

**SARDAR PATEL UNIVERSITY V.V.NAGAR**  
**T.Y. B.SC. (BIOCHEMISTRY)**  
**EFFECTIVE FROM JUNE -2008**

**BC: 301 MOLECULAR BIOLOGY & GENETIC ENGINEERING**

**Unit 1: BASIC CONCEPTS OF MOLECULAR BIOLOGY**

- Definition & Concept of gene
- Nucleic acid as genetic information carries experimental evidence e.g.; Hershey Chase experiment
- Salient features of eukaryotic, prokaryotic & viral genomes.
- Basic concepts about the secondary structure of nucleic acid 5'-3'-direction, antiparallel strand base composition, base equivalence, base pairing & Chargaff's rules
- $T_m$  & its relationship with GC content & COT value.
- Secondary & tertiary structure of DNA: Watson & Crick model, A, B & Z types of DNA, DNA Super coiling.
- Structure of RNA: secondary & tertiary structure of RNA.

**Unit 2: DNA REPLICATION**

- Central dogma of molecular genetics.
- Semi conservative type of DNA replication.
- Experimental evidence for semi conservative replication- the Meselson – Stahl experiment.
- DNA replication in prokaryotes, DNA Polymerases, Other enzyme including protein factor involved in replication, Mechanism of replication (initiation, elongation & termination).
- DNA replication in Eukaryotes, Telomeric sequence & Telomerase.

**Unit 3: TRANSCRIPTION**

- Transcription in Prokaryotes & Eukaryotes.
- Promoters, TATA box,
- Mechanism of Transcription, RNA polymerase, initiation, elongation, termination.
- Post transcriptional processing of RNA –
  - Splicing mechanism of group 1, 2, 3 & 4.
  - Generation of 5' cap in eukaryotes mRNA 3' poly tail formation.
- Inhibition of RNA polymerase by antibiotics.
- Reverse Transcriptase.
- Transposable genetics elements.

#### **Unit 4: TRANSLATIONS.**

- Genetics code.
- Ribosome structure.
- Role of m-RNA & t-RNA in translations.
- Mechanism of translations (initiation, elongation, termination) in Prokaryotes and Eukaryotes.
- Post translational modification.
- Inhibition of protein synthesis by antibiotics & toxins.
- Protein targeting.

#### **Unit 5:**

- Regulation of gene expression :
  1. Gene mutation and repair.
  2. Regulation of gene expression in eukaryotes.
  3. Enzyme induction & repression.
  4. Operon Concept – Lac Operon, Tryptophan Operon.
  5. Upstream activation sequences.
  6. Transcriptional activation protein.
- Mutation, Hot spots (definition):
  1. Base analogues.
  2. Agents producing distortion in DNA.
  3. Thymine dimmer.
  4. X-rays, mismatch repair.
  5. Base excision repair.
  6. Nucleotide excision repair.
  7. Direct repair: UV repair system in E.Coil (Brief).

#### **Unit 6: RECOMBINATION DNA TECHNOLOGY & GENETIC ENGINEERING**

1. Gene cloning (introduction).
  2. Plasmids – natural plasmids, artificial plasmids (pBR 322) (Structures).
  3. Cloning vectors in brief: plasmids, lambda phase, cosmids, phasmids, Ti plasmids, YAC, BAC.
  4. Restriction endonulclease: its type & functions.  
Detection of Recombination clone:
    1. Use of gene probes.
    2. Southern Blotting.
    3. Northern Blotting.
    4. Western Blotting.
- PCR & its application.
  - DNA finger printing –RFLP.
  - Gene sequencing –
    1. Sanger's method.
    2. Maxam & Gilbert's method

**REFERENCE:**

- 1 Lehninger – biochemistry.
- 2 Genes, Levin 6.
- 3 Molecular biology of the Gene by Watson et al.
- 4 Elements of biotechnology by Gupta.
- 5 Gene cloning by T.A. Brown R.K.

**SARDAR PATEL UNIVERSITY V.V.NAGAR**  
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**BC: 302 ENZYMOLOGY**

**Unit 1:**

- History, general, characteristics, nomenclature, IUB enzyme classification (rational, overview and examples). Significance of numbering system. Definition with examples of holoenzymes, apoenzymes, coenzymes, activators inhibitors, active site, (identification of group excluded) metallo enzyme, Units of enzymes, substrate, group & stereo specificity. Few non protein enzymes eg; Abzyme, Ribozymes.
- Definitions of IU, Katal & enzyme turn over number & specific activity.

