

THE UNIVERSITY OF BURDWAN



SYLLABUS FOR THREE-YEAR DEGREE COURSE  
IN  
PHYSIOLOGY HONOURS  
UNDER  
CHOICE BASED CREDIT SYSTEM (CBCS)  
(With effect from 2017- 18)

**Course components and allotment of credits**

Semester	Name of the Course					Total Credits
	Core Course (CC)	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE)	
I	CC-1 CC-2	AECC-1	-	-	GE-1	22
II	CC-3 CC-4	AECC-2	-	-	GE-2	20
III	CC-5 CC-6 CC-7	-	SEC-1	-	GE-3	26
IV	CC-8 CC-9 CC-10	-	SEC-2	-	GE-4	26
V	CC-11 CC-12	-	-	DSE-1 DSE-2	-	24
VI	CC-13 CC-14	-	-	DSE-3 DSE-4	-	24
<b>Total Course Number (Sem-I to Sem-VI)</b>	<b>Total Core Course-14</b>  14×6=84 credits	<b>Total Ability Enhancement Compulsory Course-2</b>  4×1=4 credits 2×1=2 credits	<b>Total Skill Enhancement Course-2</b>  2×2=4 credits	<b>Total Elective: Discipline Specific-4</b>  4×6=24 credits	<b>Total Elective: Generic-4</b>  4×6=24 credits	<b>142</b>  (Total credits)

**Note:**

\* 14 Core Course (CC) are fixed for Physiology Honours. Students

\* 4 DSE and 2 SEC to be picked up by the Physiology Honours. Students (choice based) 4 GE under Physiology Honours syllabus to be picked up (choice based) by the other discipline student (other than Physiology Honours. Students ).

Physiology Honours. Students to be picked up 4 GE course from other discipline syllabus

## Semester wise Breakup (1<sup>st</sup> Year)

Semester	Course opted		Title of the course	Credits	Total Credits
<b>I</b>	AECC-I		ENVIRONMENTAL STUDIES	4	<b>22</b>
	CC-I	Theory	CELLULAR BASIS OF PHYSIOLOGY	4	
		Practical	CELLULAR BASIS OF PHYSIOLOGY	2	
	CC-2	Theory	BIOLOGICAL PHYSICS AND ENZYMES	4	
		Practical	BIOLOGICAL PHYSICS AND ENZYMES	2	
	GE-1	I	Any discipline/ subject other than Physiology	6	
<b>II</b>	AECC-II		ENGLISH COMMUNICATIONS / MIL	2	<b>20</b>
	CC-3	Theory	PHYSIOLOGY OF NERVE AND MUSCLE CELLS	4	
		Practical	PHYSIOLOGY OF NERVE AND MUSCLE CELLS	2	
	CC-4	Theory	CHEMISTRY OF BIOMOLECULES	4	
		Practical	CHEMISTRY OF BIOMOLECULES	2	
	GE-2	II	Any discipline/ subject other than Physiology	6	

## Semester wise Breakup (2<sup>nd</sup> Year)

Semester	Course opted		Title of the course	Credits	Total Credits
	CC-5	Theory	CIRCULATING BODY FLUIDS	4	
		Practical	CIRCULATING BODY FLUIDS	2	
	CC-6	Theory	CIRCULATION	4	
		Practical	CIRCULATION	2	
	CC-7	Theory	FUNCTIONS OF THE NERVOUS SYSTEM	4	
		Practical	FUNCTIONS OF THE NERVOUS SYSTEM	2	

<b>III</b>	<b>SEC-1</b>	<b>Theory</b>	<b>1A- DETECTION OF FOOD ADDITIVES/ ADULTERANTS 1B- HISTOPATHOLOGICAL TECHNIQUES (EITHER 1A OR 1B)</b>	<b>2</b>	<b>26</b>
	<b>GE-3</b>	<b>-</b>	<b>Any discipline/ subject other than Physiology</b>	<b>6</b>	
<b>IV</b>	<b>CC-8</b>	<b>Theory</b>	<b>ENERGY BALANCE, METABOLISM, AND NUTRITION</b>	<b>4</b>	<b>26</b>
		<b>Practical</b>	<b>ENERGY BALANCE, METABOLISM, AND NUTRITION</b>	<b>2</b>	
	<b>CC-9</b>	<b>Theory</b>	<b>GASTROINTESTINAL FUNCTION</b>	<b>4</b>	
		<b>Practical</b>	<b>GASTROINTESTINAL FUNCTION</b>	<b>2</b>	
	<b>CC-10</b>	<b>Theory</b>	<b>RESPIRATION</b>	<b>4</b>	
		<b>Practical</b>	<b>RESPIRATION</b>	<b>2</b>	
	<b>SEC-2</b>	<b>Theory</b>	<b>2A- CLINICAL BIOCHEMISTRY 2B- HEMATOLOGICAL TECHNIQUES (EITHER 2A OR 2B)</b>	<b>2</b>	
	<b>GE-4</b>	<b>-</b>	<b>Any discipline/ subject other than Physiology</b>	<b>6</b>	

### **Semester wise Breakup (3<sup>rd</sup> Year)**

<b>Semester</b>	<b>Course opted</b>		<b>Title of the course</b>	<b>Credits</b>	<b>Total Credits</b>
<b>V</b>	<b>CC-11</b>	<b>Theory</b>	<b>SPECIAL SENSES</b>	<b>4</b>	<b>24</b>
		<b>Practical</b>	<b>SPECIAL SENSES</b>	<b>2</b>	
	<b>CC-12</b>	<b>Theory</b>	<b>ENDOCRINOLOGY</b>	<b>4</b>	
		<b>Practical</b>	<b>ENDOCRINOLOGY</b>	<b>2</b>	
	<b>DSE-1</b>	<b>Theory</b>	<b>1A- BIOLOGICAL STATISTICS 1B- MICROBIOLOGY AND IMMUNOLOGY (EITHER 1A OR 1B)</b>	<b>4</b>	
		<b>Practical</b>	<b>THEORY CONCERN (EITHER 1A OR 1B)</b>	<b>2</b>	
	<b>DSE-2</b>	<b>Theory</b>	<b>2A- ERGONOMICS AND OCCUPATIONAL PHYSIOLOGY 2B- SPORTS AND EXERCISE PHYSIOLOGY</b>	<b>4</b>	

		(EITHER 2A OR 2B)				
		Practical	THEORY CONCERN (EITHER 2A OR 2B)	2		
VI	CC-13	Theory	REPRODUCTION	4	24	
		Practical	REPRODUCTION	2		
	CC-14	Theory	FORMATION AND EXCRETION OF URINE	4		
		Practical	FORMATION AND EXCRETION OF URINE	2		
	DSE-3	Theory	3A- HUMAN NUTRITION AND DIETETICS 3B- GENETICS AND MOLECULAR BIOLOGY (EITHER 3A OR 3B)	4		
		Practical	THEORY CONCERN (EITHER 3A OR 3B)	2		
	DSE-4	Theory	4A- TOXICOLOGY 4B- NANO-BIOTECHNOLOGY AND BIOINFORMATICS	4		
		Practical	THEORY CONCERN (EITHER 4A OR 4B)	2		

### LIST OF CORE COURSES (CC)

CC 1	:	CELLULAR BASIS OF PHYSIOLOGY
CC 2	:	BIOLOGICAL PHYSICS AND ENZYMES
CC 3	:	PHYSIOLOGY OF NERVE AND MUSCLE CELLS
CC 4	:	CHEMISTRY OF BIOMOLECULES
CC 5	:	CIRCULATING BODY FLUIDS
CC 6	:	CIRCULATION
CC 7	:	FUNCTIONS OF THE NERVOUS SYSTEM
CC 8	:	ENERGY BALANCE, METABOLISM, AND NUTRITION
CC 9	:	GASTROINTESTINAL FUNCTION
CC 10	:	RESPIRATION
CC 11	:	SPECIAL SENSES
CC 12	:	ENDOCRINOLOGY
CC 13	:	REPRODUCTION
CC-14	:	FORMATION AND EXCRETION OF URINE

### LIST OF DISCIPLINE SPECIFIC ELECTIVE (DSE) COURSES

DSE 1 :	DSE 1A- BIOLOGICAL STATISTICS
	DSE 1B- MICROBIOLOGY AND IMMUNOLOGY
DSE 2 :	DSE 2A- ERGONOMICS AND OCCUPATIONAL PHYSIOLOGY
	DSE 2B- SPORTS AND EXERCISE PHYSIOLOGY

- DSE 3 :** DSE 3A- HUMAN NUTRITION AND DIETETICS  
DSE 3B- GENETICS AND MOLECULAR BIOLOGY
- DSE 4 :** DSE 4A- TOXICOLOGY  
DSE 4B- NANO-BIOTECHNOLOGY AND BIOINFORMATICS

**LIST OF SKILL ENHANCEMENT COURSES (SEC)**

- SEC 1 :** SEC 1A-DETECTION OF FOOD ADDITIVES/ ADULTERANTS  
SEC 1B- HISTOPATHOLOGICAL TECHNIQUES
- SEC 2 :** SEC 2A- CLINICAL BIOCHEMISTRY  
SEC 2B- HEMATOLOGICAL TECHNIQUES

**LIST OF GENERIC ELECTIVE (GE) COURSES**

<b>Semester</b>	<b>Theory (Credit 4)</b>	<b>Practical (Credit 2)</b>
<b>GE - 1: Cellular Physiology, Biophysics, Biochemistry of Biomolecules</b>	a) Units of Human System b) Biophysical and Biochemical Principles c) Biochemistry of Bio Molecules.	a) Identification of permanent slides b) Fresh tissue experiments
<b>GE – 2: Digestion and Metabolism</b>	a) Digestive System b) Nutrition c) Metabolism	<b>Qualitative and Quantitative Biochemical Experiments</b>
<b>GE – 3: Respiratory and Cardiovascular Physiology</b>	a) Respiratory Physiology b) Cardiovascular Physiology c) Blood and Body Fluids	a) Haematological experiments I b) Haematological experiments II
<b>GE – 4: Endocrinology, Renal Physiology, Skin and Body Temperature Regulation</b>	a) Endocrine System b) Renal Physiology c) Skin and Regulation of Body Temperature	<b>Biochemistry</b>

## CORE COURSES (CC)

### **CC 1: CELLULAR BASIS OF PHYSIOLOGY** [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

**Theory:**

**Total Lecture-60**

**1. Introduction**

**2. Body fluid components**

**3. Organ systems, tissues and cells**

**4. Functional morphology of cells**

Microscopic structure and functions of eukaryotic endoplasmic reticuli, ribosome, golgi bodies, mitochondria, lysosomes, peroxisomes, cytoskeletal elements and centrosomes. Plasma membrane and subcellular membranes.

