

Learning Outcome based Curriculum Framework (LOCF)

For

Choice Based Credit System (CBCS)

Syllabus

B.Sc. (Program) in Physiology

w.e.f. Academic Session 2020-21



KaziNazrul University
Asansol, Paschim Bardhaman
West Bengal 713340

PHYSIOLOGY PROGRAM LOCF

Semester- I

Course Name: **Biophysics, Biochemistry and Digestion**

Course Code: **BSCPPHYC101**

Course Type: Core(Theory+Practical)	Course Details: CC-1		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Learning outcomes

1. *Students will understand the structures and purposes of basic components prokaryotic and eukaryotic cells will especially macromolecules membrane and organelle student will understands how this cellular components are used to generate and utilized energy in cells.*
2. *Students will understand the cellular components underline mitotic cell division. Students will apply their knowledge of cell biology to selected example of changes or loses in cell function.*
3. *This can include responses to environment or physiological changes or alteration of cell function brought about by mutation and also can acquire knowledge through cell apoptosis.*
4. *Understands the principals of various fields of biochemistry and genetics.*
5. *Develop transferable quantities skill apply modern instrumentation theory and practice to biochemical problem.*
6. *The student will be able to correlate the various metabolites of carbohydrate, protein and fat.*
7. *That is to analyze appreciate and understand the basic concepts of chemical reaction that occurs in living systems which enable then to understand the various perspectives of applied sciences that benefit the mankind.*
8. *The student will be able to demonstrate a through comprehension of core concept of bio physics including osmosis , diffusion, plasmolysis. Therefore the behaviors of biological systems can be predicted from physical principle.*

Theory

(A) Cellular Physiology and Biophysical Principles

1. Membrane physiology: structure and functions of cell and subcelluar membranes, cytoskeletal system , cell junctions and cell adhesion molecules,
2. Physicochemical principles and Physiological importance of : Diffusion , Osmosis, Dialysis, Ultrafiltration ,Surface tension, Adsorption , Absorption, pH and buffers, Colloids.
3. Enzymes - classification, coenzymes, factors affecting enzyme action, regulation of enzymes- feedback, covalent and allosteric. Isozymes and nonprotein enzymes

(B) Biochemistry and Metabolism

1. *Carbohydrates* :classification , structure and properties
2. *Proteins*: Classification , order of structure (elementary idea),

3. Amino acids: classification and properties
4. *Lipids* :classification.
5. Fatty acids – Classification, and properties ,
6. lipoprotein – Classification and structure
7. *Nucleic acid* – structure of DNA and RNA
8. *Vitamins* – classification and functions.
9. *Minerals* – functions of Sodium, Potassium , Calcium , Phosphorus,Iron, Zinc , Iodine and Fluoride.
10. *Metabolism* – Glycolysis, TCA cycle, Glycogenesis, Glycogenolysis. Gluconeogenesis. , Beta oxidation of saturated fatty acid , Ketone bodies – formation and significance. Deamination, Transamination. Amino acid pool, Urea cycle, vitamins in metabolism

Digestive System:

1. Alimentary canal and digestive glands – Structure in relation to functions .
2. Composition, functions and regulation of secretion of digestive juices including bile.
3. Digestion and absorption of carbohydrate, protein and lipid.
4. Movements of the stomach and small intestine

Practical

Biochemistry

1. Qualitative Experiments:Qualitative tests for identification of starch, dextrin, lactose, sucrose, glucose, fructose, albumin,gelatin, peptone, lactic acid, hydrochloric acid, acetone, glycerol, bile salts, urea.
2. Quantitative Experiments:Quantitative estimation of glucose by Benedict's method.Quantitative estimation of amino-nitrogen by Sorensen's formol titration method.(Percentage and total quantity to be done).

Recommended readings

1. *Harper's Illustrated Biochemistry*, by R.K.Murray&others.Lange Medical Book, International Edition, McGraw Hill.
2. *Biochemistry*. by D.Das. Academic Publishers.
3. *Biophysics and Biophysical Chemistry*, by D.Das. Academic Publishers.
4. *Molecular Biology of the Cell*, by B. Alberts and others, Garland.

Semester- II

Course Name: Nerve-Muscle Physiology and Hematology

Course Code: BSCPPHYC201

Course Type: Core(Theory+Practical)	Course Details: CC-4		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

1. Describe the various constituents of blood, hematopoiesis, function and maturation of red cells, white cells and platelets, blood types, transfusion, tissue and organ transplantation.
2. Describe endothelial function, blood coagulation and discuss the most common abnormalities and complications relating to endothelial dysfunction and failure of hemostasis
3. Discuss the general characteristics of leukocytes (neutrophils and macrophages) and their roles in defending the host against infection, including the monocyte-macrophage system and inflammation
4. Define, and identify on a diagram of a motor neuron, the following regions: dendrites, axon, axon hillock, soma, and an axodendritic synapse.
5. Define, and identify on a diagram of a primary sensory neuron, the following regions: receptor membrane, peripheral axon process, central axon process, soma, sensory ganglia.
6. Describe the normal distribution of Na^+ , K^+ , and Cl^- across the cell membrane, and using the chord conductance (Goldman) equation, explain how the relative permeabilities of these ions create a resting membrane potential. Describe ionic basis of an action potential.
7. Describe the ionic basis of each of the following local graded potentials: excitatory post synaptic potential (EPSP), inhibitory post synaptic potential (IPSP), end plate potential (EPP) and a receptor (generator) potential.
8. Contrast the generation and conduction of graded potentials (EPSP and IPSP) with those of action potentials.
9. Describe the functional role of myelin in promoting saltatory conduction, contrasting the differences between the CNS and PNS.

