



# **RAJA PEARY MOHAN COLLEGE**

## Department of Physiology

### B.Sc. Honours in Physiology

Programe Specific Outcome, Course Outcome, Programe Outcome

(PSO, CO, PO)

## **Programme specific outcome**

At the end of the course in physiology students are expected to :

1. gain ability to apply basic principles of chemistry and physics to physiological systems
2. understand the functions of important physiological systems like the cardio-respiratory, endocrinological, nervous, renal, reproductive and metabolic systems
3. understand how these separate systems interact to yield integrated physiological responses to challenges such as exercise, fasting, ascent to high altitude or decent to deep sea, exposure to pathogens, fear, stress to maintain homeostasis
4. comprehend the basic understanding of genetics, molecular biology, microbiology, nutrition and dietetics, pharmacology
5. be able to perform, analyse and report on experiments and observations in physiology;
6. develop a capacity to identify public health challenges faced by the society and suggest measures to overcome it
7. understand the mechanisms of techniques and instrumentations used to investigate/assess health and disease
8. be equipped with life and employability skills necessary for careers in research, teaching, and professions allied to Medicine and industry
9. become literate digitally and acquire ability to use digital sources, and apply various platforms to convey and explain concepts of physiology.

## **Course Outcomes**

### **CC--1. Cellular Basis of Physiology, Genetics & Enzymes**

This course would enable the students to relate the structure of cellular organelles to their functions and understand the organization of cells to tissues, the organization of nucleic acids to chromatin in the nucleus.

This course also offers an insight into the activities of enzymes which are the regulators of any chemical reactions in the biological system with emphasis on diagnostic enzymes.

### **CC--2. Biophysical Principles and Chemistry of Biomolecules**

This course would enable the students to apply basic principles of chemistry and physics to biological systems and understand working principles of instruments used to study biological substances. Students would learn the chemistry of biomolecules of importance in details. It also gives an opportunity to students to learn basic technical skills required in biomedical research and laboratory based professions like the preparation and handling of laboratory reagents, pH measurements, qualitative identification of physiologically important biochemical substances.

This course endows the ability to think laterally and in an integrating manner and develop an interdisciplinary approach.

### **CC--3. Cell Signalling & Nerve-muscle Physiology**

The course would develop a molecular understanding of the complex system of communication that governs basic cellular activities and coordinates cell actions. The ability of cells to perceive and correctly respond to their microenvironment is the basis of development, tissue repair, and immunity as well as normal tissue homeostasis.

The students would be able to critically reflect on ionic movement leading to the action potential or impulse in excitable tissues of nerve and muscle. They would also be able to discriminate between the structural and functional properties of skeletal, cardiac and smooth muscles and mechanism of action of muscles. Experiment according to ethical protocols on both animal tissue and human subjects are taught to illustrate basic properties of nerve/muscle function.

### **CC--4. Nervous System**

The course enables students to outline the organisation of the human nervous system and describe the structures and functions of the different parts of brain and the spinal cord. Students would be able to role played by peripheral and autonomic nervous system in the maintenance of homeostasis. They gain insight into the modern concepts of pain, sleep, learning, memory, and emotion and molecular chemistry of neurotransmitters of importance.

Students also gain knowledge about the brain imaging techniques of CT scan and MRI in health and diseases.

### **CC--5. Blood and Body Fluids**

At the end of this course students should be able to discuss the anatomy, functional organization and characteristics of the haemopoietic system and blood and body fluids, explain the formation and functions of blood constituents, describe the biochemical basis of blood groups and illustrate their relevance in blood transfusion and explain the pathophysiology of common haematological disorders.

The students would also be able to perform haematological tests and interpret the findings.

### **CC--6. Cardiovascular System**

The students would be able to describe the anatomy of the heart and vascular system and histology of cardiac muscle and blood vessels; the origin and propagation of cardiac impulse. They would also be able to analyse the pressure and volume changes during the cardiac cycle, the regulation, factors affecting and measurement of cardiac output. They would be able to explain the factors leading to cardiovascular homeostasis – neural and chemical control of cardiac functions. They would be able to describe the common diagnostic tests for cardiovascular function like the ECG and Echocardiography. They would be able to discuss the causes of heart block, cardiac arrhythmias & myocardial infarctions, atherosclerosis, hypertension.

They would gain hands on training on measurement of blood pressure, study of the effect of sympathetic and parasympathetic stimulation on amphibian heart, preliminarily interpret the data of ECG.

### **CC--7. Respiratory System**

The student should be able to discuss the structure function relation of respiratory organs, understand the mechanics of breathing and the regulation of it by higher brain centers, explain the biophysical laws governing exchange of gases in the lungs and transport to the tissues and the pathophysiological reasons underlying various respiratory disorders.