**5. Transports across cell membrane**

Ionpores, ion pumps, ion channels ionophores. Passive transport. Facilitated diffusion, uniport, symport, antiport. Active transport.

**6. Capillary wall**

**7. Intercellular communication**

Basic idea of tight junctions, gap junctions and cell adhesion molecules.

**8. Cell cycle**

**9. Cell division**

**a. Mitosis**

**b. Meiosis**

**10. Homeostasis**

**11. Aging**

**Practical :**

**Study and identification of stained section of different mammalian tissues and organs:**

Hyaline cartilage, Trachea, Lung, Spleen, Lymph gland, Parotid gland, Bone, Sub maxillary gland, Sublingual gland, Tongue, Oesophagus, Stomach, Duodenum, Jejunum, Ileum, Large intestine, Liver, Kidney, Ureter, Pancreas, Adrenal gland, Thyroidgland, Testis, Ovary, Spinalcord, Cerebralcortex, Cerebellum, Skin, Cardiac muscle, Skeletal muscle, Smooth muscle, Artery, Vein, Uterus.

**Suggested Reading**

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.

4. Harper's Biochemistry, by R.K. Murry and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.

## **CC 2: BIOLOGICAL PHYSICS AND ENZYMES**

### **[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

#### **Theory:**

**Total Lecture-60**

- 1. A Study of Units for Measuring Concentration of Solutes: Moles, Equivalent, Osmoles**
- 2. Principles of Dilution, pH, Buffers**  
Proteolysis of water, pH, acid-base neutralization curves
- 3. Bonds and Forces in Biomolecules**
- 4. Colloids, Properties, Importance**  
Colloids: Classification, properties—optical, electrical, electro kinetic. Biological importance of colloids
- 5. Surface tension, Specific Gravity**  
Surface tension and Specific Gravity: characteristics, factors influencing and biological applications
- 6. Viscosity and Resistance**  
Viscosity and Resistance characteristics, factors influencing and biological applications
- 7. Acids, Bases, Buffers and pH**  
Buffer action: Henderson-Hasselbalch equation. Regulation of pH by blood buffers.  
Determination of pH— Basic concept of indicators, principle of pH meter- hydrogen electrode and glass electrode
- 8. Flow and Pressure**  
Diffusion and Osmosis: osmotic pressure—laws.
- 9. Dialysis and Ultracentrifugation**  
Dialysis and ultrafiltration
- 10. Chromatography**
- 11. Electrophoresis**

**12. Autoradiography****13. Cell Fractionation and Tracer Techniques****14. Nanoparticles and its application in Physiology****15. Laminar and Streamline Flow****16. Poiseuille- Hagen Formula****17. Laws of Laplace****18. Thermodynamics**

Thermodynamics: Type of surroundings and systems, First Law–Internal energy, enthalpy. Second Law–Entropy, Free energy change, Endergonic and Exergonic reactions, Reversible and Irreversible processes, Equilibrium constant Physiological steady-state, Living body as a Thermodynamic system.

**19. Laws****20. Application in Physiology****21. Osmosis and Diffusion**

Diffusion and Osmosis: osmotic pressure–laws.

**22. A Study of Enzymes**

## a. Structures, coenzymes and Prosthetic Groups

Classification- EC nomenclature, Concept of apoenzyme, holoenzyme, coenzyme, cofactors and prosthetic group.

## b. Mechanism of Enzyme Action

Mechanism of enzyme action: Activation energy, Enzyme-substrate complex, Transition state and Products. Models of enzyme-substrate interactions. Specificity of enzymes.

Kinetics

Concept of initial rate, maximum velocity and steady-state kinetics.

## c. Michaelis Constant

Michaelis constant, Michaelis-Menten equation, Graphical representation of hyperbolic kinetics--Lineweaver-Burk plot. Significance of  $K_m$  and  $V_{max}$ .

## d. Modulation of Enzyme Activities

Competitive, non-competitive and uncompetitive inhibitions. Regulation of enzyme activities covalent modifications, allosteric modifications–Sigmoid kinetics and Hill equation: K- and M-series, Feed-back inhibition. Rate-limiting enzymes

## e. Factors controlling Enzyme Activities

Factors influencing enzyme-catalyzed reactions: substrate concentration, enzyme concentration, Max pH, temperature.

## f. Isoenzymes, Allosteric Enzymes

## g. Pro-enzymes

## h. Ribozymes, Abzymes

- i. Concept of Rate Limiting Enzymes

### **Practicals :**

1. Determination of Oncotic Solution Colloidal solutions
2. Determination of Systolic, Diastolic, Pulse and Mean Blood Pressure by non invasive methods (Auscultatory method).
3. Determination of enzyme activities (eg. SOD, CAT, Amylase, Transaminase etc.)

### **Suggested Reading**

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.

## **CC 3: PHYSIOLOGY OF NERVE AND MUSCLE CELLS** [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

### **Theory:**

**Total Lecture-60**

### **1. Excitable Tissues: Nerve**

#### **I. Introduction**

#### **II. Nerve cells**

Structure, classification and functions of neurons, Cytoskeletal elements and axoplasmic flow.

#### **III. Excitation and Conduction**

#### **IV. Measurement of electrical events**

Propagation of nerve impulse in different types of nerve fibers.

#### **V. Ionic basis of excitation and conduction**

The resting membrane potential, action potential, electrotonic potentials, current of injury and compound action potential.

#### **VI. Properties of mixed nerves**

Properties of nerve fibers: excitability, conductivity, all or none law, accommodation, adaptation, summation, refractory period, Indefatigability, Chronaxie & rheobase and utilization time. Injury to peripheral nerves—degeneration and regeneration in nerve fiber, changes in the nerve cell body, transneuronal degeneration, changes in receptor and motor end-plates, denervation hypersensitivity. Thermal changes of nerve during activity

#### **VII. Nerve fibre types and function**

#### **VIII. Neurotrophins**

Nerve growth factors and Neurotrophins

#### **IX. Glia**

Structure, classification and functions of neuroglia cells

### **2. Excitable Tissues: Muscle**

#### **I. Introduction**

#### **II. Skeletal Muscle**

##### **i. Morphology**

Microscopic and electron microscopic structure of skeletal muscles. The sarco-tubular system. Red and white striated muscle fibers. Muscle groups: antagonists and agonists. Muscle proteins.

##### **ii. Electrical phenomena and Ionic Fluxes**

Chemical, thermal and electrical changes in skeletal muscle during contraction and relaxation. Electromyography.

##### **iii. Contractile Responses**

Mechanism of skeletal muscle contraction and relaxation: Excitation-contraction coupling. Dihydropyridine receptors & Ryanodine receptors.

##### **iv. Energy sources and Metabolism**

Mechanical components of muscle. Isometric and isotonic contractions— muscle length, tension and velocity relationships.

##### **v. Properties of Muscle in the intact Organism**

Properties of skeletal muscle: excitability, contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity. Optimal load, optimal length of fibers.

### **III. Cardiac Muscle**

#### **i. Morphology**

Microscopic and electron microscopic structure of cardiac muscles.

#### **ii. Electrical Properties**

#### **iii. Mechanical Properties**

#### **iv. Metabolism**

#### **v. Pacemaker Tissue**

### **IV. Smooth Muscle**

#### **i. Morphology**

Microscopic and electron microscopic structure of smooth muscles. Single-unit and multi unit smooth muscle

#### **ii. Visceral smooth Muscle**

#### **iii. Multi- unit Smooth Muscle**

## **3. Synaptic and Junctional Transmission**

### **I. Introduction**

### **II. Synaptic Transmission**

#### **i. Functional Anatomy**

Synapses: types, structure, synaptic transmission of the impulse,.

#### **ii. Electrical Events at Synapses**

synaptic potentials

#### **iii. Inhibition and Facilitation at Synapses**

#### **iv. Chemical Transmission at Synaptic Activity**

Neurotransmitters, co transmitters and neuromodulators

#### **v. Principal neurotransmitter Systems**

#### **vi. Synaptic Plasticity and learning**

### **III. Neuromuscular Transmission**

#### **i. Neuromuscular Junction**

The neuromuscular junction : structure, transmission, end- plate potential, MEPP and post-tetanic potentiation. Motor unit and Motor point.

## ii. Denervation Hypersensitivity

### 4. Initiation of Impulses in Sense Organs

#### I. Introduction

#### II. Sense Organs and Receptors

Classification of general and special senses. Receptors as biological transducers. General concept of ionotropic and metabotropic receptors. Structure, sub-types and functions of nicotinic and muscarinic acetylcholine receptors. Adrenoceptors, glutamate receptors (NMDA and AMPA receptors), GABA, opiate, serotonin, dopamine and histamine receptors.

#### III. The Senses

#### IV. Electrical and Ionic Events in Receptors

Muller's law of specific nerve energies. Weber-Fechner law, Steven's power law. Sensory transduction in Pacinian corpuscle. Adaptation of receptors—phasic and tonic adaptations.

#### V. "Coding" of Sensory Information

#### CC4T

### Practicals

1. Isolation and staining of staining of nerve fibers with node (s) of Ranvier ( $\text{AgNO}_3$ ) and muscle fiber (H and E).
2. Preparation of Sciatic nerve innervated Gastrocnemius muscle of toad.
3. Study of Kymograph, Induction coil, Key and other instruments used to study mechanical responses of skeletal muscle.
4. Kymographic recording of mechanical responses of Gastrocnemius muscle to a single stimulus and two successive stimuli.
5. Kymographic recording of the effects of variations of temperature and load (after-load) on single muscle twitch.
6. Calculation of work done by the muscle.
7. Determination of nerve conduction velocity.

### Suggested Reading

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
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19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.