Theory

(A) Nerve-muscle physiology

1. Different types of muscle and their structures. Sarcotubular system. Red and white muscles. Properties of muscle: all or none law, beneficial effect, summation, refractory period, tetanus and fatigue. Single-unit and multi-unit smooth muscle.
2. A brief idea of muscle spindle.

3. Mechanism of muscular contraction. Structural, chemical and mechanical changes in skeletal muscle during contraction and relaxation. Isotonic and isometric contraction.
4. Structure and classification of nerves.
5. Degeneration and regeneration of nerve fibre. Myelination.
6. Origin and propagation of nerve impulse.
7. Velocity of impulse in different types of nerve fibres.
8. Properties of nerve fibre: all or none law, rheobase, chronaxie, refractory period, indefatigability.
9. Synapse: structure, classification, mechanism of synaptic transmission. Motor unit, motor point.
10. Neuromuscular junction: structure, mechanism of impulse transmission, end plate potential.
11. A brief overview on neurotransmitters.

(B) Blood, body fluid and immune system

1. Blood: composition and functions.
2. Plasma proteins: origin and functions.
3. Plasmapheresis.
4. Bone marrow.
5. Formed elements of blood - their morphology and functions.
6. Erythropoiesis and leucopoiesis.
7. Haemoglobin: different types of compounds and derivatives.
8. Blood volume and its determination (dye method and radioisotope method) and regulation.
9. Coagulation of blood - mechanism, factors affecting, procoagulants, anticoagulants, and disorders of coagulation.

(C) Lymph and tissue fluids: composition, formation, and functions

(D) Immune system

1. Overview of Innate and acquired immunity.
2. Immunogens and antigens.
3. Antibody: structure and classification.
4. Brief idea of auto-immunity and Aids.
5. Vaccination: passive and active immunization,
6. Toxins and toxoids

Practical

Hematology

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

References/ Suggested Readings

1. Barman, S (23rd Edition): *Ganong's Review of Medical Physiology, McGraw Hill Lange.*
2. Guyton and Hall (11th Edition): *Textbook of Medical Physiology, Elsevier Saunders.*
3. *The Human Nervous System, by Charles nobach, McGraw Hill Book Co.*
4. *Neurobiology, by G.M. Shepherd. Oxford University Press*
5. *Human Physiology, by C.C. Chatterjee, Medical Allied Syndicate.*

Semester- III

Course Name: Digestive System

Course Code: BSCHPHYC302

Course Type: Core (Theory+Practical)	Course Details: CC-6		L-T-P: 4- 0 –2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Identify the sources and typical amounts of fluid and nutrients entering and leaving the gastrointestinal tract daily.*
- 2. For major classes of nutrients (carbohydrates, proteins, fats), differentiate the processes of ingestion, digestion, absorption, secretion, and excretion; include the location in the GI tract where each process occurs.*
- 3. Understand the integrated regulation (neural, endocrine, luminal) that drives digestion and absorption of nutrients after a meal and the temporal sequence of regulatory events during digestion.*
- 4. Understand how the physical and chemical compositions of luminal contents are sensed and the cellular and systemic responses to luminal stimuli.*
- 5. Describe the major anatomical characteristics of the enteric nervous system and the major cellular divisions of enteric ganglia (sensory nerves, interneurons, and motor neurons).*
- 6. Know how afferent and efferent extrinsic nerves (sympathetic and parasympathetic) interact with the enteric nervous system and regulate the functions of the GI tract. GI*
- 7. Know the major excitatory and inhibitory motor neurotransmitters and major digestive hormones in the GI tract and how these biomediators affect function in GI tissues and cells. Understand the neural circuitry driving major GI reflexes and the neural pathways and neurotransmitters that accomplish reflex control of GI functions.*
- 8. Identify the cell type and anatomical location of the endocrine cells secreting major GI hormones, such as gastrin, secretin, cholecystokinin (CCK), GLP-1, GLP-2, leptin, and motilin.*
- 9. List the water, ionic, bile salt, and bilirubin components of bile as secreted by the liver and after modification by the gallbladder.*
- 10. Describe the cellular mechanisms for the hepatic uptake, conjugation, and secretion of bile salts and bilirubin.*
- 11. Describe the mechanisms whereby the gall bladder concentrates bile, and the endocrine mechanism stimulating gall bladder contraction and the secretion of bile through the sphincter of Oddi into the small intestine.*
- 12. Describe the entero hepatic circulation, including any different handling among primary and secondary bile salts, and bile acids.*
- 13. Describe the sequential digestion of ingested starch by enzymes of the salivary glands, pancreas, and the intestinal apical membrane. Describe the sequential digestion of ingested proteins by gastric pepsin, pancreatic enzymes, and enzymes at the intestinal apical membrane. Make sure to include the role of duodenal enteropeptidase.*

Course Content:

Theory

Digestive system

1. Anatomy and histology of alimentary canal.
2. Digestive glands – histological structures of salivary glands, pancreas, liver.
3. Deglutition. Movements of alimentary canal and their regulations.
4. Composition, functions and regulation of the secretion of salivary, gastric, pancreatic and intestinal juices and bile. Synthesis of Bile acids.
5. Entero-hepatic circulation.
6. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.
7. Defecation. Faeces. GALT.
8. Basic concepts of Peptic Ulcer, Jaundice and Gall-stones.