**Unit 2:**

- Role of cofactors in enzyme catalysis: NAD/NADP, FMN/FAD, Coenzyme, Role of vitamin as Co-enzymes - Co-enzyme A, Biotin, Cobalamine, Lipoamide, TPP, Pyridoxal phosphate, Tetrahydrofolate, metal ions with special emphasis on enzymes functions.
- Mechanism of enzyme action: acid-base catalysis, covalent catalysis Proximity & orientation effects, strain & distortion.
- Mechanism of action of Chymotrypsin, Carboxy peptidase ribonuclease & Lysozyme.

**Unit 3:**

- Methods for isolation, purification & characterization of enzymes.
- Methods that dependent on size/mass -centrifugation, Gel filtration, Dialysis & Ultra filtration.
- Methods that dependent on polarity - ion exchange chromatography, Electrophoresis, Isoelectric focusing, hydrophobic interaction chromatography.
- Methods that dependent on change in solubility- Change in pH change in ionic strength, Decrease in dielectric Constant.
- Methods that dependent on the possession of specific binding sites or structural features - Affinity chromatography, Affinity elution.

**Unit4:**

- Factors affecting enzyme activity :
  1. Enzyme concentration.
  2. Substrate concentration.
  3. pH & temperature.
  4. Derivation of M.M. Equation for unisubstrate reaction,  $K_m$  & its

significance.

5. Line Weaver Burk plot & its limitations, importance of  $K_{cat}/K_m$ .

6. Bisubstrate reaction: introduction to sequential & ping pong mechanism with egs.

- Kinetics of Zero & first order reactions. Significance & evaluation of energy of activation & free energy.
- Reversible & irreversible inhibition - competitive, non competitive & uncompetitive.
- Inhibitions, determination of  $K_m$  &  $V_{max}$  in presence & absence of inhibitor, Allosteric enzymes.

#### Unit 5:

- Enzyme in the Cell- intracellular compartmentation, isolation of sub cellular organelles,
- Enzyme located in following organelles -nucleus, endoplasmic reticulum, mitochondria, lysosomes, cytoplasm & compartmentation of metabolic pathway for carbohydrate, fat & protein. Enzymes in membrane, role of membrane.
- Industrial application of enzyme –
  1. Immobilization of enzyme & its industrial application.
  2. Production of glucose from starch, cellulose dextrin.
  3. Uses of lactose in dairy industrial, production of glucose - fructose syrup from sucrose.
  4. Uses of protease in food detergent, & leather.
  5. Uses of microorganism in brewing & cheese making.
  6. Uses of microorganism in production of organic chemicals.

#### Unit 6:

- Definition of functional & non functional plasma enzymes, isoenzyme & diagnosis tests, enzyme pattern in health & disease with special mention of plasma lipase, amylase, cholinesterase alkaline & acid phosphate, SGOT, SGPT, LDH, CPK.
- Use of enzyme to determine the concentration of metabolites of clinical importance fluids, blood glucose, uric acid & cholesterol, TG.
- Use of glucose oxidase in enzyme electrodes.
- Enzyme therapy- in treatment of genetics deficiency disease. Cancer therapy.

#### REFERENCE:

- 1 Fundamentals of enzymology, NicholasC.Price& Lewis Stevens.
- 2 Enzymes: Dixon & Webb.
- 3 Modern enzymology by Palmer.
- 4 Medical biochemistry by Rana Shinde.

SARDAR PATEL UNIVERSITY V.V.NAGAR  
T.Y. B.SC. (BIOCHEMISTRY)  
EFFECTIVE FROM JUNE -2008  
BC: 303 INTRODUCTIONS TO METABOLISM

**Unit 1:**

- Basic concepts – anabolism, catabolism, intermediary metabolism, metabolic pathway, regulation of metabolism.
- Carbohydrates metabolism:
  1. Glycolysis: central pathway of catabolism, citric acid cycles & its regulation.
  2. Pentose Phosphate pathways, Glyoxalate cycle, Cori's cycle.
  3. Gluconeogenesis & glycogen metabolism.