**CC 4: CHEMISTRY OF BIOMOLECULES**  
**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

**1. Carbohydrates**

- a. Classification of Carbohydrates  
 Definition and classification of Carbohydrates
- b. Structure of Carbohydrates  
 Cyclic structures- Pyranose and furanose forms, structure of disaccharides and polysaccharides.
- c. Properties of Carbohydrates  
 stereoisomerism, optical isomerism, optical activity, epimerism, anomerism, mutarotation and its mechanism. Chemical reactions of monosaccharides (Glucose & Fructose) – Reactions with concentrated mineral acids, alkali, phenylhydrazine and their biochemical importance
- d. Function of Carbohydrates

Derivatives of monosaccharides --Amino sugars, deoxysugars, sugar alcohols, sugar acids, sugar esters, their biochemical and physiological importance.

## 2. Proteins and Lipids

- a. Classification of Proteins and lipids  
Definition and classification of proteins and Fatty acids - Classification, systemic nomenclature. Mono, Di and Triglycerides. Classification, Structure, Nomenclature of proteins and amino acids.
- b. Structure of Proteins and lipids  
Structure and properties of peptide bonds-- Phi and Psi angles. Different levelsof protein structure-- Primary, Secondary ( $\alpha$ -helix and  $\beta$ -pleated sheet), Tertiary and Quarternary. Forces stabilizing the structures. Lipoproteins- Structure and classification.
- c. Properties of Proteins and lipids  
Properties of Fat and Fatty acids--Hydrolysis, Saponification, Saponification number, Iodine number, Acetylation- Acetyl number, Hydrogenation, Rancidity-Acid number, Reichert-Meissl number. Cis-trans isomerism. Eicosanoids, Phospholipids, Glycolipids, Sphingolipids, Cholesterol & its ester-their structure and physiological importance. Protonic equilibria of Amino acids--Zwitterions, Isoelectric point, titration curve of amino acids. Reactions with ninhydrin and formaldehyde. Reactions with Sanger's and Edman's reagent. Biuret reaction. Denaturation and Renaturation.
- d. Functions of Proteins and lipids  
Physiological importance of proteins and lipids

## 3. DNA and RNAs

- a. Structure of DNA and RNA
- b. Types of DNA and RNA
- c. Functions of DNA and RNA

### Practicals

1. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic Acid, Uric Acid, Glucose, Galactose, Fructose, Sucrose, Lactose, Albumin, Gelatin, Peptone, Starch, Dextrin, Urea, Glycerol, Bile salts.

### Suggested Readings

1. TextbookofMedicalPhysiology,by A.C.Guyton.W.B.SaundersCo.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.

9. SamsonWright'sAppliedPhysiology.EditedbyC.A.Keele.ENeil&N. Toels.OxfordUniversity Press.
- 10.Physiology,by R.M.Berne&M.N.Levy,C.V.MosbyCo.
- 11.BasicHistology,by L.C.Junqueira&JCarneiro,McGraw-Hill.
- 12.Histology-ATextandAtlas,byM.H.Ross&E.J.Reith.TheWilliamsandWilkinsCompany.
- 13.Bailey'sTextBookofHistology,revisedby W.M.Copenhaver;TheWilliams andWilkinsCompany.
- 14.TheCell–AMolecularApproach,G.M.Cooper&R.E.Hausman,ASMPressSINAUER.
- 15.CoreTextBookofNeuro-Anatomy,byM.B. Carpenter;theWilliamsandWilkinsCompany.
16. TheHumanNervousSystem,byCharlesNobach,McGrawHillBookCo.
- 17.BiomedicalInstrumentation&Measurements,byL.Cromwell,F.J.Weibell& E.A.Pfeiffer; Prentice-HallofIndiaPvtLtd.
18. TheHumanNervousSystem.By M.L.Barr&J.A.Kierman,Harper&Row.
- 19.EssentialFoodandNutrition,byM.Swaminathan.TheBangalorePrinting&PublishingCo.Ltd.
20. EssentialImmunology,byI.M.Roitt,BlackwellScientificPublications.
- 21.KubyImmunology,byR.A. Goldsby.T.J.Kindtand B.A.Osborne,W.H. FreemanandCo.
- 22.Microbiology,byM.J.Pelczar&Others;TataMcGrawHillPublishingCo. Ltd.
- 23Cellular&MolecularBiology,byEDPDeRobertis&EMFDeRobertis;Lea&Febiger.
24. Molecular Biologyof the Gene, byJ.D. Watson, H.H. Nancy &others; Benjamin-Cummings.
25. MolecularBiologyoftheCell,by B.Albertsandothers,Garland.
26. TextbookofMedicalPhysiology,InduKhurana,Elsevier.
27. Carleton's Histological Techniques, byR.A.B. Drury&E.A. Wellington, OxfordUniversityPress.
- 28.HandbookofExperimentalPhysiologyand Biochemistry, byP.V.Chadha; Jaypee BrothersMedicalpublishers.
- 29.Neurobiology,byG.M.Shepherd,OxfordUniversity Press
- 30.Biochemistry,byL.Stryer,W.H.FreemanandCo.

## **CC 5 : CIRCULATING BODY FLUIDS**

### **[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

#### **Theory:**

**Total Lecture-60**

#### **1. Concepts in theory**

**a. Introduction**

**b. Blood**

Formed elements of blood– origin, formation, functions and fate. Blood volume – normal values, regulation and determination by dye and radioisotope methods.

**c. Bone Marrow**

**d. White Blood Cells**

**e. Immune Mechanisms**

**f. Platelets**

**g. Red Blood Cells**

Haemoglobin– Structure, reactions, biosynthesis and catabolism. Foetal haemoglobin. Abnormal haemoglobins- Sickle-cell anemia and Thalassemia. Different types of anaemia and their causes.

**h. Blood Types**

Blood group – ABO and Rh. Erythroblastosis foetalis. Blood transfusion and its hazards.

**i. Plasma, Hemostasis**

Plasmaproteins– normal values, origin and functions. Hemostasis– factors, mechanism, anticoagulants, procoagulants. Disorders of hemostasis. Hemophilia, thrombosis and embolism

**j. Lymph**

Lymph and tissue fluids– formation, circulation, functions and fate. Lymphatic organs- histological structures and functions of lymph gland and spleen.

**k. Clinical implications.****Practicals**

1. Preparation and staining of blood film with Leishman's stain.
2. Identification of the blood corpuscles.
3. Differential count of WBC.
4. Total count of RBC and WBC.
5. Bleeding time and clotting time
6. Hemoglobin estimation
7. Preparation of haemin crystals
8. Preparation and staining of bone marrow.
9. Measurement of diameter of megakaryocyte.
10. Reticulocyte staining
11. . Blood group determination.

**Suggested Reading**

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
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8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.

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16. TheHumanNervousSystem,byCharlesNobach,McGrawHillBookCo.
- 17.BiomedicalInstrumentation&Measurements,byL.Cromwell,F.J.Weibell& E.A.Pfeiffer; Prentice-HallofIndiaPvtLtd.
18. TheHumanNervousSystem.By M.L.Barr&J.A.Kierman,Harper&Row.
- 19.EssentialFoodandNutrition,byM.Swaminathan.TheBangalorePrinting&PublishingCo.Ltd.
20. EssentialImmunology,byI.M.Roitt,BlackwellScientificPublications.
- 21.KubyImmunology,byR.A. Goldsby.T.J.Kindtand B.A.Osborne,W.H. FreemanandCo.
- 22.Microbiology,byM.J.Pelczar&Others;TataMcGrawHillPublishingCo. Ltd.
- 23Cellular&MolecularBiology,byEDPDeRobertis&EMFDeRobertis;Lea&Febiger.
24. Molecular Biologyof the Gene, byJ.D. Watson, H.H. Nancy &others; Benjamin-Cummings.
25. MolecularBiologyoftheCell,by B.Albertsandothers,Garland.
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27. Carleton's Histological Techniques, byR.A.B. Drury&E.A. Wellington, OxfordUniversityPress.
- 28.HandbookofExperimentalPhysiologyand Biochemistry, byP.V.Chadha; Jaypee BrothersMedicalpublishers.
- 29.Neurobiology,byG.M.Shepherd,OxfordUniversity Press
- 30.Biochemistry,byL.Stryer,W.H.FreemanandCo.

## **CC 6: CIRCULATION**

**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

### **Theory:**

**Total Lecture-60**

### **1. Origin of the Heartbeat & the Electrical Activity of the heart**

#### **a. Introduction**

#### **b. Origin & Spread Of Cardiac Excitation**

Cardiac action potential. Origin and propagation of cardiac impulse.

#### **c. The Electrocardiogram**

Electrocardiography –the normal electrocardiogram, electrocardiographic leads,vectorial analysis, the vectorcardiogram, the mean electrical axis of heart. The His bundle electrogram.

#### **d. Cardiac Arrhythmias**

Cardiac Arrhythmias – Normal cardiac rate. Myocardial Infarctions. Cardioplegic solutions.

#### **e. Electrocardiographic Findings in Other Cardiac & Systemic Diseases, hypertrophy and cardiac myopathy**

## 2. The Heart as a Pump

### a. Introduction

Anatomy of the heart. Properties of cardiac muscle. Cardiac Innervation. Stannius ligature.

### b. Mechanical Events of the Cardiac Cycle

The cardiac cycle- pressure and volume changes. Heart sounds. Murmurs.

### c. Cardiac Output

Cardiac output- measurement by application of Fick's principle and dye dilution method, factors affecting. Starling's law of heart.

## 3. Dynamics of Blood & Lymph Flow

### a. Introduction

### b. Anatomic Considerations

Functional morphology of arteries, arterioles, capillaries, venules and veins, sinusoids. General pattern of circulation and significance of branching of blood vessels.

### c. Biophysical Considerations

Hemodynamics of blood flow.

### d. Arterial & Arteriolar Circulation

### e. Capillary Circulation

### f. Lymphatic Circulation & Interstitial Fluid Volume

### g. Venous Circulation

## 4. Cardiovascular regulatory Mechanisms

### a. Introduction

### b. Local Regulatory Mechanisms

Cardiac and vasomotor centers, baroreceptors and chemoreceptors, cardiac and vasomotor reflexes.

### c. Substances Secreted by the Endothelium

### d. Systemic Regulation by Hormones

### e. Systemic Regulation by the Nervous System

Cardiovascular homeostasis- neural and chemical control of cardiac functions and blood vessels.