The students would be able to do and interpret spirometry and critically explain the pneumographic recording of impact of various physiological activities on chest movements.

### **CC--8. Digestion and Metabolism**

The students would be able to explain the structure function relation of different parts of the digestive tract, the breakdown of food into simpler absorbable forms, would be able to categorize the transport of simpler compound across the mucosal membrane. Students would also be able to explain the pathophysiology of several disorders related to digestion like gall bladder stone, jaundice, peptic ulcer etc. They would learn critically the metabolism of the major nutrients like carbohydrate, lipid, proteins, nucleic acids and the mechanism of energy generation from nutrients. Students would be able to explain the enzymatic dysfunctions related to different metabolic disorders.

They would gain the technical knowledge of demonstrating the effects of sympathetic and parasympathetic nervous system on the movement of intestine in a mammalian model. They would also learn to quantitate amino acids by titrimetric method.

### **CC--9. Molecular Biology**

Students would gain in depth knowledge of the processes constituting the central dogma of life namely transcription, translation and DNA synthesis. They would be able to explain mutation and relation between mutation and generation of oncogenes in the development of cancer. They would be able to comprehend the basic concepts of recombinant DNA technology and its uses in cure by gene therapy. The students would be able to describe the working principle and uses of common molecular techniques like chromatography, electrophoresis, ultracentrifugation and RIA, ELISA. They would also be understand the principles of Western, Northern and Southern blotting techniques and Polymerase chain reaction.

The students would be able to estimate colorimetrically molecules of bio medical importance like serum protein, blood glucose and urea and separate biomolecules from mixtures by paper chromatography

### **CC--10. Nutrition and Dietetics Public Health**

From this part, at the end of the course the students are enriched with the knowledge about dietary sources, daily requirements, biochemical functions of several vitamins such as Thiamin, Riboflavin, Niacin, Pyridoxine, Pantothenic Acid, Biotin, Cyanocobalamin, Folic Acid, Ascorbic Acid, Inositol. Vitamins A, D, E and K and minerals such as sodium, potassium, calcium, phosphorus, iron, zinc, iodine and fluoride. They also possess good idea about dietary requirements of carbohydrate, protein, lipid and other nutrients as well as formulation of balanced diet for adult man, adult woman, lactating woman and pregnant women.

The students acquire an exposure of conduction of a diet survey with preparation of a survey report.

### **CC--11. Special Senses**

At the end of this course students would be able to describe the various steps in the biological transduction of different types of external stimuli like light, sound, chemicals into nerve impulse by sense organs ultimately leading to physiological perception of vision, audition, gustation and olfaction. They would also be able to explain the pathophysiology of diseases associated with vision, hearing, taste and smell.

The students would be able to perform some common tests to assess the functions of the special organs like the visual acuity test, tests for deafness etc.

### **CC--12. Endocrinology**

The students would be able to describe the structure and location of the endocrine glands in the body and explain the functions and chemistry of the hormones secreted by them. They would be able to understand the regulation of secretion of hormones under different physiological conditions and situations and appreciate the role of these hormones in maintaining homeostasis. They would be able to associate the function of these hormones with the symptoms

arising from the deficiency or excess amount of these hormones in various endocrinological disorders.

The course would endow the ability to identify the endocrine glands under the microscope by their histological specificities.

### **CC--13. Reproductive Physiology & Developmental Biology**

After completion of the course the students would acquire a general knowledge of histology, functions and hormonal control of male and female reproductive organ. They would possess a brief idea of different reproductive cycles with their hormonal control and the physiology of pregnancy, parturition, lactation and spermatogenesis. After the course they would gain a extensive knowledge of different stages of embryo development such as Fertilization, Blastulation, Implantation and Gastrulation as well development of different organs during pregnancy period such as Heart, urinary system and genital system.

The students acquire a practical knowledge of Pregnancy Test by kit method. They also could identify different histological sections of different organs.

### **CC--14. Excretory Physiology**

The students would develop a detailed idea about structure and functional relationship of kidney and nephron, the mechanism of release the excretory products in urine, learn how to test the abnormal functions of kidney and their interpretation. They would also be able to explain the role of skin as an excretory organ and its role in regulation of body temperature. The students would also be able to detect the sources of pollutants like Lead, Arsenic etc. and describe their effects on human health.