**Unit 2:**

- Oxidation of saturated fatty acid & its energetic (alpha, beta, omega) –
  1. Oxidation of unsaturated fatty acids & odd chains fatty acids.
  2. Ketone body formation.
- Biosynthesis of fatty acid, TG, phospholipids spingolipids & Cholesterol.
  1. Hormonal regulation of lipids metabolism.
  2. Role of liver & adipose tissues in lipids metabolism.

**Unit 3:**

- Basic concepts, classification of amino acids.
- Protein catabolism: protein turn over, amino acid pools, deamination, transamination, decarboxylation, urea cycle, detoxification of ammonia, Biosynthesis of non essential amino acid & their regulation.
- Fate of carbon skeleton of amino acids (Glycogenesis & ketogenic amino acid).

**Unit 4**

- Biosynthesis of purine & pyrimidine nucleotide & its degradation – Salvage pathway for purine & pyrimidine base.
- Porphyrine metabolism- biosynthesis and degradation of heme, production of bile pigments.

**Unit 5**

- Metabolism as an integrated process: relation between carbohydrates, fat & nucleic acid metabolism.
- Conservation of metabolic energy, electron transport chains, oxidative phosphorylation, mechanism of oxidative phosphorylation & theories (hypothesis) for ATP synthesis, uncouplers of oxidative phosphorylation,

- regulation of electron transport chain.
- Energy rich compound.
  - Inhibitors for oxidative phosphorylation.
  - Free radicals & antioxidant.

## Unit 6

- Disorder of following :
  1. Carbohydrates –
    - I. Glycogen storage disease.
    - II. Galactosamine.
    - III. Fructose intolerance.
    - IV. Pentosuria.
  2. Lipid –
    - I. Gaucherie's disease.
    - II. Niemann pieck disease.
    - III. Refsum's disease.
    - IV. Carnitine / carnitine Acyl transferase deficiency.
  3. Protein - phenylketouria, albism, maple syrup disease, homocystine urea, histidinemia, hyper-ammonemic syndrome.
  4. Nucleic acid – Gout.
  5. Commercial important plant metabolites in brief.
  6. Terprnoids - biosynthesis & function.
  7. phenol& flavonoids, biosynthesis & functions.
  8. Non protein amino acid, biosynthesis & functions.

## REFERENCE:

- 1 Principal of biochemistry by Lehninger.
- 2 Biochemistry by Satyanarayn.
- 3 Review of physiological biochemistry by Haroid Harper.
- 4 Biochemistry by Lipin Cott's.

SARDAR PATEL UNIVERSITY V.V.NAGAR  
T.Y. B.SC. (BIOCHEMISTRY)  
EFFECTIVE FROM JUNE -2008  
BC: 304. IMMUNOLOGY & CLINICAL BIOCHEMISTRY

Unit 1:

- Introduction to infection, sources of infection, methods of transmission of infection.
- Microbial pathogenicity, Immunity - innate, acquired; Measurement of immunity.
- Antigen & antibody - Essential feature of antigen, Biology classes of antigens.
- Antibody (immunoglobulin) - structure, properties & types, complements properties & function, complements pathway.
- Lymphocytes - primary & secondary lymphoid organ.
- Phagocytosis.
- Introduction & general feature of antigen - antibody reaction, measurement of antigen & antibody.

Unit 2:

- Serological reaction: Precipitation reaction, mechanism of precipitation, application of precipitation reaction, agglutination reaction, application of agglutination reaction.
- Complement fixation test, Immunofluorescence, Radioimmunoassay, ELISA.
- AIDS & Cancer.

Unit 3:

- Molecular basis of antibody diversity.
- Major histocompatibility complex.
- Immunology of transplantation - classification of transplantation, allograft reaction, mechanism of allograft rejection.
- Immunology of malignancy, tumor antigens, immune response in malignancy, cancer.

Unit 4:

- Hypersensitivity: types I, II, III & IV.
- Auto immunity -introduction, mechanism of autoimmunization, name of various autoimmune diseases, Rheumatoid arthritis in Detail.
- Vaccines & Vaccination: - types of immunization - passive & active, Routes of administration, Vaccination schedule.