## 5. Circulation Through special Regions

### a. Introduction

### b. Cerebral Circulation

#### i. Anatomic Considerations

#### ii. Cerebrospinal Fluid

#### iii. Cerebrospinal Fluid

#### iv. The Blood-Brain barrier

#### v. Cerebral Blood Flow

#### vi. Regulation of Cerebral Circulation

**vii.** Brain Metabolism & Oxygen Requirements

- c.** Coronary Circulation
- d.** Splanchnic Circulation
- e.** Circulation of the skin
- f.** Placental & Fetal Circulation

**4. Cardiovascular Homeostasis in Health & Disease**

- a. Introduction
- b. Compensation for Gravitational Effects
- c. Exercise
- d. Inflammation & Wound Healing
- e. Shock

Cardiovascular adjustment after haemorrhage. Hypovolemic and hypervolemic shock. RTI and atherosclerosis.

- f. Hypertension

The pulse – arterial and venous. Blood pressure– its measurement and factors affecting.

- g. Heart Failure, stroke

**Practicals**

1. Preparation of Amphibian Ringer solution
2. Kymographic recording of the movements of perfused heart of toad.
3. Study of the effects of changes in perfusion fluid pressure, changes in temperature, excess calcium and potassium ion concentration, acetylcholine, adrenaline on the movement of heart.

**Suggested Reading**

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.

21. Kuby Immunology, by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.

**CC7: FUNCTIONS OF THE NERVOUS SYSTEM**  
**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

**1. Reflexes :**

- a. Introduction
- b. Monosynaptic Reflexes: The Stretch Reflex
- c. Polysynaptic Reflexes: The Withdrawal Reflex
- d. General Properties of Reflexes

**2. Cutaneous, Deep and Visceral Sensation**

- a. Introduction  
 Ascending and descending tracts: origin, courses, termination and functions. Lower and upper motor neurones. Functions of the spinal cord with special reference to functional changes following hemisection and complete section of spinal cord. Brown-Sequard syndrome, Spinal animal. Pain production, perception and regulation. Referred pain.
- b. Pathways
- c. Touch
- d. Proprioception
- e. Temperature
- f. Pain
- g. Other Sensations

**3. Arousal Mechanism, Sleep and the Electrical Activity of the Brain**

- a. Introduction
- b. The Reticular Formation & the Reticular Activating System  
 Reticular formation: organization, connection and functions of ascending and descending reticular formation. Physiological basis of sleep and wakefulness
- c. The Thalamus & the Cerebral Cortex
- d. Evoked Cortical Potentials
- e. The Electroencephalogram
- f. Physiological Basis of the EEG, Consciousness, & Sleep
- g. Interpretation of abnormal EEG pattern

**4. Control of Posture and Movement**

- a. Introduction
- b. General Principles

- c. Corticospinal & Corticobulbar System
  - d. Anatomy & Function
  - e. Posture and its regulation  
Decerebrate rigidity, Decorticate rigidity, Postural reflexes and regulation of Posture
  - f. Basal Ganglia
  - g. Cerebellum
  - h. Movement disorders
- 5. The Autonomic Nervous System**
- a. Introduction
  - b. Anatomic Organization of Autonomic Outflow
  - c. Chemical Transmission at autonomic Junctions
  - d. Responses of Effector Organs to Autonomic Nerve Impulses
  - e. Cholinergic and Adrenergic Discharge
- 6. Central Regulation of Visceral Function**
- a. Introduction
  - b. Medulla Oblongata
  - c. Hypothalamus
    - i. Anatomic Considerations
    - ii. Hypothalamic Function
    - iii. Relation to Autonomic Function
    - iv. Relation to Sleep
    - v. Relation to Cyclic Phenomena
    - vi. Hunger
    - vii. Thirst
    - viii. Control of Posterior Pituitary Secretion
    - ix. Control of Anterior pituitary Secretion
    - x. Temperature Regulation, fever
- 7. Neural Basis of Instinctual Behaviour and Emotions**
- a. Introduction
  - b. Anatomic Considerations
  - c. Limbic Functions  
Limbic system: structure, connections and functions. Physiology of emotion.
  - d. Sexual Behavior
  - e. Fear & Rage
  - f. Motivation
- 8. Higher Functions of the Nervous System**
- a. Introduction
  - b. Methods
  - c. Learning & Memory  
Higher functions of nervous system: conditioning, learning, short-term and long-term memory. Speech and Aphasia. Asymmetrical organization of certain cognitive functions-split brain
  - d. Functions of the Neocortex  
Electrophysiology of brain: spontaneous electrical activity of brain, EEG and ECoG, evoked potential, DC potential. Isolated cortex.
  - e. Disorders relating learning and memory

## Practicals

1. Experiments on superficial (plantar) and deep (knee jerk) reflex
2. Measurement of grip strength
3. Reaction time by stick drop test
4. Short term memory test (shape, picture word)
5. Two point discrimination test

## Suggested Reading

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## CC 8: ENERGY BALANCE, METABOLISM, AND NUTRITION [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

**Theory:**

**Total Lecture-60**

1. Concepts in theory

- a. Introduction
- b. Energy metabolism
- c. Carbohydrate metabolism

Glycolysis, R-L cycle Detail, TCA cycle. Gluconeogenesis Cori cycle, Glucose Alanine cycle. Anaplerotic reactions and Amphibolic nature of TCA cycle. Pentose Phosphate Pathway. Glycogenesis and Glycogenolysis.

*(Hormonal regulation of the above mentioned biochemical pathways /cycles not required.)*

- d. Protein metabolism

Amino acids Amino acid pool. Deamination, transamination, amination and decarboxylation. Synthesis of Urea and Nitric oxide. Basic idea of glucogenic and ketogenic amino acids. Metabolism of glycine, sulfur-containing amino acids, tryptophan and phenylalanine.

*(Hormonal regulation of the above mentioned biochemical pathways /cycles not required.)*

- e. Fat and cholesterol metabolism

$\beta$ -oxidation and biosynthesis of saturated and monounsaturated fatty acids. Carnitine shuttle. Metabolism of Triglycerides. Biosynthesis of Lecithin, Cephalin and Cholesterol. Metabolism of Adipose Tissue. Role of lipoproteins in transport and storage of lipids. Formation of Reactive Oxygen Species (ROS) and the role of Catalase, Superoxide Dismutase, Glutathione Peroxidase and Glutathione Reductase in combating oxidative stress– role of vitamins.

*(Hormonal regulation of the above mentioned biochemical pathways /cycle not required.)*

- f. Integration of carbohydrate, fat and protein metabolism  
Biological oxidation– Redox Potential. Mitochondrial Electron Transport Chain. Oxidative Phosphorylation–Inhibitors and uncouplers.
- g. Nutrition – BMR, RQ, RDA, SDA, NPU, Biological value of proteins, vitamins and minerals

Basal metabolic rate-factors, determination by Benedict-Roth apparatus. biological value of proteins – measurement and factors affecting. Proteins spacers. Supplementary value of protein. Protein efficiency ratio and net protein utilization of dietary proteins. Dietary fibres

## **Practicals**

### **1. Biochemical Estimation**

- a. Quantitative estimation of glucose and sucrose by Benedict's method.

- b. Quantitative estimation of amino nitrogen (Sorensen's formol titration method [percentage as well as total quantity to be done]).
- c. Estimation of percentage quantity of lactose in milk by Benedict's method.

### Suggested Reading

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2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
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28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.

## CC 9: GASTROINTESTINAL FUNCTION [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

### Theory:

**Total Lecture-60**

#### 1. Digestion & Absorption

##### a. Introduction

Anatomy and histology of alimentary canal, Deglutition and Movements of alimentary canal and their regulations.

- b. Carbohydrates
- c. Proteins & Nucleic Acids
- d. Lipids
- e. Absorption of Water & Electrolytes
- f. Absorption of Vitamins & Minerals

## 2. Regulation of Gastrointestinal Function

- a. Introduction

Digestive glands – histological structures of salivary glands, pancreas and liver.

- b. General Considerations

Composition, functions and regulation of the secretion of salivary, gastric, pancreatic and intestinal juices and bile. Synthesis of Bile acids. Enterohepatic circulation, Feces and defecation. GALT, MALT. Basic concepts of Peptic Ulcer, Jaundice and Gall-stones Cholelithiasis.

- c. Gastrointestinal hormones
- d. Mouth & Esophagus
- e. Stomach
- f. Exocrine Portion of the Pancreas
- g. Liver & Biliary System
- h. Small Intestine
- i. Colon

## Practicals

1. Kymographic recording of normal movements of rat's intestine in Dale's apparatus.
2. Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements

## Suggested Reading

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.

9. SamsonWright'sAppliedPhysiology.EditedbyC.A.Keele.ENeil&N. Toels.OxfordUniversity Press.
- 10.Physiology,by R.M.Berne&M.N.Levy,C.V.MosbyCo.
- 11.BasicHistology,by L.C.Junqueira&JCarneiro,McGraw-Hill.
- 12.Histology-ATextandAtlas,byM.H.Ross&E.J.Reith.TheWilliamsandWilkinsCompany.
- 13.Bailey'sTextBookofHistology,revisedby W.M.Copenhaver;TheWilliams andWilkinsCompany.
- 14.TheCell–AMolecularApproach,G.M.Cooper&R.E.Hausman,ASMPressSINAUER.
- 15.CoreTextBookofNeuro-Anatomy,byM.B. Carpenter;theWilliamsandWilkinsCompany.
16. TheHumanNervousSystem,byCharlesNobach,McGrawHillBookCo.
- 17.BiomedicalInstrumentation&Measurements,byL.Cromwell,F.J.Weibell& E.A.Pfeiffer; Prentice-HallofIndiaPvtLtd.
18. TheHumanNervousSystem.By M.L.Barr&J.A.Kierman,Harper&Row.
- 19.EssentialFoodandNutrition,byM.Swaminathan.TheBangalorePrinting&PublishingCo.Ltd.
20. EssentialImmunology,byI.M.Roitt,BlackwellScientificPublications.
- 21.KubyImmunology,byR.A. Goldsby.T.J.Kindtand B.A.Osborne,W.H. FreemanandCo.
- 22.Microbiology,byM.J.Pelczar&Others;TataMcGrawHillPublishingCo. Ltd.
- 23Cellular&MolecularBiology,byEDPDeRobertis&EMFDeRobertis;Lea&Febiger.
24. Molecular Biologyof the Gene, byJ.D. Watson, H.H. Nancy &others; Benjamin-Cummings.
25. MolecularBiologyoftheCell,by B.Albertsandothers,Garland.
26. TextbookofMedicalPhysiology,InduKhurana,Elsevier.
27. Carleton's Histological Techniques, byR.A.B. Drury&E.A. Wellington, OxfordUniversityPress.
- 28.HandbookofExperimentalPhysiologyand Biochemistry, byP.V.Chadha; Jaypee BrothersMedicalpublishers.
- 29.Neurobiology,byG.M.Shepherd,OxfordUniversity Press
- 30.Biochemistry,byL.Stryer,W.H.FreemanandCo.
- 31.Molecular Cell Biology, by H. Lodish, D. Baltimore &others. ScientificAmericanBook.
- 32.Genetics:AnalysisofGenesandGenomes,byDLHartlandEW Jones&BurtletPublishers.
- 33.William'sTextBookofEndocrinologyLarsen *etal.*,:An ImprintofElsevier.
34. Endocrinology,MacE.Hadley,PearsonEducation.
35. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener,ELBS.
- 36.PhysiologyofRespirationby J.H.Comroe. YearBookMedicalPublihsers.
- 37.TextBookofPhysiology. Vols.I&IIbyH.D.Patton.A.F.Ruchs.B.Hille. A.M.Scher andR.