## **DSE -- A**

### **1. Biostatistics**

The students would be able to understand the basic concepts of statistics like variable, parameter, population and sampling etc. They would be able to represent data in appropriate formats. They would be able to comprehend the importance of central tendencies in evaluating parameters of populations and samples. They would be able to understand the principles of determination of significance of difference between central tendencies of groups of samples like Null hypothesis, alternative hypothesis, errors of inference, levels of significance, t-test and z score for They would be able to correlate between variables of a sample by linear correlation and linear regression.

At the end of the course students would be able to calculate central tendencies of a set of data, evaluate the existence of differences in a variable between groups and impact of one variable on another.

### **2. Microbiology & Immunology**

The students would be able to classify microorganisms and describe the growth patterns and disinfection techniques with special emphasis on bacteria. They would gain in depth knowledge of bacteriology namely bacterial structure, metabolism, genetics and artificial culture

techniques practiced in laboratories. They would be enlightened about the beneficial aspects of bacteriology in the food industry and also on the principles of controlling bacterial growth by different generations of antibiotics when they become the pathogens and cause infectitious diseases in humans. The students would also be able to describe the structure – virion, prion and bacteriophages ,classify viruses based on nucleic acid composition and explain the replication of bacteriophages – lytic and lysogenic cycle.

The students would gain insight into the intriguing world of immunology and would be able to explain the importance of different branches of immunity namely innate and adaptive and the humoral and cellular branches of adaptive immunity, the functions of individual cells of each branch and the coordination among the different branches in conferring protection to individual against pathogens. They would also be able to explain the mechanism of development of diseases due to overt immune functions like autoimmune diseases, allergy, graft rejection on one hand and diseases due to deficiency of immune system like cancer, AIDS etc. They would be able to explain the underlying principles of vaccination and immunization protocols.

### **3. Ergonomics**

The students would gain knowledge about the physical abilities and limitations as well as other human characters that are relevant to job design, learn about designing of equipments, devices, processes that fit the human body and its cognitive abilities, and improves the quality of work, productivity. They would learn how to reduce cost of production by minimizing the risk of work place, provide brief idea about musculo skeletal disorders and other occupational diseases associated with work. It can impart knowledge about body composition and body type analysis and its relationship with work or abilities.

### **4. Community and Public Health**

At the end of this course students would be able to suggest dietary management of different abnormal physiological conditions in humans. They would be aware the problems of infertility and modern day techniques to solve the problem. They would gain knowledge of population control, immunization, nutrition related disorders and their social implications and epidemiology of diseases and their prevention

## **DSE - B**

### **1.Chronobiology and Stress Physiology**

The students would be able to comprehend the importance of time of the day in regulating various physiological processes like sleep, body temperature, hormone release etc. and the consequences of mismatch between time and bodily activities in jet lag and shift work. They would learn in detail about the biochemical link between time of the day with the biological clock in SCN.

Students would be able to explain the stress response that causes physiologic and behavioural changes in various systems such as nervous, endocrine, and immune and the pathways such as activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis which brings about these changes to promote homeostasis. They would be able to describe the impact of chronic stress in CV

disorders and immunosuppression. They would gain detailed insight in to oxidative stress and the cellular mechanisms to control it.

## **2. Advanced Molecular Biology and Nanotechnology**

The students would accumulate an extensive knowledge of fundamental molecular biology processes such as control of gene expression, operon model, post-transcriptional modifications, cell-cell communication and apoptosis. They would gain idea of several advanced molecular biology techniques such as protein sequencing methods, genome analysis, methods for analysis of gene expression, methods for detection of molecules in living cells, genomic medicine and genetic counselling. They also acquire a brief idea of fundamental of nanotechnology and applications of nano materials in biology.

## **3. Toxicology and Pharmacology**

After the course the students could gather a concept of the importance of pharmacology in the study of physiological processes by gaining an idea on toxins and toxicology and factors affecting toxicity along with pharmacokinetics and pharmacodynamics. The students also would be able to acquire an extensive idea related to usage of drugs in humans such as drugbiotransformation. bioavailability and drug accumulation. They would possess a concept of various aspects of different drugs which have therapeutic index.

## **4. Work, Exercise and Sports Physiology**

The students would be to understand how the body functions in working condition and would gain knowledge to develop activities and programs that establish, maintain and promote physical fitness. gain knowledge in the scientific study of human movement and can help athletes to improve their performance and help them to recover from injuries.