Endocrine system

1. Anatomy of endocrine system.
2. Hormones - classification. Basic concept of regulation of hormone actions. Positive and negative feedback mechanism. Elementary idea of hormone action.
3. *Hypothalamus*: Basic concept of neurohormone. Hypothalamo-hypophyseal tract and portal system.
4. *Pituitary*: Histological structure, hormones, functions. Hypo and hyperactive states of pituitary gland.
5. *Thyroid*: Histological structure. Functions of thyroid hormones (T4T3) Thyrocalcitonin. Hypo and hyperactivestates of thyroid.
6. *Parathyroid*: Histological structure, functions of parathyroid hormone. Tetany.
7. *Adrenal Cortex*: Histological structure and functions of different hormones. Hypo and hyperactivestates of adrenal cortex.
8. Primary and accessory sex organs and secondary sex characters.
9. Testis: histology, spermatogenesis, testicular hormones and their functions.
10. Ovary: histology, oogenesis, ovarian hormones and their functions.
11. *Pancreas*: Histology of islets of Langerhans. Origin and functions of pancreatic hormones. Diabetesmellitus.
12. Brief idea of the origin and functions of renin-angiotensin, prostaglandins, erythropoietin and melatonin.
13. Elementary idea of gastrointestinal hormone.

Practical

Human Experiment

1. Determination of heart rate and breathing rate during rest and exercise.
2. Pneumographic recording of respiratory movements along with the effect of drinking of water, talking, forced hyperventilation and breath holding.
3. Measurement of systolic and diastolic arterial pressure by sphygmomanometer and determination of pulse pressure and mean pressure during rest and exercise.
4. Determination hemoglobin concentration by hemoglobinometer
5. Measurement of visual acuity

References/ Suggested Readings

1. *Barman, S (23rd Edition): Ganong's Review of Medical Physiology, McGraw Hill Lange.*
2. *Guyton and Hall (11th Edition): Textbook of Medical Physiology, Elsevier Saunders.*
3. *Best & Taylor's Physiological Basis of Medical Practices, edited by B.K.Brobeck. The William and Wilkins Co.*
4. *Harper's Illustrated Biochemistry, by R.K.Murray&others. Lange Medical Book, International Edition, McGraw Hill.*
5. *Biochemistry. By D.Das. Academic Publishers.*

Semester- III

Course Name: Diet Chart and ECG
Course Code: BSCPPHYSEC301

Course Type: SEC(Practical)	Course Details: SEC-1		L-T-P: 0-2-10		
Credit: 6	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	-----	20	-----

Course Learning Outcomes:

After the completion of course, the students will have ability to:

1. Interpret and apply nutrition concepts to evaluate and improve the nutritional health of communities.
 - a) Determine and translate nutrient needs into menus for individuals and groups across the lifespan, in diverse cultures and religions, and for different income levels.
 - b) Plan a community intervention based upon a needs assessment
 - c) Advocate for a public policy related to nutrition programs or health care
2. Interpret and apply nutrition concepts to evaluate and improve the nutritional health of individuals with medical conditions
 - a) Apply biological, biochemical and physiologic scientific principles to nutrition practice
 - b) Interpret of medical terminology and laboratory parameters relating to nutrition
 - c) Interpret scientific research, apply it to nutrition practices, and document interventions
 - d) Calculate and/or define of diets for health conditions addressed by health promotion/disease prevention activities or uncomplicated instances of chronic disease of the general population
 - e) Collect pertinent information for comprehensive nutrition assessments
 - f) Determine medical nutrition therapy for a variety of advanced medical conditions. (CPD, DPD only)
3. Identify and apply food principles to food and nutrition systems
 - a) Calculate and interpret nutrient composition of foods
 - b) Apply scientific research, including microbiology, food science and food safety to functions of ingredients in food and process controls
 - c) Demonstrate basic food preparation, quantity food production, and food presentation skills
 - d) Modify recipes and recipe proportions for individual, group dietary and volume production
 - e) Summarize health promotion and disease prevention theories and guidelines and explain the role of food in promotion of a healthy lifestyle
 - f) Analyze foodservice operations using the foodservice systems approach

4. *Apply management principles to evaluate human, physical and fiscal resources in organizations.*
 - a) *Apply principles and theories of management to the administration of human, physical and financial resource in food and nutrition services*
 - b) *Apply management concepts to personnel selection, training, evaluation, organizational behavior, governmental influences, labor management relations, marketing and budgeting through case studies and the development of a business plan.*
5. *Integrate knowledge and skills in food and nutrition with professional issues affecting the nutrition and/or dietetics fields.*
 - a) *Develop a position on a public policy affecting nutrition and food issues and/or programs*
 - b) *Utilize outcomes based research and statistics to interpret a nutrition issue*
 - c) *Explain health care policy and systems as related to food and nutrition health*
 - d) *Describe issues related to third party reimbursement for nutrition care*
6. *Describe the electrical pathway of the heart*
7. *Identify the three planes of electrocardiography: standard limb leads, augmented leads, precordial leads*
8. *Describe the components of a normal 12 Lead ECG*
9. *Describe the six step systemic approach to interpretation of 12 Lead ECG*
10. *Relate coronary artery anatomy to myocardial perfusion*
11. *Recognize common ECG patterns associated with various locations of injury/infarction.*
12. *Interpret various 12 lead ECG examples*

Course Content:

Practical

1. Diet chart preparation

- a) Introduction to Nutrition Care Process: Definition of Nutrition Care Process.
- b) Steps of Nutrition Care Process
- c) Nutrition Assessment:-Definition , Nutrition assessment component, Critical thinking
- d) Nutrition Diagnosis: nutrition diagnosis domain:- intake, clinical, behavioral – environmental
- e) Nutrition diagnosis component• nutrition vs. medical diagnosis
- f) Nutrition Interventions: Definition and objectives
- g) Nutrition Monitoring & Evaluation : Definition, Nutrition monitoring & evaluation components, nutrition goals & objectives.
- h) Evaluation of nutrition care
- i) Diet chart preparation