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Sleiner.W.B.SaundersofCo.

- 38.ThePhysiologicalBasisofPhysicalEducationandAthleticsbyE.L.FoxandD.K. Mathews.SaundersCollegePublishing.
- 39.StatisticsinBiologyandPsychologybyD.DasAcademicPublishers.
- 40.AnIntroductiontoBiostatistics,N.Gurumani,M.J.P.Publishers,Chennai.

## CC10: RESPIRATION

[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

### Theory:

Total Lecture-60

#### 1. Pulmonary Function

- a. Introduction
- b. Properties of Gases
- c. Anatomy of the Lungs
- d. Mechanics of breathing
- e. Gas Exchange in the lungs
- f. Pulmonary Circulation

- g. Other Functions of the Respiratory System
- 2. **Gas Transport Between the Lungs & the Tissues**
  - a. Introduction
  - b. Oxygen Transport
  - c. Carbon Dioxide Transport
  - d. Respiratory acidosis and alkalosis
- 3. **Regulation of Respiration**
  - a. Introduction
  - b. Neural control of Breathing
  - c. Chemical Control of Breathing
  - d. Nonchemical Influences on Respiration
- 4. **Respiratory Adjustments in Health & Disease**
  - a. Introduction
  - b. Effects of Exercise
  - c. Other Forms of Hypoxia
  - d. Oxygen Treatment
  - e. Hypercapnia & Hypocapnia
  - f. Other Respiratory Abnormalities
  - g. Effects of Increased Barometric Pressure
  - h. Artificial Respiration

### **Practicals**

1. Measurement of peak expiratory flow rate
2. Measurement of oxygen saturation by pulse oxymeter before and after exercise
3. Measurement of forced expiratory volume (FEV) in first second.

### **Suggested Reading**

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4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.

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7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele, E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.
31. Molecular Cell Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.
32. Genetics: Analysis of Genes and Genomes, by DL Hartland & EW Jones & Burtlet Publishers.
33. William's Text Book of Endocrinology Larsen *et al.*; An Imprint of Elsevier.
34. Endocrinology, MacE. Hadley, Pearson Education.
35. The Kidney - An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
36. Physiology of Respiration by J.H. Comroe. Year Book Medical Publishers.
37. Text Book of Physiology. Vols. I & II by H.D. Patton, A.F. Ruchs, B. Hille, A.M. Scher and R. Sleiner. W.B. Saunders of Co.
38. The Physiological Basis of Physical Education and Athletics by E.L. Fox and D.K. Mathews. Saunders College Publishing.
39. Statistics in Biology and Psychology by D. Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.

## CC 11: SPECIAL SENSES

[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

**Theory:**

**Total Lecture-60**

### 1. Vision

a. Introduction

b. Anatomic Considerations

- c. The Image-Forming Mechanism (accommodation and visual acuity)
- d. The Photoreceptor Mechanism: Genesis of Electrical Responses
- e. Visual Pathways and effects of lesions of these pathways
- f. Color Vision
- g. Other Aspects of Visual Function
- h. Eye Movements
- i. Errors in visual process

## 2. Hearing & Equilibrium

- a. Introduction
- b. Anatomic considerations
- c. Hair cells
- d. Mechanism of hearing
- e. Vestibular function
- f. Loss of hearing

## 3. Smell & Taste

- a. Introduction
- b. Smell
- c. Receptors & Pathways
- d. Physiology of Olfaction
- e. Taste
  - i. Receptor Organs & Pathways
  - ii. Physiology of Taste

## Practicals

1. Principles of fixation and staining,
2. Staining and identification of fixed endocrine glands and nervous tissue.
3. Determination of visual acuity by Snellen's chart / Landolt's C chart
4. Determination of colour blindness by Ishihara chart.

## Suggested Reading

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby. T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by E.D.P. De Robertis & E.M.F. De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.
31. Molecular Cell Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.
32. Genetics: Analysis of Genes and Genomes, by D.L. Hartland & E.W. Jones & Burtlet Publishers.
33. William's Textbook of Endocrinology Larsen *et al.*; An Imprint of Elsevier.
34. Endocrinology, MacE. Hadley, Pearson Education.
35. The Kidney - An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
36. Physiology of Respiration by J.H. Comroe. Year Book Medical Publishers.
37. Textbook of Physiology. Vols. I & II by H.D. Patton. A.F. Ruchs. B. Hille. A.M. Scher and R. Sleiner. W.B. Saunders of Co.
38. The Physiological Basis of Physical Education and Athletics by E.L. Fox and D.K. Mathews. Saunders College Publishing.
39. Statistics in Biology and Psychology by D. Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.

**CC 12: ENDOCRINOLOGY**  
**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

1. **The Thyroid Gland**
  - a. Introduction
  - b. Anatomic Considerations
  - c. Formation & Secretion of Thyroid Hormones
  - d. Transport of Thyroid Hormones
  - e. Effects of Thyroid Hormones
  - f. Regulation of Thyroid Secretion
  - g. Clinical Correlates
2. **Endocrine Functions of the Pancreas & the Regulation of Carbohydrate Metabolism**
  - a. Introduction
  - b. Islet Cell Structure
  - c. Structure, Biosynthesis, & Secretion of Insulin
  - d. Effects of Insulin
  - e. Mechanism of action
  - f. Insulin Excess
  - g. Regulation of Insulin Secretion
  - h. Glucagon
  - i. Other Islet Cell Hormones
  - j. Hypoglycemia & Diabetes Mellitus in Humans
3. **The Adrenal Medulla & Adrenal Cortex**
  - a. Introduction
  - b. Adrenal Morphology
  - c. Adrenal Medulla
    - i. Structure & Function of Medullary Hormones
    - ii. Regulation of Adrenal Medullary Secretion
  - d. Adrenal Cortex
    - i. Structure & Biosynthesis of Adrenocortical Hormones
    - ii. Effects of Adrenal Androgens & Estrogens
    - iii. Physiologic Effects of Glucocorticoids
    - iv. Pharmacologic & Pathologic Effects of Glucocorticoids
    - v. Regulation of Glucocorticoid Secretion
    - vi. Effects of Mineralocorticoids
    - vii. Regulation of Aldosterone Secretion
    - viii. Summary of the effects of Adrenocortical Hyper & Hypofunction in Humans
4. **Hormonal Control of Calcium Metabolism & the Physiology of Bone**
  - a. Introduction
  - b. Calcium & Phosphate Metabolism

- c. Bone Physiology
  - d. Vitamin D & the Hydroxycholecalciferols
  - e. The Parathyroid Glands
  - f. Calcitonin
  - g. Effects of Other Hormones & Humoral Agents on Calcium Metabolism
- 5. The Pituitary Gland**
- a. Introduction
  - b. Morphology
  - c. Posterior pituitary hormones
  - d. Growth Hormone
  - e. Physiology of Growth
  - f. Pituitary Insufficiency
  - g. Pituitary Hyperfunction in Humans
- 6. Endocrine Functions of the Kidneys, Heart, & Pineal Gland**
- a. Introduction
  - b. The Renin-Angiotensin System
  - c. Erythropoietin
  - d. The Endocrine Function of the Heart: Atrial Natriuretic Peptide
  - e. Pineal Gland
  - f. Human chronobiology, biological rhythms; basic concepts and implications

### Practicals

1. Study of the effects of oxytocin on uterine contraction.
2. Study of the effects of adrenaline on intestinal / uterine movements.

### Suggested Reading

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
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12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.

19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I. M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R. A. Goldsby, T. J. Kindt and B. A. Osborne, W. H. Freeman and Co.
22. Microbiology, by M. J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J. D. Watson, H. H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R. A. B. Drury & E. A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P. V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G. M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W. H. Freeman and Co.
31. Molecular Cell Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.
32. Genetics: Analysis of Genes and Genomes, by DL Hartland EW Jones & Burtlet Publishers.
33. William's Text Book of Endocrinology Larsen *et al.*; An Imprint of Elsevier.
34. Endocrinology, Mac E. Hadley, Pearson Education.
35. The Kidney - An outline of Normal and Abnormal Functions, by H. E. Dewardener, ELBS.
36. Physiology of Respiration by J. H. Comroe. Year Book Medical Publishers.
37. Text Book of Physiology. Vols. I & II by H. D. Patton, A. F. Ruchs, B. Hille, A. M. Scher and R. Sleiner. W. B. Saunders of Co.
38. The Physiological Basis of Physical Education and Athletics by E. L. Fox and D. K. Mathews. Saunders College Publishing.
39. Statistics in Biology and Psychology by D. Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M. J. P. Publishers, Chennai.

### **CC13: REPRODUCTION**

**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

#### **Theory:**

**Total Lecture-60**

1. Introduction
  - Primary and accessory sex organs and secondary sex characters, Physiology of puberty.
2. Sex Differentiation & Development
  - a. Chromosomal Sex
  - b. Embryology of the Human Reproductive System
  - c. Aberrant Sexual Differentiation
  - d. Puberty
  - e. Precocious & Delayed Puberty
  - f. Menopause
3. Pituitary Gonadotropins & Prolactin
4. The male reproductive system
  - a. Structure
    - Histology of testis
  - b. Gametogenesis & Ejaculation
  - c. Endocrine Function of the Testes
  - d. Control of Testicular Function
  - e. Abnormalities of Testicular Function

5. The Female Reproductive system
  - a. The Menstrual Cycle  
Histology of ovary, Oogenesis, folliculogenesis and ovulation. Formation, functions of corpus luteum and luteolysis, Menstrual cycle and its regulation
  - b. Ovarian Hormones
  - c. Control of Ovarian Function
  - d. Abnormalities of Ovarian Function  
Abnormalities in menstrual cycle. Onset of menopause and post-menopausal changes, Postmenopausal syndromes
6. Pregnancy  
Fertilization, Preliminary ideas of implantation. Structure and functions of placenta. Maintenance of pregnancy and the bodily changes during pregnancy. Pregnancy tests. Parturition.
7. Lactation  
Mammogenesis, Galactopoesis: Hormonal control.
8. Physiological concepts for a planned family

### Practicals

1. Study of estrous cycle
2. Staining and identification of kidney and ureters, Estimation of estrogen by spectrophotometric method
3. Pregnancy test from human urine by kit method.