## **SEC-A**

### **1. Hematological Techniques**

The students would gain in depth knowledge of the biochemical basis of ABO and Rh blood groups and its importance in blood transfusion and the hazards of blood transfusion and the concept of blood bank. They would be able to explain the cause and symptoms of haemoglobinopathies, anaemia, leucocytosis, leucopenia and purpura. The students would also be able to explain the significance of glycated haemoglobin, C-reactive protein, Ghrelin and Leptin in health and disease. They would be able to define, determine and explain the significance of blood parameters like TC, DC, ESR, Arneth count, etc. of pathophysiological importance. Concepts of bone marrow ans suppression of transplantation



## **2. Clinical Biochemistry**

At the end of this course students would be able to describe pathophysiological significance of blood constituents glucose, serumprotein, albumin, urea, creatinine, uric acid, bilirubin and ketone bodies, various serum enzyme, lipid profiles and tissue specific substances like Cardiac Troponins. They would be able to analyse the significance of hormones like thyroid hormones, adiponectin, leptin in health and diseases.

### **SEC-B**

#### **1. Detection of Food Additives /Adulterants and Xenobiotics**

The students would learn about chemical contaminants in food in general and their impacts on human health. They would learn about the tests identifying specific food adulterants like Metanil yellow, Rhodamin B in food samples and their pathophysiological effects. They would learn about the concept of xenobiotics and mechanisms of detoxification of xenobiotics by the human body.

#### **2. Bioinformatics**

The students would gain knowledge about this interdisciplinary field that is essential for management of data in modern biology and medicine. They would learn about bioinformatic databases- PubMed, PDB, Gen Bank, NCBI and computer software programs such as FASTA, BLAST which are bioinformatic tools. The students would be aware of the Applications of bioinformatics like homology searches, sequence alignments and pattern searching etc. They would gain an insight into computational biology and its application in medical sciences.

## **Program specific outcome**

At the end of the course in physiology students are expected to:

1. gain ability to apply basic principles of bio-chemistry and bio-physics to physiological systems
2. understand the functions of important physiological systems like the cellular, metabolic, cardio-vascular, respiratory, endocrinological, nervous, renal and reproductive systems
3. understand how these separate systems interact to generate integrated physiological responses to challenges such as exercise, fasting, certain environmental changes, stress etc. to maintain homeostasis
4. be able to perform, analyze laboratory report on experiments and observations in physiology;
5. understand the mechanisms of techniques and instrumentations used to assess health and disease
6. able to develop life and employability skills necessary for careers in teaching, and professions allied to medicine and industry
7. become literate digitally and acquire ability to use digital sources, and apply various platforms to convey and explain concepts of Physiology.

## Course specific outcomes

### CC 1

#### **Cellular basis of Physiology**

This course would enable the students to relate the structure of different cellular organelles to their functions like plasma membrane, nucleus, endoplasmic reticulum, mitochondria, lysosome and peroxisome.

#### **Biophysical Principles, Enzymes and Chemistry of Bio-molecules**

This course would enable the students to apply basic principles of physics to biological systems and understand their significance in human body.

This course also offers an insight into the activities of enzymes which are the regulators of any chemical reactions in the biological system.

Students would learn the chemistry and physiological importance of different biomolecules such as carbohydrate, protein, lipid nucleic acids in details.

#### **Digestion and Metabolism**

The students would be able to explain the structure function relation of different parts of the digestive tract, the breakdown of food into simpler absorbable forms. They would learn critically the metabolism of the major nutrients like carbohydrate, lipid, proteins, nucleic acids and the mechanism of energy generation from nutrients by studying different metabolic pathways.

### CC 2

#### **Blood and Body Fluids**

At the end of this course students should be able to discuss the functional organization and characteristics of blood and body fluids, explain the formation and functions of blood constituents describe the mechanism of blood coagulation and can learn the formation and function of lymph and tissue fluids.

The students would also be able to perform haematological tests and interpret the findings.

#### **Cardiovascular System**

The students would be able to describe the anatomy of the heart and histology of cardiac muscle, origin and propagation of cardiac impulse. They would also be able to analyze the pressure and volume changes during the cardiac cycle, the regulation, factors affecting and

measurement of cardiac output. They would also be able to understand blood pressure and factors controlling it, peculiarities of regional circulation like coronary and cerebral.

They would gain hands on training on measurement of blood pressure, study of the effect of hot and cold saline on amphibian heart.

### **Respiratory System**

The student should be able to discuss the structure function relation of respiratory organs, understand the mechanics of breathing, explain the biophysical laws governing exchange of gases in the lungs and transport to the tissues.

The students would be able to do and interpret lung function test by measuring peak expiratory flow rate and critically explain the pneumographic recording of impact of normal ventilation, hyperventilation and breath holding.

### **CC 3**

#### **Nerve-muscle Physiology**

The students would be able to understand the ionic movement leading to the action potential or impulse in excitable tissues of nerve and muscle. They would be able to know different properties of nerve tissues; how excitation can propagate from one nerve to the next or muscle from its origin; why nerve undergo degeneration processes and their recovery, etc.