## UNIT 5: BLOOD & BLOOD CELLS

- Introduction, functions, composition, normal values of blood constituents, commonly of clinical importance, specific gravity & viscosity of blood.
- ESR, Hematocrit, blood volume - definition, normal: blood volume, variation under different physiological conditions, causes of increase & decrease blood volume.
- Plasma proteins- chemistry, functions & separation of plasma protein.
- RBC - composition, normal cell count, volume, thickness, genesis, life span, energy metabolism in RBC.
- WBC- Anatomy, classification, total count & variation in count. Biochemical composition & function of WBC.
- Blood platelets (thrombocytes) –functions, purpura.

## Unit 6: BLOOD COAGULATION & Hb.

- Coagulation of blood - Theories of coagulation, Extrinsic & intrinsic mechanism of blood coagulation, Bleeding time, clotting time.
- Hb- chemistry, function, structure derivatives (types), properties & formation of Hb.
- Anemia -Types, causes & clinical symptoms.

## REFERENCES:

- Immunology by Kubey.
- Medical microbiology by Anantnarayan.
- Immunology by Roit, Male, 6th.
- Text book of physiology by C.C. Chatterjee.
- Clinical chemistry of fundamental text book by Donald F. Calbreath.
- Medical physiology by Guyton.

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T.Y. B.SC. (BIOCHEMISTRY)  
EFFECTIVE FROM JUNE -2008  
BC: 305 HUMAN PHYSIOLOGIES & CLINICAL ENDOCRINOLOGY

Unit 1: RESPIRATION & CIRCULATION

- Respiration: Definition, basic structure of lung, functions of respiratory system, transportation of O<sub>2</sub> & CO<sub>2</sub>, Acidosis & Alkalosis, (respiratory & metabolic) Dissociation of oxyhemoglobin, Hypoxia.
- Circulation: - importance of circulatory system, basic structure & function of heart, Cardiac cycle, blood pressure.

Unit 2: DIGESTION & EXCRETION

- Digestion & Absorption: Function of digestive system, Composition, Function of Saliva, gastric, pancreas, intestinal & bile secretion.  
-Digestive glands & digestion & absorption of Carbohydrates, Protein, lipids.
- Excretion :Basic Structure & function of Kidney , Structure of Nephron , Formation of urine ,GFR , renal threshold , threshold substances , Tubular load , plasma & renal clearance , Acidification of urine , T max Value.

Unit 3 PHYSIOLOGY OF MUSCLES, SLEEP, BODY TEMPERATURE

- Physiology of muscles - types of muscle, composition of skeletal muscle, properties of muscle & mechanism of muscles contraction.
- Organ functions testes - kidney function test, liver function tests.
- Physiology of sleep -requirement, physiology changes during sleep types of sleep, sleep disorders.
- Body temperature-introduction, variation of body temperature, heat balance, heat loss from the body, Regulation of body temperature, Hyperthermia - fever, hypothermia.

Unit 4 NEURO TRANSMITTERS, NEUROMODULATORS & SYNAPSE

- Neuro transmitters- definition, classification transport & release of neuron transmitter.
- Acetylcholine, noradrenaline, dopamine, serotonin, inactivation of neurotransmitter.
- Neuro modulators, Non opioid peptides & opioid peptides.
- Synapse - Definition, Classification, functions, nerve impulse transmission.

## Unit 5 CINICAL ENDOCRINOLOGY

- General introduction & definition of hormones - endocrine glands, classes & function of hormone , classification by tissue of origin , Classification by structure , Derivatives of fatty acid, mechanism of hormone action(receptor interaction , binding at cell surfaces, internal binding control of hormone releases , feed back control , hormone transport proteins , homeostasis of general function of hormone.

## Unit 6: FUNCTION & DISORDER OF FOLLOWING HORMONE

- Human Growth hormone.
- Thyroid hormone.
- Insulin.
- Aldosterone.
- Cortisol.
- Calcitonin.
- Oxytocin & ADH.

## REFERENCE:

- 1 Essential of medical physiology by *K. Sembulingam*, Prema Sembulingam 4th Ed.
- 2 Medical physiology by *Guyton*.
- 3 Human physiology by *C.C. Chattergees* Vol1&2.
- 4 Concised medical physiology by *Surgit chaudhari*.
- 5 Anatomy & physiology – *Tortora Grabasky*.
- 6 Clinical Biochemistry –*Allan GAW Robert A & Cown Shepherd*.
- 7 Medical Biochemistry – *Vasudevan*.

