing over

### **Suggested Books:**

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

2. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.

4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

5. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.

6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

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**VI TH SEMESTER**

**Cluster Electives –VIII-B-II**

**GENETICS & ECOLOGY**

**Unit-I Mendel's Laws and Inheritance**

1.1 Mendel experiments-Mendel Laws and deviations: incomplete dominance and Co dominance

1.2 Penetration and pleiotropism

1.3 Recessive and Dominant epistatic gene interactions.

1.4 Concept of multiple alleles.

**Unit II -Genes and their variations:**

2.1 Structure of gene, gene and environment

2.2 gene copies and heterogeneity

2.3 Eukaryotic chromosome organization, histone proteins.

2.4 Gene transfer in bacteria (Conjugation, transformation and transduction).

2.5 linkage, recombination, interference and coincidence

2.6 sex determination

**Unit III Mutations and Repair:**

3.1 Gene mutations-Spontaneous, missense, nonsense, frame shift and induced mutations

3.2 Mutagens –Physical and chemical mutagens

3.3 Repair Mechanisms- Light induced repair, Mismatched repair, post – replicational repair, excisional repair, SOS repair.

**Unit IV chromosomal disorders**

4.1 Haemophilia, sickle cell anemia, Thalassaemia

4.2 Phenyl ketonuria

4.3 colour Blindness, cystic fibrosis

4.4 klinefelter's syndrome, Turner's syndrome

4.5 Edward syndrome, Patau syndrome

4.6 Cri-du-chat syndrome, Down's syndrome

4.7 chronic myelogenous leukaemias

## **Unit V ECOLOGY**

### **5.1 Concept of an ecosystem**

**5.2** Ecosystem structure & function;

5.3 producers, consumers and decomposers

5.4 food chains, food webs and ecological pyramids

5.5 characteristic features of the following ecosystems: forest ecosystem, desert ecosystem and aquatic ecosystem.

5.6 energy flow and mineral cycling (C,N,P);

5.7 conservation of biodiversity.

### **Practicals:**

1. To determine basal cover of trees in forest ecosystem-forest plantation.
2. qualitative of analysis of soil organic carbon
3. Qualitative analysis of soil pH
4. To study pore space, water holding capacity and bulk density of soil.
5. Identification of rocks and minerals on the basis of physical characters.
6. Problems and assignments in Mendilian genetics

### **Suggested Books:**

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
5. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

**Unit-1 Methods in Molecular biology**

- 1.1 Methods for measuring nucleic acid and protein interactions – foot printing, CAT assay, gel Shift analysis.
- 1.2 DNA markers in genetic analysis – RFLP, Minisatellites, Microsatellites, PCR based RAPD markers,
- 1.3 Chromosomal Walking, Chromosomal jumping.
- 1.4 RNA silencing – siRNAs and anti- sense RNAs- their design and applications.
- 1.5 Principle and applications of Nanotechnology

**Unit: 2 Plant tissue culture**

- 2.1 Plant tissue culture: Culture media – Composition and preparation,
- 2.2 Totipotency, Organogenesis and plant regeneration,
- 2.3 Somatic embryogenesis, Artificial seeds, Micropropagation.
- 2.4 Isolation and culture of protoplasts, Somatic hybridization.

**Unit: 3 Animal tissue culture:**

- 3.1 Animal tissue culture: Composition and preparation of culture media,
- 3.2 Primary cultures, established/continuous cell lines. T
- 3.3 Tissue and organ culture.
- 3.4 gene therapy-types and its applications

**Unit –IV stem cells**

- 4.1 Stem cells – Sources embryonic stem cells, adult stem cells, cord blood stem cells.
- 4.2 Generation of stem cells by cloning, stem cell differentiation, stem cell plasticity, preservation of stem cells.
- 4.3 Organogenesis through stem cells for transplantation.
- 4.4 Applications of stem cell therapy- Parkinson's disease and Alzheimer's disease.

**Unit: V Vaccines**

- 5.1 Vaccines Classification
- 5.2 Principles of vaccination, Design of vaccines.
- 5.3 Conventional vaccines – Whole organism, live and attenuated, purified macromolecules.
- 5.4 New generation vaccines- Recombinant antigen vaccines, recombinant vector antigens, DNA vaccines, synthetic vaccines, edible vaccines.
- 5.5 Vaccine delivery systems – Liposomes, micelles, ISCOMS.

**Practical's :**

Project work

### **Suggested Books:**

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
6. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
7. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
8. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers.
9. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
10. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA Genes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.