2. ECG Recording

- a. Introduction to ECG
- b. ECG grids
- c. ECG Complexes and intervals
- d. Heart rate, Cardiac axis

- e. Approach to ECG Interpretation: Rate, Rhythm, Axis, Intervals, P wave, QRS complex, ST segment, T wave, overall interpretation
- f. Rhythm analysis: Locate the P wave, relationship between P wave and QRS Complex, analyze QRS morphology, interpretation and calculation of rhythm

References/ Suggested Readings:

1. *Barman, S (23rd Edition): Ganong's Review of Medical Physiology, McGraw Hill Lange.*
2. *Guyton and Hall (11th Edition): Textbook of Medical Physiology, Elsevier Saunders.*
3. *Akhter, A S (2011) The heart and pericardium, Elsevier.*

Semester- IV

Course Name: Cardiovascular and Respiratory System
Course Code: BSCPPHYC301

Course Type: Core(Theory+Practical)	Course Details: CC-4		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 2. Identify and describe the interior and exterior parts of the human heart*
- 3. Describe the path of blood through the cardiac circuits*
- 4. Describe the size, shape, and location of the heart*
- 5. Compare cardiac muscle to skeletal and smooth muscle*
- 6. Explain the cardiac conduction system*
- 7. Describe the process and purpose of an electrocardiogram*
- 8. Explain the cardiac cycle*
- 9. Calculate cardiac output*
- 10. Describe the effects of exercise on cardiac output and heart rate*
- 11. Name the centers of the brain that control heart rate and describe their function*
- 12. Identify other factors affecting heart rate*
- 13. Describe and illustrate the main anatomical structures of the respiratory system and the mechanics of inspiration and expiration*
- 14. List the major functions of the respiratory system*
- 15. Outline the forces that allow for air movement into and out of the lungs*
- 16. Outline the process of gas exchange*
- 17. Discuss the factors that affect pulmonary ventilation*
- 18. Outline the mechanisms of O₂ and CO₂ transport in the blood*
- 19. Describe diseases resulting from mutations in haemoglobin*
- 20. Demonstrate an understanding of the control of the respiration rate.*
- 21. Create a flowchart illustrating how respiration is controlled*
- 22. Discuss how the respiratory system responds to exercise*
- 23. Acquire an advanced knowledge related to the complex skin structure (epidermis, dermis, hypodermis) and skin appendages.*
- 24. Discover and understand the multiple functions of skin (i.e. sensory organ, immunological barrier, synthesis of vitamin D, etc).*

Course Content:

Theory

(A) Cardiovascular system I

1. Cardiovascular system-Anatomy and histology of the heart. Properties of cardiac muscle.
2. Origin and propagation of cardiac impulse.
3. Cardiac cycle :events. Heart sounds. Heart rate.
4. Cardiac output: methods of determination (dye dilution and Fick principle), factors affecting, regulation

(B) Cardiovascular System – II :

1. Functional morphology of arteries, arterioles, capillaries, venules and veins, sinusoids.
2. General pattern of circulation and significance of branching of blood vessels. The pulse – arterial and venous.
3. Hemodynamics of blood flow.
4. Blood pressure– its measurement and factors affecting.
5. Cardiovascular homeostasis – neural and chemical control of cardiac functions and blood vessels. Cardiac and vasomotor centers, baroreceptors and chemoreceptors, innervation of the heart and blood vessels, cardiac and vasomotor reflexes.
6. Cardiovascular adjustment after haemorrhage.

(C) Respiration

1. Anatomy and histology of the lung and airways.
2. Mechanics of breathing -- role of respiratory muscles, glottis. Lung volumes and capacities.
3. Compliance of lungs and chest wall, pressure-volume relationship, alveolar surface tension and surfactant, work of breathing.
4. Ventilation- perfusion ratio. Dead space and uneven ventilation. Spirometry.
5. Transport of gases in body - Partial pressure and composition of normal atmospheric gases in inspired, expired, alveolar air and blood. Oxygen dissociation curve of hemoglobin and myoglobin – factors affecting. Carbon dioxide dissociation curve.
6. Regulation of respiration -- neural and chemical, respiratory centers, chemoreceptors, baroreceptors, pulmonary receptors.
7. Hypoxia – types, effects. Asphyxia, Voluntary hyperpnoea, Apnoea, Cyanosis, Periodic breathing, Asthma, Emphysema.

(D) Excretory system and skin

1. Relationship between structure and functions of kidney.
2. Mechanism of formation of urine.
3. Normal and abnormal constituents of urine.
4. Physiology of urine storage and maturation.
5. Renal balance.
6. Non-excretory function of kidney
7. Regulation of acid-base balance.
8. Structure and functions of skin.
9. Insensible and sensible perspiration.
10. Regulation of body temperature-- physical and physiological processes involved in it.
11. Physiology of sweat secretion and its regulation.

Practical

Histology

1. Fresh tissue experiments: Examination & staining of fresh tissue: squamous, ciliated & columnar epithelium, skeletal muscle fibre (Rat/Goat) by Methylene blue stain.
2. Transitional epithelium, mesentery (Rat/ Goat) (counter stain by Methylene blue)

3. Staining of adipose tissue by Sudan III or IV
4. Identification of permanent slides: Bone, cartilage, lung, trachea, spleen, lymph gland, liver, salivary glands, pancreas, esophagus, stomach, small intestine, large intestine, ovary, adrenal, testis, thyroid, spinal cord, cerebellum, cerebral cortex, kidney, skin, tongue.

