

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

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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 T₄ .
- 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) 7th 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, 7th 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

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

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

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.
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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. T₄/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) 6th ed., Coico, R and Sunshine, G., John Wiley & sons, Inc (New Jersey), ISBN: 978-0-470-08158-7
3. Biochemistry (2012) 7th 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) 6th 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, IP₃ , , diacyl glycerol, Ca²⁺, 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.