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EFFECTIVE FROM JUNE -2008  
BC: 306 MICROBIAL BIOCHEMISTRY AND FERMENTATION  
TECHNOLOGY

Unit 1:

- The structure of a microbial cell, difference between prokaryotic & eukaryotic cell.
- Different group of bacterial cells: Gram+ ve, Gram -ve: acid fast & non acid fast.
- Biosynthesis of bacterial cell walls: action of antibiotics on cell wall biosynthesis.

Unit 2:

- Whittaker system of classification living organisms.
- Microbial classification, nomenclature & identification: Archaeobacteria & eubacteria.
- Characteristics of microorganisms; introduction to biochemical & genetic methods for identification of microorganisms.
- Viruses' structure & Classification.

Unit 3:

- Microbial growth kinetics, quantitative measurement of bacterial growth.
- Primary & secondary metabolites production.
- Microbial diversity & its importance for novel metabolic production.
- Batch & continuous cultures of microorganisms; synchronous culture.
- Microbial cell culture in comparison with plant, animal cell culture.

Unit 4:

- Role of microorganism in fermentation technology.
- Introduction to fermentation process.
- The range of fermentation of process & component parts of fermentation processes.
- Isolation & preservation of industrially important microorganisms.
- Quality control of preserved stock cultures.
- Enrichment cultures & screening methods.
- The development inoculates for industrial fermentation; importance of uniform inoculates in batch cultures.

## Unit 5:

- fermentation of processes for production of:
  - Bread** -baking process & factors affecting baking qualities, flavors production in bakery products.
  - Malt beverages** -brewing of beer & other malt beverages & types of beer.
  - Vinegar**
    - Different types of Vinegar.
    - Fermentation methods for manufacturing Vinegar
    - Finishing process in Vinegar production.

## Unit 6:

- Fermentation of fruit -production of wine.
- Fermentation of Dairy production: - cheese, buttermilk, yogurt, cream, butter, spoilage, & defeat dairy product, spoilage in dairy ripening, and spoilage of finished cheese.
- Orient fermented foods: Soya Sauce (the Starter, manufacture & fermentation), Miso, tempeh, Ang-Khah, Natto, Soybean cheese, pidan, poi.

## REFERENCE:

- Microbiology by Peizar, Chan, Kreig. Tata Mc Graw Hill edition.
- Basic Microbiology by Power & Dagainawala.
- Principle of fermentation technology by Stanburry & Whitakar.
- Practical Microbiology by Siorckin & Cullimore.

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BC: 307

- Estimation of RNA by Orcinol method.
- Estimation of DNA by DPA method.
- Determination of SGOT
- Determination of SGPT
- Estimation of Alkline Phosphatase
- Estimation of Acid Phosphatase.
- Estimation of blood Urea by Urease
- Estimation of A/G ratio by biuret method.
- Estimation of total protein by Folin Lowry.
- Estimation of (total, HDL, LDL) Cholesterol.
- Estimation of Serum Amylase.
- To study the kinetics of ENZYME (Arginase) -
  1. Effect of Enzyme Concentration.
  2. Effect of Substrate Concentration.
  3. Effect of pH.
  4. Effect of Temp.
  5. Effect of time.

BC: 308

- Estimation of Albumin by BCG method.
- Estimation of Hb by Drabkin method.
- Estimation of creatinine by Jaff's method.
- Estimation of creatine by Jaff's method.
- Estimation of Uric acid by Uricase method.
- Estimation of total bilirubin.
- Estimation of Citric acid titration method.
- Estimation of reducing sugar by DNS method.
- Estimation of total sugar by Anthrone method.
- Estimation of TG by GPO method.
- WIDAL test
- Rheumatoid Arthritis.
- Estimation of Free fatty acid.
- Estimation of Ascorbic acid.

BC: 309

- Bleeding & clotting time.
- Total count of RBC.
- Total count of WBC.

- ESR.
- Differential Count of leukocytes.
- Chemical analysis of Normal Urine.
- Chemical analysis of Abnormal Urine.
- MBRT.
- Growth of E.Coil.
- Generalized test for factor influencing microbial growth.
- Estimation of Glucose by GOD POD.
- TLC for amino acid.
- Separation protein by electrophoresis.
- Estimation of milk by Pattern-Hustan method.
- Ethanol fermentation using yeast.
- Gram Staining.
- Measurement of the microbial growth by CFU measurement.
- Estimation of total: Ipid (phosphoValine method.).