References/ Suggested Readings

1. *Concise Medical Physiology* by S.K. Chaudhury; New Central Book Agency.
2. *Medical Physiology* by A.B. Mahapatra, Current Books International.
3. *Barman, S (23rd Edition): Ganong's Review of Medical Physiology*, McGraw Hill Lange.
4. *Human Physiology*, by C.C. Chatterjee, Medical Allied Syndicate.

Semester- IV

Course Name: Analysis and Representation of Biological Data

Course Code: BSCPPHYSEC401

Course Type: SEC(Practical)	Course Details: SEC-2		L-T-P: 0-2-10		
Credit: 6	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	-----	20	-----

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Have a solid foundation of mathematical and statistical processes at a level comparable to that of students graduating with a BA/BS in Statistics at other universities. Processes should include (but are not limited to) a proficiency in collection, organization, design, and drawing inferences from data using appropriate statistical methodology and problem solving skills.*
- 2. Demonstrate their ability to apply statistics in other fields at an appropriate level and demonstrate their ability to apply knowledge acquired from their major to real world models.*
- 3. Demonstrate mastery of data analysis and statistical concepts by communicating critically reasoned analysis through written and oral presentations.*
- 4. Acquire up-to-date skills and/or applications of computer and statistical programming related to future career choices.*
- 5. Apply their knowledge of statistics through an in-depth senior project/research experience. Results will be presented in both written (paper, publication, portfolio, etc.) and visual (PowerPoint, poster, portfolio, etc.) formats.*
- 6. Read, interpret, and critically analyze journal articles directed at undergraduate students.*

Course Content:

Practical

Statistical Analysis of Data

1. Probability,
2. Discussion of sampling techniques,
3. Data summarization,
4. Common sampling distributions,
5. Statistical inference and hypothesis testing,
6. Regression and
7. Nonparametric inference

Basic Application of Computer in Physiological data Analysis

M.S. Word and M.S. Excel.

References/ Suggested Readings:

- 1. Statistics in Biology and Psychology by D.Das. Academic Publishers.*
- 2. An Introduction to Biostatistics (2nd ed.) by N.Gurumani, M.J.P.Publishers, Chennai.*
- 3. Medical Statistics by B.K.Mahajan. Jaypee Brothers, Medical Publishers Pvt. Ltd*

Semester- V

Course Name: Nutrition and Dietetics

Course Code: BSCPPHYDSE501

Course Type: Core(Theory+Practical)	Course Details: CC-13		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

1. Understand what an adequate and well-balanced diet is.
2. Examine the several concepts of nutrition.
3. Explain elements of nutrition.
4. List rules of adequate and balanced diet.
5. Learn the physical and social changes taking place during the elderly period of life.
6. Learn the changes in a body taking place during the ageing period of life
7. Learn the energy and food demands of the elderly people.
8. Learn how to make nutritive plans according to those demands
9. Have knowledge about the diseases caught by the elderly people and their nutritive demands.
10. Examine the chronic diseases caught by the elderly people.
11. Learn the nutritive ways peculiar to those diseases.
12. Make samples of menu planning suitable for the elderly people, growing child, adult man and woman, pregnant woman and lactating woman.

Course Content:

Theory

Nutrition & Dietetics:

1. Basic constitution of food & their nutritional significance.
2. Vitamins: deficiency symptoms & daily requirements, hypervitaminosis.
3. Mineral metabolism: Ca, Fe, P.
4. BMR: definition, factors affecting, determination by Benedict Roth apparatus.
5. RQ: definition, factors affecting, significance.
6. Biological value of proteins, essential & non essential amino acids, N₂ equilibrium, minimum protein requirement. Positive and negative N₂ balance.
7. SDA - definition & importance.
8. Food groups,
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 – measurement and factors affecting. Proteins spacers. Supplementary value of protein.
11. Dietary fibres.
12. Principle of diet survey. Composition and nutritional value of common food stuffs.
13. Physiology of starvation and obesity

Practical

Diet Survey Report:

1. Report should be as per ICMR specification. Report should be hand written. Each student has to prepare and submit the report on his/her own family.

References/ Suggested Readings

1. *Essential Food and Nutrition*, by M.Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
2. *Park's Text Book of Preventive and Social Medicine* by K.Park, M/s. BanarsidasBhanot Publishers.
3. *Concise Medical Physiology* by S.K.Chaudhury; New Central Book Agency.
4. *Medical Physiology* by A.B. Mahapatra, Current Books International.

Semester- V

Course Name: Work Physiology and Ergonomics

Course Code: BSCPPHYDSE502

Course Type: Core(Theory+Practical)	Course Details: CC-13		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Demonstrate knowledge of general overall physiological principles associated with metabolic processes; musculoskeletal system; cardiovascular system; aerobic and anaerobic program design.*
- 2. Demonstrate knowledge of pathophysiology and risk factors associated with exercise and disease.*
- 3. Demonstrate the ability to administer and interpret electrocardiography and other diagnostic techniques associated with physiological processes.*
- 4. Describe and understand issues involved with patient management and medications.*
- 5. Design and monitor exercise prescriptions and fitness programming.*
- 6. Demonstrate knowledge of safety, injury prevention, and emergency procedures associated with laboratory activities and general exercise.*
- 7. Demonstrate knowledge of cardiovascular physiology, pulmonary physiology, metabolic processes and associated pathology and risk factors for disease.*
- 8. Demonstrate knowledge of orthopedic/musculoskeletal issues including pathophysiology and risk factors for injury.*

Course Content:

Theory

Work Physiology and Ergonomics

1. Physical work—its definition and nature—isotonic, isometric and isokinetic, positive and negative work. Concept of physiological work.
2. Power and capacity relation.
3. Work -load – light, moderate (sub-maximal) and heavy (maximal) depending on intensity and duration of work.
4. Exercise inducing equipment – bicycle ergometer, treadmill and stepping stool.
5. Energetics of work – sources of energy and energy demand for different activities.
6. Assessment of energy cost of various physical work – direct and indirect methods with their limitations.
7. Physiological responses to work – cardiovascular, respiratory, metabolic and muscular – short- term and long-term.