### Suggested Reading

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
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39. Statistics in Biology and Psychology by D. Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
41. Pesticides by P.K. Gupta, Interprint.
42. Environmental Chemistry by P.V. De. Wiley Eastern Ltd.
43. Exercise Physiology – Energy, Nutrition and Human Performance by W.D. McArdle, F. Katch and V.L. Katch. Lippincott, Williams and Wilkins.
44. Essentials of Exercise Physiology by L.G. Shaver, Surjeet Publications.
45. Text Book of Environmental Physiology by C. Edger Folk Jr. Lea and Febiger.
46. Goodman & Gilman's The Pharmacological Basis of Therapeutics, McGraw-Hill.
47. Quintessence of Medical Pharmacology, S.K. Chaudhuri, New Central Book Agency.
48. Essentials of Medical Pharmacology, K.D. Tripathi, Jaypee.
49. Textbook of Work Physiology by P.O. Astrand and K. Rodahl. McGraw-Hill Book Co.
50. Human Factors in Engineering and Design by E.O. McCormick and M. Sanders. Tata McGraw Hill.

### **CC-14: FORMATION AND EXCRETION OF URINE** [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

#### **Theory:**

**Total Lecture-60**

1. Renal Functions and Malnutrition:
  - a. Introduction  
Anatomy of kidney. Histology of Nephron.
  - b. Function of Malpighian corpuscles and renal tubule, counter-current mechanism  
Formation of urine – glomerular function and tubular functions. Counter-current multiplier and exchanger. Formation of hypertonic urine.
  - c. Water Excretion  
Renal regulation of osmolarity and volume of blood fluids
  - d. Acidification of the Urine & Bicarbonate Excretion  
Renal regulation of acid-base balance, acidification of urine.
  - e. Regulation of Na<sup>+</sup> & Cl<sup>-</sup> Excretion
  - f. Renal Circulation  
peculiarities and autoregulation
  - g. Diuretics

- h.** Disorders of Renal Functions  
Diabetes insipidus. Renal function tests—creatinine, inulin, urea and PAH clearance tests. Abnormal constituents of urine, their detection and significance. Renal dialysis.  
Artificial Kidney.
- i.** Filling of the Bladder  
Physiology of urinary bladder
- j.** Emptying of the Bladder  
micturition.
- k.** Non-excretory function of kidney

### Practicals

Identification of normal and abnormal constituents of urine.

### Suggested Reading

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.
31. Molecular Cell Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.

32. Genetics: Analysis of Genes and Genomes, by DL Hartland and EW Jones & Burtlet Publishers.
33. William's Text Book of Endocrinology Larsen *et al.*,: An Imprint of Elsevier.
34. Endocrinology, Mac E. Hadley, Pearson Education.
35. The Kidney- An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
36. Physiology of Respiration by J.H. Comroe. Year Book Medical Publishers.
37. Text Book of Physiology. Vols. I & II by H.D. Patton, A.F. Ruchs, B. Hille, A.M. Scher and R. Sleiner. W.B. Saunders of Co.
38. The Physiological Basis of Physical Education and Athletics by E.L. Fox and D.K. Mathews. Saunders College Publishing.
39. Statistics in Biology and Psychology by D. Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
41. Pesticides by P.K. Gupta, Interprint.
42. Environmental Chemistry by P.V. De. Wiley Eastern Ltd.
43. Exercise Physiology – Energy, Nutrition and Human Performance by W.D. McArdle, F. Katch and V.L. Katch. Lippincott, Williams and Wilkins.
44. Essentials of Exercise Physiology by L.G. Shaver, Surjeet Publications.
45. Text Book of Environmental Physiology by C. Edger Folk Jr. Lea and Febiger.
46. Goodman & Gilman's The Pharmacological Basis of Therapeutics, McGraw- Hill.
47. Quintessence of Medical Pharmacology, S.K. Chaudhuri, New Central Book Agency.
48. Essentials of Medical Pharmacology, KD Tripathi, Jaypee.
49. Textbook of Work Physiology by P.O. Astrand and K. Rodahl. McGraw- Hill Book Co.
50. Human Factors in Engineering and Design by E.O. McCormick and M. Sanders. Tata McGraw Hill.

## **DISCIPLINE SPECIFIC ELECTIVE (DSE) COURSES**

### **DSE 1A : BIOLOGICAL STATISTICS**

**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

#### **Concepts in theory**

1. Scope of statistics – Principles of statistical analysis of biological data.
2. Basic concepts – variable, parameter, statistics. Sampling.
3. Presentation of data-frequency distribution, frequency polygon, histogram, bar diagram and pie diagram.
4. Parameters
5. Different classes of statistics- mean, median, mode, mean deviation, variance, standard deviation, standard error of mean.
6. Standard score.
7. Degrees of freedom.
8. Probability.
9. Normal distribution.
10. Student's t-distribution

11. Testing of hypothesis - Null hypothesis, errors of inference, levels of significance, students' t-test and z score for significance of difference.

12. Distribution-free test - Chi-square test

### Practicals

1. Computation of mean, median, mode, standard deviation and standard error of the mean with physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects.
2. Graphical representation of data in frequency polygon and histogram.
3. Student's t test for significance of difference between means.
4. Demonstration: Statistical analysis and graphical representation of biological data with computer using One way ANOVA.

### Suggested readings

1. Medical Statistics by B.K. Mahajan. Jaypee Brothers, Medical Publishers Pvt. Ltd.
2. Statistical Methods by G.W. Snedecor and W.G. Cochran, Oxford & IBH Publishing Co Pvt. Ltd.
3. Statistics in Biology and Psychology by D. Das Academic Publishers

## DSE 1B : MICROBIOLOGY AND IMMUNOLOGY [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

### Theory:

**Total Lecture-60**

#### 1. Bacteria

- a. Structure & morphological classification.
- b. Gram positive, gram negative, pathogenic & nonpathogenic bacteria. Sterilization, pasteurization, brief idea about antibiotics
- c. Bacterial growth curve.
- d. Elementary idea of bacteriostatic and bacteriocidal agents, bacterial genetics.
- e. Viruses- Structure and types, Lytic and lysogenic cycle. Prions – basic ideas and prion diseases.

#### 2. Overview of Immune System

- a. Idea about innate and acquired immunity. Immuno-competent Cells.
- b. Humoral and cell mediated immunity.
- c. Antigen-antibody interaction.
- d. Immunoglobulin - classification, basic structure and function.

- e. Antigen presentation. Major Histocompatibility Complex (MHC).
- f. Cytokines. Complement system.
- g. Vaccination - principles and importance of immunization.
- h. Basic principles of immunological detection of pregnancy.
- i. Immunization program - immunization against Polio, Hepatitis-B, Tetanus, Measles, Whooping cough, Tuberculosis, Rabbits through vaccine, AIDS-causative virus, mode of transmission, effects on human body, preventive measures, principles of diagnostic test for AIDS (ELISA).
- j. Immunopathology - basic principles of autoimmune disease and transplantation immunology.

### Practicals

1. Gram staining of bacteria and identification of Gram positive and Gram negative bacteria.
2. Demonstration: Spore Staining, Radial immune-diffusion.

### Suggested readings

1. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
2. 21. Kuby Immunology, by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
3. 22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
4. 23 Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
5. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
6. Molecular Biology of the Cell, by B. Alberts and others, Garland.

## **DSE 2A : ERGONOMICS AND OCCUPATIONAL PHYSIOLOGY** [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

**Theory:**

**Total Lecture-60**

### Concepts in theory

1. Genesis and concept of ergonomics
2. Importance of ergonomics in occupational health and well-being.
3. Classification of Physiological work load. Concept of work rest cycle.
4. Physical work environment
  - i. Thermal environment, its' effect, Heat stress indices
  - ii. Noise and vibration, its' effect on workers. Occupational deafness,
  - iii. Illumination level and its' effect on visual performances,

- iv. Ergonomic principles of control of Physical hazards.
5. Static anthropometry, Application of anthropometric data in design.
6. User interface and control display compatibility.
7. Prevention of accidents, concept of Industrial safety.
8. Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.

### **Practicals**

1. Measurement of working heart rate by ten beats methods.
2. Determine cardiac cost of specific work.
3. Measurement of blood pressure before and after different grades of exercise.
4. Measurement of Some common anthropometric parameters. Calculation of BSA and BMI from anthropometric data.
5. Measurement of WBGT indices.
6. Measurement of noise level by noise level meter.

### **Suggested readings**

1. Human Factors in Engineering and Design by E.O. McCormick and M. Sanders. Tata McGrawHill.
2. Energy, Work and Leisure J.V.G.A. Durin and R. Passmore, Heinemann Educational Books.
- 3.

## **DSE 2B: SPORTS AND EXERCISE PHYSIOLOGY [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

### **Concepts in theory**

1. Importance of regular exercise in health and wellbeing.
2. Basic concept of Bioenergetics, Energy sources during exercise (Phosphagen, Anaerobic system and Aerobic system).
3. Cardio-respiratory responses during different grades of exercise.
4. Concept of excess post exercise oxygen consumption (EPOC), physiological fatigue and recovery.
5. Aerobic work Capacity: Measurement, physiological factors and applications

6. Training: Principles of physical training, Training to improve aerobic and anaerobic power. Effect of overtraining and detraining.
7. Nutritional supplements and ergogenic aids.
8. Sports injury and its' management.
9. Basic idea sports rehabilitation and sports medicine.