They would also be able to discriminate between the structural and functional properties of skeletal, cardiac and smooth muscles and mechanism of action of muscles.

Experiments according to ethical protocols on both animal tissues and human subjects would help them to know the basic properties of nerve/muscle function.

#### **Nervous System**

This part of the course enables students to outline the organization of the human nervous system and describe the structures and functions of the different parts of brain and the spinal cord. Students would be able to know the role played by peripheral and autonomic nervous system in the maintenance of homeostasis. They gain brief insight into the modern concepts of pain, sleep, learning, memory, and emotion and molecular chemistry of neurotransmitters of importance.

#### **Special Senses**

At the end of this part, students would be able to understand the various steps in the biological transduction of different types of external stimuli like light, sound, chemicals into nerve impulse by sense organs ultimately leading to physiological perception of vision, audition, gustation and olfaction. They would also be able to explain the pathophysiology of diseases associated with vision, hearing, taste and smell.

The students would be able to perform some common tests to assess the functions of the special organs like the visual acuity test, tests for deafness etc.

## **CC 4**

### **Endocrinology**

The students would be able to describe the structure and location of the endocrine glands in the body and explain the functions of the hormones secreted by them. They would also be able to understand the modified state of secretion of hormones under different physiological conditions and know the role of these hormones in maintaining homeostasis. They would be able to associate the function of these hormones with the symptoms arising from the deficiency or excess amount of these hormones in various endocrinological disorders.

The students can visualize the histological structures and can identify the endocrine glands under the microscope by their histological specificities.

### **Reproductive Physiology**

The students would be able to describe the structure and location of the human reproductive structures, their functions, endocrine roles along with the process of gametogenesis. Brief outline of post-gestational changes would help them in future to build a healthy society.

### **Excretory Physiology**

This part of the course helps students to know about the structure and functions of different parts of the excretory system of the body along with their roles in maintaining homeostasis. They would learn about the heat gaining and dissipating processes of our body and how it works to maintain homeostasis.

The course would also help them to visualize the histological structures of different organs. The students would also learn the bio-chemical process of identifying the normal and abnormal constituents of urine.

## **Discipline Specific Electives outcome**

### ***DSE: Group-A***

#### **Biological Statistics**

This discipline specific course would help students to understand the basic concepts of variable, population, parameter, and sample. They would also be able to discriminate between qualitative and quantitative data, continuous and discontinuous data. They would learn how to present data by different graphical representation. They would gain brief insight about

mean, median, mode, standard deviation and standard error of ungrouped data; concept of probability.

The students would be able to perform different computational tests using physiological data of human subjects and also can represent them graphically.

### **Haematology**

At the end of this course students should be able to describe the biochemical basis of blood groups and illustrate their relevance in blood transfusion and explain the pathophysiology of common haematological disorders, discuss the anatomy, functional organization and characteristics of the hematopoietic system explain the pathophysiology of common haematological disorders.

The students would also be able to perform haematological tests and interpret the findings.

### ***DSE: Group-B***

#### **Work & Exercise Physiology and Ergonomics**

This discipline specific course would help students to know about the different types of works and their effect on normal physiological processes. The students would also know about physical fitness and how it affects physical activities. They can gather knowledge about anthropometry and imply their knowledge on daily activities in future.

#### **Human nutrition and dietetics**

Proper nutrition is an essential element of healthy life. By this course, students can gather knowledge about different food commodities, their functions in body and their daily requirements. Students would also know about the status of their food-consumption and necessary rectification to sustain health.

## **Skill Enhancement Course (SEC)**

### ***SEC: Group- A***

#### **Microbiology and Immunology**

At the end of this course students would be able to learn about the structures and morphological classification of different viruses and bacteria. They would also gain knowledge about disinfection methods and idea about different antibacterial agents. Students would also gain knowledge about innate and acquired immunity, toxin and immunization through vaccination.

## **Clinical Biochemistry**

At the end of this course students would be able to describe pathophysiological significance of several blood constituents, lipid profile in health and disease and pathophysiological significance of various serum enzymes.

### ***SEC: Group- B***

## **Detection of Food Additives / Adulterants & Xenobiotics**

Though food is very essential, the components are continuously contaminated by different adulterants or mixed with additives which may not be beneficial for our body. This course will guide students to identify those malpractices and aware them to the functions of certain drugs along with the brief idea of their processing in the body.

## **Community and Public Health**

This course would guide students about some common public health issues along with their remedies. Their knowledge in this section would also guide them to build a healthy society by enlighten them about family planning, proper nutrition of expecting and nursing mother, growing child etc



  
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