8. Work-rest cycle and importance of rest pause.
9. Ergogenic aids.
10. Basic concept of ergonomics and its application in industry to improve efficiency and industrial safety as well as to restrict occupational health hazards.
11. Anthropometry and its implication in ergonomics in general

Practical

Human Experiment

- a) Measurement of some common anthropometric parameters: stature, weight, eye height, shoulder height, elbow height, sitting height, elbow rest height (sitting), knee height (sitting), arm reach from wall, mid-arm circumference, waist circumference, hip circumference, neck circumference, head circumference, chest circumference.
- b) Calculation of Body Surface Area (using a nomogram) and Body Mass Index (BMI) from anthropometric measurements.
- c) Determination of Physical Fitness Index (PFI) of an individual by modified Harvard step test and recording of recovery heart-rate after standard exercise.

References/ Suggested Readings

1. *Exercise Physiology – Energy, Nutrition and Human Performance* by W.D.McArdle, F.Katch and V.L.Katch. Williams and Wilkins.
2. *Essentials of Exercise Physiology* by L.G.Shaver, Surjeet Publications.
3. *Energy, Work and Leisure* by J.V.G.A.Durin and R.Passmore. Heinemann Educational Books.
4. *Sports Physiology* by E.L.Fox, Saunders College Publishing Holt-Saunders

Semester- V

Course Name: Neurophysiology

Course Code: BSCPPHYDSE503

Course Type: Core(Theory+Practical)	Course Details: CC-13		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Define, and identify on a diagram of a motor neuron, the following regions: dendrites, axon, axon hillock, soma, and an axodendritic synapse.*
- 2. Define, and identify on a diagram of a primary sensory neuron, the following regions: receptor membrane, peripheral axon process, central axon process, soma, sensory ganglia.*
- 3. Describe the normal distribution of Na^+ , K^+ , and Cl^- across the cell membrane, and using the chord conductance (Goldman) equation, explain how the relative permeabilities of these ions create a resting membrane potential. Describe ionic basis of an action potential.*
- 4. Describe the ionic basis of each of the following local graded potentials: excitatory post synaptic potential (EPSP), inhibitory post synaptic potential (IPSP), end plate potential (EPP) and a receptor (generator) potential.*
- 5. Contrast the generation and conduction of graded potentials (EPSP and IPSP) with those of action potentials..*
- 6. Compare electrical and chemical synapses based on velocity of transmission, fidelity, and the possibility for neuromodulation (facilitation or inhibition).*
- 7. Describe chemical neurotransmission, listing in correct temporal sequence events beginning with the arrival of a wave of depolarization at the pre-synaptic membrane and ending with a graded potential generated at the post-synaptic membrane.*
- 8. Define the characteristics of a classical neurotransmitter.*
- 9. Describe formation and reabsorption of cerebral spinal fluid (CSF), including the anatomy and function of the choroid plexus.*
- 10. Contrast the barrier mechanisms between the blood brain barrier and the blood CSF barrier and the consequences of barrier break down.*
- 11. Describe the impact of the blood brain barrier for the CNS distribution of intravenously administered hydrophilic and hydrophobic drugs.*
- 12. Describe the steps in sensory transduction and action potential generation at a mechanoreceptor and at a nociceptor.*
- 13. Discuss what is meant by the Pain/Temperature/Coarse Touch System and be able to trace its connections to the cerebral cortex.*
- 14. Explain how motor units are normally recruited to increase muscular force and what the functional advantages are of this recruitment order.*
- 15. Discuss the underlying physiological mechanisms in which muscular force can be increased by increasing the rate at which action potentials are transmitted to the muscle from the CNS.*

Course Content:

Theory

Neurophysiology

1. A brief outline of organization and basic functions (sensory, motor and association) of the nervous system,
2. Central and peripheral nervous system. (Emphasis on the structure of spinal cord and brainstem).
3. Ascending tracts carrying touch, kinaesthetic, temperature and pain sensations.
4. Descending tracts: pyramidal tract and brief outline of the extra-pyramidal tracts.
5. Pain. Reflex action –definition, reflex arc, classification, properties.
6. Functions of the spinal cord.
7. Outline of functions of brain stem.
8. A brief idea of the structure, connections and functions of cerebellum.
9. Different nuclei and functions of thalamus and hypothalamus.
10. Cerebral cortex: histological structure and localization of functions.
11. CSF: composition, formation, circulation and functions.
12. A brief description of the organization of the autonomic (sympathetic and parasympathetic) nervous system. Functions of sympathetic and parasympathetic nervous system.
13. A brief idea of speech, aphasia, conditioning, learning and memory.

Sensory physiology

1. Classification of general and special senses and their receptors.
2. Receptors as biological transducer.
3. *Olfaction and Gustation*: Structure of sensory organ,
4. Neural pathway of olfactory and gustatory sensation.
5. Physiology of olfactory and gustatory sensation.
6. Olfactory and gustatory adaptation. After taste.
7. *Audition*: Structure of ear, auditory pathway, mechanism of hearing.
8. *Vision*: Structure of the eye. Histology of retina. Visual pathway. Light reflex.
9. Chemical changes in retina on exposure to light.
10. Accommodation - mechanism and pathway. Errors of refraction. Positive and negative after-image. Light and dark adaptation.
11. Elementary idea of color vision and color blindness.