### **Practicals**

1. Measurement of blood pressure before and after different grades of exercise.
2. Recording of recovery heart-rate after standard exercise.
3. Determination of Physical Fitness Index by Harvard Step Test (Modified).
4. Determination of VO<sub>2</sub>max by Queen College step test.
5. Measurement of body fat percentage.
6. Six minute walk test.
7. Determination of endurance time by hand grip dynamometer.
8. Pneumographic recording of effect of talking, laughing, coughing, breath holding and hyperventilation

### **Suggested readings**

1. Exercise Physiology–Energy, Nutrition and Human Performance by W.D. McArdle,
2. F.Katch and V.L.Katch. Lippincott, Williams and Wilkins.
3. Essentials of Exercise Physiology by L.G. Shaver, Surjeet Publications.
4. Textbook of Work Physiology by P.O. Astrand and K. Rodahl. McGraw- Hill Book Co.
5. Sports Physiology by E.L. Fox, Saunders College Publishing. Holt-Saunders.

## **DSE 3A: HUMAN NUTRITION AND DIETETICS** [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

### **Theory:** **Concepts in theory**

**Total Lecture-60**

1. Constituents of food and their significance.
2. Basal metabolic rate -factors, determination by Benedict-Roth apparatus.
3. Respiratory quotient.
4. Specific dynamic action.
5. Basic concept of energy and units.
6. Calorific value of foods.

7. Body calorie requirements – adult consumption unit
8. Dietary requirements of carbohydrate, protein, lipid and other nutrients.
9. Balanced diet and principles of formulation of balanced diets for growing child, adult man and woman, pregnant woman and lactating woman.
10. Nitrogen balance, essential amino acids, biological value of proteins.
11. Supplementary value of protein.
12. Protein efficiency ratio and net protein utilization of dietary proteins.
13. Dietary fibres.
14. Vitamins.
15. Principle of diet survey.
16. Composition and nutritional value of common food stuffs.
17. Physiology of starvation and obesity.
18. Sources and physiological significances of vitamins and minerals.
19. Space nutrition.

#### **Practicals**

#### **Nutrition and Dietetics - Diet Survey (Field Study Record)**

1. Diet survey report (hand-written) of a family (as per ICMR specification) : Each student has to submit a report on his/her own family.
2. A report (hand-written) on the basis of field survey from ONE of the followings:
  - a. Physiological parameters of human (at least three parameters).
  - b. Anthropometric measurements on human (at least three parameters).
  - c. Epidemiological studies on human.

#### **Suggested readings**

1. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
2. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
3. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
4. Biochemistry. By D. Das, Academic Publishers.

## **DSE 3B: GENETICS AND MOLECULAR BIOLOGY**

**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

### **Genetics**

Basic principles of Mendelian genetics - monohybrid and dihybrid, test and back crosses, Bacterial genetics-transformation, transduction, conjugation (mention of F<sup>+</sup> /F<sup>-</sup> , Hfr strain, function of pillus). Extension of Mendelism - Epistasis and its different types present in plants and animals. Penetrance, expressivity, pleiotropism.

Crossing over and Gene mapping. Numerical and Structural variations in chromosome - basic

concepts of aneuploids and polyploids. Human Cytogenetics - human karyotype, banding technique, use of human cytogenetics in medical science, inborn errors of metabolism, aneuploidy in humans. Sex determination and sex linkage.

### **Molecular Biology**

Genes - definition. DNA- structure, DNA replication, transcription of RNA in prokaryotes, Genetic code – properties and wobble hypothesis, translation in prokaryotes, regulation of gene expression – operon concept: lac operon, gene mutation, DNA repairing processes. Basic idea of Recombinant DNA technology and its applications, Polymerase chain reaction (PCR) - basic concepts.

### **Practical**

DNA gel electrophoresis (agarose gel)

### **Suggested readings**

1. The Cell – A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
2. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
3. Molecular Biology of the Cell, by B. Alberts and others, Garland.
4. Molecular Cell Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.
5. Genetics: Analysis of Genes and Genomes, by DL Hartland EW Jones & Burtlet Publishers

## **DSE 4A: TOXICOLOGY**

**[TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]**

**Theory:**

**Total Lecture-60**

### **List of topics to be studied**

1. Toxins and Toxicology
2. Factors Affecting toxicity
3. LD50, LOD50, ED50, NOEL, LOEL

4. Concept of Acute and Chronic Effects
5. Birth defects and Teratogens
6. Concepts of Biomagnification and Bioconcentration
7. Popular Food Additives and Food Adulterants
8. Prevention of Food Adulteration Act, 1954
9. Other Food Toxicants: BPA, BPS, Pesticides, PAH, Dioxin, PCB, Heavy Metals: Pb, Hg, Cd, As etc

## Practical

### Physiological (experimental) Experiments

Kymographic recording of the effects of Hg, Pb and As compounds on: the contraction of perfused heart of toad, the intestinal movements of rats in Dale's bath.

### Histo-chemical Experiments

Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.

## Suggested readings

1. Quintessence of Medical Pharmacology, S.K. Chaudhuri, New Central Book Agency.
2. Essentials of Medical Pharmacology, K.D. Tripathi, Jaypee.

## DSE 4B: NANO-BIOTECHNOLOGY AND BIOINFORMATICS [TOTAL CREDITS: 6 (THEORY-4, PRACTICAL-2)]

**Theory:**

**Total Lecture-60**

### Concepts in theory

1. Introduction to nanoscience and nano-biotechnology.
2. Definition of a Nano system.
3. Types of Nanostructures; Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials - Quantum dots - Quantum wire; Core/Shell structures.
4. Synthesis of Nanomaterials.
5. Characterization techniques for Nanomaterials: X-ray diffraction; Scanning Electron Microscope (SEM); Atomic force microscopy (AFM ); scanning tunneling microscopy (STM), scanning near field optical microscopy (SNOM); Transmission Electron Microscopy (TEM); Infrared spectroscopy (IR).

6. Properties of Nanomaterials: Size dependent properties - Mechanical, Physical and Chemical properties. Types of Nanomaterials: Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO<sub>2</sub>, CeO<sub>2</sub>, ZnO) – Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites . Applications of Nanomaterials in Biology: Biochemical sensors; Imaging; Cancer treatment etc.
7. Toxicity of nano materials in the environment – Health threats.

### **Practical**

To be decided by respective universities board of studies based on the availability of infrastructure.

### **Suggested readings**

## **GENERIC ELECTIVES** (For other disciplines/ subjects)

### **GE- 1: Cellular Physiology, Biophysics, Biochemistry of Biomolecules** **Theory (Credit 4) Class 60**

#### **1. Units of Human System**

- a. Structure and functions of plasma membrane, nucleus and different cell organelles
- b. Endoplasmic reticulum, Golgi bodies, Mitochondria, Lysosome and Peroxisome.
- c. Structure, function and classification of Epithelial, Connective, Muscular and Nervous tissues.

#### **2. Biophysical and Biochemical Principles**

- a. Physiological importance of the following physical processes:
  - i. Diffusion
  - ii. Osmosis
  - iii. Dialysis
  - iv. Ultra filtration
  - v. Surface tension
  - vi. Adsorption
  - vii. Absorption.
- b. A brief idea about acids, bases, buffers and indicators. pH – definition, significance and maintenance of pH in the blood.
- c. Colloids - definition, classification and physiological importance
- d. Enzymes: definition, classification, factors affecting enzyme action.

Concept of coenzymes and isozymes.

### 3. Biochemistry of Bio Molecules.

- a. Carbohydrates: Definition and classification.
- b. Monosaccharide – Classification, structure. Chemical reactions of monosaccharide (Glucose & Fructose) - Reactions with concentrated mineral acids, alkali, phenylhydrazine and their biochemical importance.
- c. Disaccharides – Maltose, Lactose and Sucrose: Structure, occurrence and physiological importance.
- d. Polysaccharides – Starch, Glycogen, Dextrin, Cellulose.
- e. Lipids: Definition and classification. Fatty acids -----  
Classification. Properties of Fat and Fatty acids—Hydrolysis, Saponification, Saponification number, Iodine number, Hydrogenation, Rancidity-Acid number. Phospholipids, Cholesterol & its ester - physiological importance.
- f. Amino acids, Peptides and Proteins : Classification and structure. Structure of peptide bonds.

#### Practicals (Credit 2)

- i. **Identification of permanent slides** : Bone, Lung, Trachea, Spleen, Lymph gland, Liver, Salivary gland, Pancreas, Adrenal gland, , Thyroid gland, Spinal cord, Cerebellum, Cerebral cortex, Kidney, Skin, Testis, Ovary, Tongue, Oesophagus, Stomach, Small intestine, Large intestine.
- ii. **Fresh tissue experiments:**
  - a) Examination and staining of fresh tissues (other than blood) squamous, cuboidal, ciliated and columnar epithelium, skeletal muscle, cardiac muscle by methylene blue stain.
  - b) Staining of adipose tissue by Sudan III or IV.

#### Suggested Readings

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.

9. SamsonWright'sAppliedPhysiology.EditedbyC.A.Keele.ENeil&N. Toels.OxfordUniversity Press.
- 10.Physiology,by R.M.Berne&M.N.Levy,C.V.MosbyCo.
- 11.BasicHistology,by L.C.Junqueira&JCarneiro,McGraw-Hill.
- 12.Histology-ATextandAtlas,byM.H.Ross&E.J.Reith.TheWilliamsandWilkinsCompany.
- 13.Bailey'sTextBookofHistology,revisedby W.M.Copenhaver;TheWilliams andWilkinsCompany.
- 14.TheCell–AMolecularApproach,G.M.Cooper&R.E.Hausman,ASMPressSINAUER.
- 15.CoreTextBookofNeuro-Anatomy,byM.B. Carpenter;theWilliamsandWilkinsCompany.
16. TheHumanNervousSystem,byCharlesNobach,McGrawHillBookCo.
- 17.BiomedicalInstrumentation&Measurements,byL.Cromwell,F.J.Weibell& E.A.Pfeiffer; Prentice-HallofIndiaPvtLtd.
18. TheHumanNervousSystem.By M.L.Barr&J.A.Kierman,Harper&Row.
- 19.EssentialFoodandNutrition,byM.Swaminathan.TheBangalorePrinting&PublishingCo.Ltd.
20. EssentialImmunology,byI.M.Roitt,BlackwellScientificPublications.