Practical

1. Measurement of visual acuity
2. Test on Stretch reflex
3. Measurement of reaction time by ruler drop test
4. Test of motor learning

References/ Suggested Readings

1. *Barman, S (23rd Edition): Ganong's Review of Medical Physiology, McGraw Hill Lange.*
2. *Guyton and Hall (11th Edition): Textbook of Medical Physiology, Elsevier Saunders.*
3. *Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.*
4. *The Human Nervous System, by Charles nobach, McGraw Hill Book Co.*
5. *The Human Nervous System, by M.L. Barr & J.A. Keirman, Harper & Row.*

6. *Neurobiology*, by G.M. Shepherd. Oxford University Press

Semester- V

Course Name: Community Health and Nutrition

Course Code: BSCPPHYSEC501

Course Type: SEC(Practical)	Course Details: SEC-3		L-T-P: 0-2-10		
Credit: 6	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	-----	20	-----

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Understand and appreciate the diverse socioeconomic, behavioural, sociocultural, biological, environmental, philosophical, and historical factors that influence health, rehabilitation, and human movement*
- 2. Comprehend the significant theories, models, themes, and ideas in the biomechanical, physiological, behavioral, pedagogical, biological, socioeconomic, environmental, and sociocultural correlations of Kinesiology and Community Health.*
- 3. Comprehend and demonstrate ethical practices and the application of scientific findings and/or critical analysis in order to interpret new ideas related to health, rehabilitation, and/or human movement.*
- 4. Apply best practices in developing, implementing, assessing, and evaluating programs and interventions related to health promotion, physical activity adoption and adherence, and the prevention and treatment of diseases.*

Course Content:

Practical

Community Health and Nutrition

- Nutritional status of children and adults: Growth curves (Height-for-age, Weight-for-age, weight-for-height, BMI-for-age) for detection of stunting, underweight, wasting, thinness, overweight and obesity.
- Somatotype for adult (Heath-Carter method).
- Socioeconomic status assessment (Kuppuswamy's Socioeconomic Scale)

References/ Suggested Readings

- 1. Essential Food and Nutrition, by M.Swaminathan. The Bangalore Printing & Publishing Co. Ltd.*
- 2. Park's Text Book of Preventive and Social Medicine by K.Park, M/s. BanarsidasBhanot Publishers.*
- 3. Concise Medical Physiology by S.K.Chaudhury; New Central Book Agency.*
- 4. Medical Physiology by A.B. Mahapatra, Current Books International.*

Semester- VI

Course Name: Microbiology, Immunology and Molecular biology

Course Code: BSCPPHYDSE601

Course Type: Core(Theory+Practical)	Course Details: CC-16		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

1. Define/explain within multiple microbiology disciplines the core theories and practices;
2. Describe/explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations;
3. Explain the theoretical basis of the tools, technologies and methods common to microbiology; and
4. Learn the basic structure of immune system and realizes its importance.
5. Learn antigen recognition
6. Learn structure, of antibody and classes of antibody.
7. Learn the basic functions of immunity of humoral and cellular types.
8. Learn the basic mechanism of antigen antibody reactions.
9. Learn methods of protection against infectious diseases.
10. Learn diagnosis of infectious diseases which methods are determined.
11. Learn about the basic structure of DNA and RNA
12. Learn about the transcription and translation process and understand about its importance

Course Content:

Theory

Microbiology, Immunology and Molecular biology

- (a) Virus - DNA virus and RNA virus. Bacteriophage.
- (b) Bacteria-structure and morphological classification. Gram positive and Gram negative and acid-fast bacteria. Pathogenic and non-pathogenic bacteria - definition with a few examples.
- (c) Sterilization and Pasteurization.
- (d) A brief idea of antibiotics.
- (e) Elementary knowledge of innate and acquired immunity. Humoral and cell mediated immunity
- (f) Vaccination - principles and importance of immunization.
- (g) Basic principle of immunological detection of pregnancy.
- (h) Purine and pyrimidine bases, nucleosides, nucleotides and polynucleotides.
- (i) Basic structure of different types DNA and RNA.
- (j) Elementary idea of gene, genome, transcription, genetic code, translation and genetic engineering

Practical

Microbiology

Gram staining of bacteria and identification of Gram positive and Gram negative bacteria.

References/ Suggested Readings

1. *Essential Immunology*, by I.M. Roitt, Blackwell Scientific Publication
2. *Microbiology*, by M.J.Pelczar & Others; Tata McGraw Hill Publishing Co Ltd.

Semester- VI

Course Name: Hematology and Thermoregulation

Course Code: BSCPPHYDSE602

Course Type: Core(Theory+Practical)	Course Details: CC-16		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Describe the various constituents of blood, hematopoiesis, function and maturation of red cells, white cells and platelets, blood types, transfusion, tissue and organ transplantation.*
- 2. Describe endothelial function, blood coagulation and discuss the most common abnormalities and complications relating to endothelial dysfunction and failure of hemostasis*
- 3. Discuss the general characteristics of leukocytes (neutrophils and macrophages) and their roles in defending the host against infection, including the monocyte-macrophage system and inflammation*
- 4. Understand about ABO blood groups and their immunological basis.*
- 5. Learn about blood transfusion and its hazards*

Course Content:

Theory

(A) Hematology

1. Blood groups - ABO and Rh. Immunological basis of identification of ABO and Rh blood groups.
2. Blood transfusion - precaution and hazards.
3. Anaemia- types (definition and causes). Leucocytosis, leucopenia and leukaemia. Purpura.
4. Pathophysiological significance of the following blood constituents: glucose, urea, creatinine, uric acid, cholesterol, bilirubin, SGPT and SGOT, alkaline and acid phosphatases and ketone bodies.

(B) Thermoregulation

1. Channels of heat regulation – skin, lung and others organs.
2. Regulation of body temperature in homeotherms – its physical and physiological processes, roles of neural and hormonal processes. Pyrexia, hyperthermia

(c) Reproductive Physiology:

1. Primary and accessory sex organs and secondary sex characters.
2. Testis: histology, spermatogenesis, testicular hormones and their functions.
3. Ovary: histology, oogenesis, ovarian hormones and their functions.
4. Oestrus and menstrual cycles and their hormonal control.
5. Fertilization, implantation and structure and functions of placenta.
6. Maintenance of pregnancy – role of hormones.
7. Development of mammary gland and lactation - role of hormones. Sympathetic nervous system.

Practical

1. Differential count of WBC
2. Determination of clotting time, bleeding time
3. Determination of blood group
4. Determination of ESR

References/ Suggested Readings

1. *Barman, S (23rd Edition): Ganong's Review of Medical Physiology, McGraw Hill Lange.*
2. *Guyton and Hall (11th Edition): Textbook of Medical Physiology, Elsevier Saunders.*
3. *The Human Nervous System, by Charles nobach, McGraw Hill Book Co.*
4. *Neurobiology, by G.M. Shepherd. Oxford University Press*
5. *Human Physiology, by C.C. Chatterjee, Medical Allied Syndicate.*

Semester- VI

Course Name: Environmental Physiology

Course Code: BSCPPHYDSE603

Course Type: Core(Theory+Practical)	Course Details: CC-16		L-T-P: 4-0-2		
Credit: 4+2	Full Marks: 100	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	10	20	40

Course Learning Outcomes:

After the completion of course, the students will have ability to:

- 1. Learn basic concepts, Auto Ecology and Population Ecology.*
- 2. Learn Dynamics of Population, Ecology of Communities.*
- 3. Learn Functional and Structural Features of Communities.*
- 4. Learn Ecosystem and Characteristics.*
- 5. Learn Functional Characteristics of Ecosystems.*
- 6. Learn Ecological Cycles, Biological Accumulation.*
- 7. Learn The Great Ecosystems in the World.*
- 8. Learn Evolutional Ecology, Natural Selection, Genetic Variability.*
- 9. Learn Economics of Environment and Planning, Sustainable Development.*
- 10. Evaluate the major interactions between physiological state and the environment*
- 11. Learn about greenhouse gases and their effects.*

Course Content:

Theory

Environmental Physiology

1. Ecosystem – structure and function, different types of ecosystem,
2. Food chains, food webs and energy flow and mineral cycling in ecosystems; primary production and decomposition ,
3. Biogeochemical cycle.
4. Global environmental problems: global climate change ,
5. Ozone layer depletion, the green house effect, global warming and its consequences.
6. Environment – Physical and biological aspects.
7. Effects of exposure to hot and cold environment.
8. Acclimatization to hot and cold environment. Heat disorders and its preventive measures.
9. Effects of hypobaric and hyperbaric environment. Caisson disease. Preventive measure for hypobaric and hyperbaric effects. Acclimatization to high altitudes. G force,
10. Ionizing and non-ionizing radiations - physiological effects and preventive measures.
11. Air, noise and water pollutions – causes, effects, prevention measures and control.
12. Brief idea of the hazards of pesticides, carcinogens, mutagens, neurotoxins and war gases.
13. Impact of green house effects on life Radio-active wastes and their health effects.

Practical

- a) Measurement of environmental temperature - dry bulb and wet bulb, relative humidity,
- b) Determination of O₂, CO₂, Determination of total alkalinity, and chlorine in water by titration method,
- c) Measurement of noise

References/ Suggested Readings

1. *General and Comparative Physiology* by W.S.Hoar, Prentice-Hall of India Pvt.Ltd.
2. *Comparative Animal Physiology* by C.L.Posser and E.A.Brown. W.B.Saunders.Co.
3. *Ecology: Principles and Applications* by J. L. Chapman and M. J. Reiss, Cambridge University Press

Semester- VI

Course Name: Clinical Biochemistry

Course Code: BSCPPHYSEC601

Course Type: SEC(Practical)	Course Details: SEC-4		L-T-P: 0-2-10		
Credit: 6	Full Marks: 50	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	20

Course Learning Outcomes:

After the completion of course, the students will have ability to:

1. Students will gather knowledge and understand the theory and practice clinical biochemistry;
2. They will understand how biochemical investigations are employed to develop a clinical diagnosis;
3. The necessary professional and research skills to promote lifelong learning and career development.
4. They can understand the structure and metabolism of macromolecules and understand the regulation and disorders of metabolic pathways.
5. They can gain proficiency in laboratory techniques in both biochemistry and molecular biology, and be able to apply the scientific method to the processes of experimentation and Hypothesis testing.
6. They can acquire thorough knowledge in biochemical techniques, immunology, physiology and Biotechnology.
7. Develop the ability to understand and practice the ethics surrounding scientific Research.

Course Content:

Practical

Clinical Biochemistry

1. Physiological importance and measurements of serum total protein, thyroxine, ferritin, transferritin, prolactin, uric acid, bilirubin, CKP, catalase, amylase, SOD.
2. Estimation of acid and alkaline phosphatase, SGOT & SGPT of supplied blood

References/ Suggested Readings

1. Clinical Biochemistry by R.Luxton, Scion Publishing Limited
2. Clinical Biochemistry by Nanda Maheshwari, Japee
3. Practical Biochemistry with Clinical Correlation by Poonam Agarwal, CBS Publishers
4. Clinical Biochemistry by Ranjna Chawla, Japee