## **GE 2: Digestion and Metabolism**

### **Theory (Credit 4)**

### **Class 60**

#### **1. Digestive System**

- a. Structure in relation to functions of alimentary canal and digestive glands.
- b. Composition, functions and regulation of secretion of digestive juices including bile.
- c. Digestion and absorption of carbohydrate, protein and lipid.
- d. Movements of the stomach and small intestine

#### **2. Nutrition**

- a. Basic constituents of food and their nutritional significance.
- b. Vitamins: definition, classification, functions, deficiency symptoms and daily requirements. Hypervitaminosis.
- c. Mineral metabolism - Ca, P, Fe.
- d. BMR: definition, factors affecting, determination by Benedict-Roth apparatus. Respiratory quotient: definition, factors affecting and significance.
- e. Biological value of proteins. Essential and non-essential amino acids, Nitrogen equilibrium.
- f. Minimum protein requirement-Positive and negative nitrogen balance.
- g. SDA: definition and: importance.

#### **3. Metabolism**

- a. Glycolysis, TCA cycle, Glycogenesis, Glycogenolysis.

Gluconeogenesis.

- b. Depot fat. Beta oxidation of saturated fatty acid
- c. Ketone bodies formation and significance.
- d. Deamination, Transamination. Amino acid pool - fate and functions of amino acids in the body.
- e. Formation of urea and its importance.
- f. Brief idea of HMP shunt and its significance (detailed enzymatic reactions are not required).
- g. Lipoproteins - types and functions.
- h. Purine and pyrimidine bases, nucleosides, nucleotides and polynucleotides.
- i. Pathophysiological significance of the following blood constituents: glucose, urea, creatinine, uric acid, cholesterol, bilirubin, SGPT and SGOT, alkaline and acid phosphatases and ketone bodies.

## **Practicals (Credit 2)**

### **Qualitative and Quantitative Biochemical Experiments**

#### **1. Qualitative Experiments:**

Qualitative tests for identification of starch, dextrin, lactose, sucrose, glucose, fructose, albumin, gelatin, peptone, lactic acid, hydrochloric acid, uric acid, acetone, glycerol, bile salts, urea.

#### **2. Quantitative Experiments:**

- a) Quantitative estimation of glucose by Benedict's method.
- b) Quantitative estimation of amino-nitrogen by Sorensen's formol titration method. Percentage and total quantity to be done.

#### **Demonstration:**

- a) Quantitative estimation of Sucrose by Benedict's method.
- b) Analysis of wheat, rice, milk and oil to test the presence of carbohydrate, protein and fat.
- c) Salivary amylase activity on starch at body temperature (37.5 C), above 40°C and in presence of HCl.

### **Suggested Readings**

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.

3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.

### **GE 3: Respiratory and Cardiovascular Physiology**

#### **Theory (Credit 4)**

**Class 60**

**1.**

#### **Respiratory Physiology**

- a. Anatomy and histology of the respiratory passage and organs.
- b. Role of respiratory muscles in breathing. Artificial respiration.
- c. Significance of physiological and anatomical dead space.
- d. Lung volumes and capacities.
- e. Exchange of respiratory gases between lung and blood and between blood and tissues.
- f. Transport of oxygen and carbon dioxide in blood.
- g. Regulation of respiration - neural and chemical. Hypoxia.

**2.**

#### **Cardiovascular Physiology**

- a. Anatomy and histology of the heart.
- b. Properties of cardiac muscle.
- c. Origin and propagation of cardiac impulse.
- d. Cardiac cycle: events. Heart sounds. Heart rate. Cardiac output: methods of determination (dye dilution and Fick principle), factors affecting, regulation.
- e. Structure of arteries, arterioles, capillaries. venules and veins.
- f. Pulse - arterial and venous.

- g. Blood pressure and its regulation and factors controlling. Baro- and chemoreceptors. Vasomotor reflexes. Methods of measurement of blood pressure.
- h. Peculiarities of regional circulations coronary, pulmonary, renal, hepatic and cerebral.

### 3. Blood and Body Fluids

- a. Blood: composition and functions.
- b. Plasma proteins: origin and functions. Plasmapheresis.
- c. Bone marrow. Formed elements of blood - their morphology and functions.
- d. Erythropoiesis and leucopoiesis.
- e. Haemoglobin : different types of compounds and derivatives. Functions and estimation of haemoglobin. Abnormal haemoglobins - thalassaemia and sickle-cell anaemia.
- f. Blood volume and its determination (dye method and radioisotope method) and regulation.
- g. Coagulation of blood : mechanism, factors affecting, procoagulants, anticoagulants, and disorders of coagulation.
- h. Lymph and tissue fluids: composition, formation, and functions.
- i. Blood groups - ABO and Rh. Blood transfusion - precaution and hazards. Immunological basis of identification of ABO and Rh blood groups.
- j. Anaemia - types (definition and causes).
- k. Leucocytosis, leucopenia and leukaemia. Purpura.

### Practicals (Credit 2)

#### 1. Haematological experiments I

- a. Leishman's staining of human blood film and identification of different types of blood corpuscles.
- b. Preparation of Haemin crystals.

#### 2. Haematological experiments II

DC of WBC, estimation of haemoglobin, blood group determination,

Bleeding time and coagulation time.

**Demonstration:** Haematocrit, MCV, TC of RBC and WBC, ESR.

## Suggested Readings

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.

## **GE 4: Endocrinology, Renal Physiology, Skin and Body Temperature Regulation** **Theory (Credit 4) Class 60**

### 1. Endocrine System

- a. Anatomy of endocrine system. Hormones - classification. Basic concept of regulation of hormone actions. Positive and negative feedback mechanism. Elementary idea of hormone action.
- b. *Hypothalamus*: Basic concept of neurohormone. Hypothalamo-hypophyseal tract and portal system.
- c. *Pituitary*: Histological structure, hormones, functions. Hypo and hyperactive states of pituitary gland.
- d. *Thyroid*: Histological structure. Functions of thyroid hormones &

thyrocalcitonin. Hypo and hyper-active states of thyroid.

e. *Parathyroid*: Histological structure, functions of parathyroid hormone.

Tetany.

f. *Adrenal Cortex*: Histological structure and functions of different hormones.

Hypo and hyper-active states of adrenal cortex.

g. *Adrenal Medulla*: Histological structure and functions of medullary hormones. The relation of adrenal medulla with the sympathetic nervous system.

h. *Pancreas*: Histology of islets of Langerhans. Origin and functions of pancreatic hormones. Diabetes mellitus. Brief idea of the origin and functions of renin-angiotensin, prostaglandins. Erythropoietin and melatonin. Elementary idea of gastrointestinal hormone.

## 1. Renal Physiology

- a. Elementary Structure of Kidney & Location.
- b. Relationship between structure and functions of kidney.
- c. Mechanism of formation of urine.
- d. Normal and abnormal constituents of urine.
- e. Physiology of urine storage and micturition.
- f. Renal regulation of acid-base balance.
- g. Non-excretory functions of kidney

## 2. Skin and Regulation of Body Temperature

- a. Structure and functions of skin.
- b. Insensible and sensible perspiration
- c. Regulation of body temperature -- physical and physiological processes involved in it.
- d. Physiology of sweat secretion and its regulation

## Practicals (Credit 2)

### Biochemistry II

1. Identification of normal constituents of urine - chloride, sulphate, phosphate, creatinine and urea.

## 2. Identification of abnormal constituents of urine - glucose, protein, acetone blood and bile salts.

**Demonstration:** Blood sugar estimation (Folin -Wu method)

### Suggested Readings

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The Williams and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murray and others. Lange Medical Book. Prentice-Hall International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Textbook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D. Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J. Carneiro, McGraw-Hill.
12. Histology - A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Textbook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell - A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press SINAUER.
15. Core Textbook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby. T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczar & Others; Tata McGraw Hill Publishing Co. Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.

**SKILL ENHANCEMENT ELECTIVE (SEC)**  
**SEC 1A: DETECTION OF FOOD ADDITIVES/ ADULTERANTS**  
**[TOTAL CREDITS: 2 (THEORY/PRACTICALS-2)]**

**Theory:**

**Total Lecture-60**

**Detection of food additives/ adulterants**

**Qualitative tests for Food Adulteration**

Qualitative tests for identifying Food Adulterants in some food samples: Metanil yellow, Rhodamin B, Saccharin, Monosodium glutamate, Aluminium foil, Chicory, Bisphenol A and Bisphenol S, Chocolate Brown HT, Margarine, Pb, Hg, As, PCB, Dioxin etc in turmeric powder, besan, laddoo, noodles, chocolate and amriti.

**Suggested Reading**

1. Practical Biochemistry in Medicine by Srinivas Rao., Academic Publishers.
2. 73. Practical Physiology, by M.K. Manna, Sritara Prakashani, Kolkata

**OR**

**SEC 1B: HISTOPATHOLOGICAL TECHNIQUES**  
**[TOTAL CREDITS: 2 (THEORY/PRACTICALS 2)]**

**Theory:**

**Total Lecture-60**

**List of Practical**

1. Preparation of tissue sections, H&E staining of tissue sections,
2. Preparation and staining of bone marrow smear, measurement of diameter of megakaryocyte, reticulocyte staining, staining of collagen in tissue sections.

**Suggested Reading**

1. Theory and Practice of Histological Techniques by J.D. Bancroft & A. Stevens, Churchill Livingstone.

**SEC 2A: CLINICAL BIOCHEMISTRY**

**[TOTAL CREDITS: 2 (THEORY/PRACTICALS 2)]**

**Theory:**

**Total Lecture-60**

**Concepts in theory**

1. Photo-colorimetric estimation of blood constituents.

2. Measurement of blood glucose by Nelson-Somogyi method, measurement of blood inorganic phosphate by Fiske - Subbarow method, measurement of serum total protein by Biuret method and determination albumin globulin ratio, determination of serum amylase by iodometric method.

### **Suggested Reading**

1. Practical Biochemistry in Medicine by Srinivas Rao., Academic Publishers.
2. 73. Practical Physiology, by M.K. Manna, Sritara Prakashani, Kolkata

### **OR**

### **SEC 2B: HEMATOLOGICAL TECHNIQUES [TOTAL CREDITS: 2 (THEORY/PRACTICALS 2)]**

**Theory:**

**Total Lecture-60**

### **List of Practical**

1. Preparation of blood smear and identification of blood cells.
2. Determination of haematocrit, MCV, MCH, MCHC, bleeding time, clotting time etc.
3. Measurement of haemoglobin in blood. Preparation of serum, Estimation of SGOT and SGPT.

### **Suggested Reading**