

**Curriculum Framework for  
UNDERGRADUATE PROGRAMME  
IN  
PHYSIOLOGY**

**3 Year B.Sc. (Programme)  
&  
4 Year B.Sc. (Honours) or B.Sc. (Honours with Research)**

*Based on guideline of National Higher Education Qualifications Framework  
(NHEQF)  
(Semester VII & VIII)*

**Undergraduate Board of Studies in Physiology**



**Council for Undergraduate Studies  
Kalyani University**

**KALYANI – 741235  
NADIA, WEST BENGAL, INDIA  
([www.klyuniv.ac.in](http://www.klyuniv.ac.in))**

# Subject: Physiology Major

Semester VII

**PHY-MJ-11: Functions of Kidney [6 credits; Marks 60+15=75]**

<b>Course Code: PHY-MJ-T-11 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>1. Anatomy &amp; Histology</b> – Histology of nephron. & its structural differences between cortical and juxta medullary nephrons, juxta glomerular apparatus, Function of Malpighian corpuscles and renal tubule, Aquaporin, Non –excretory functions of kidney.	<b>10 Hrs.</b>
<b>2. Renal Blood Flow:</b> Renal circulation, peculiarities and its autoregulation, Measurement of RBF.	<b>8 Hrs.</b>
<b>3. Urine Formation:</b> Glomerular filtration-mechanism,GFR, Measurement of GFR- renal clearance tests- inulin, urea and PAH clearance tests, Autoregulation, Tubular functions .	<b>10 Hrs.</b>
<b>4. Concentration &amp; Dilution of Urine:</b> Counter-current mechanism-counter-current exchanger and multiplier, Renal regulation of osmolarity and volume of blood fluids, Diuresis and diuretics, Diabetes insipidus.	<b>10 Hrs.</b>
<b>5. Acid-Base Balance:</b> Renal regulation of acid-base balance, acidification of urine. Concept of renal threshold.	<b>8 Hrs.</b>
<b>6. Physiology of Micturition:</b> Physiology of urinary bladder and structure & innervation of urinary bladder, urethra. Physiology of Micturition: Filling & emptying of bladder. Cystometrogram. Micturition reflexes.	<b>10 Hrs.</b>
<b>7. Kidney Functions Tests:</b> Composition of urine. Abnormal constituents of urine, their detection and significance. Renal dialysis, Renal failure-Acute and Chronic failure. Renal stone formation.	<b>4 Hrs.</b>
<b>Course Code: PHY-MJ-P-11 [2 Credits]</b>	<b>No of Lectures/Hours : 60</b>
1. Identification of normal and abnormal constituents of urine.	<b>30 Hrs.</b>
2. Study of histological sections of kidney, ureter.	<b>30 Hrs.</b>

**[COURSE LEARNING OUTCOMES:** Graduates will develop an understanding of the principles and physiological functions of kidney and underlying processes of urine formation and its role in human health. They will also learn to identify different normal and abnormal constituents of urine which will help them to gain their practical knowledge related to the theory part.]

**PHY-MJ-12: Microbiology and Genetic Basis of Life (6 credits; Marks 60+15= 75)**

<b>Course Code: PHY-MJ-T-12 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>1. Microbiology:</b> Bacteria-structure & morphological classification. Gram-positive, gram-negative, pathogenic & non-pathogenic bacteria. Sterilization, pasteurization, brief idea about antibiotics. Bacterial growth curve. Elementary idea of bacteriostatic and bactericidal agents. Bacterial genetics. Viruses - Structure and types, Lytic and lysogenic cycle. Prions – basic ideas and prion diseases.	<b>15 Hrs</b>
<b>2. Genetics:</b> Basic principles of Mendelian genetics - monohybrid and dihybrid, test and back crosses, Dominance, segregation, independent assortment. Bacterial genetics-transformation, transduction, conjugation (mention of F+ /F-, 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.	<b>15 Hrs</b>
<b>3. Molecular Biology and Biotechnology:</b> 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. Definition, history of biotechnology, importance of biotechnology, Cloning, Gene therapy, Transgenic animals, hybridoma, monoclonal antibody, DNA finger printing and its application in forensic science, polymerase chain reaction, RT-PCR, enzyme immobilization, basic idea of tissue culture and CO <sub>2</sub> -incubators.	<b>30 Hrs</b>
<b>Course Code: PHY-MJ-P-12 [2 Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>Microbiology:</b> Gram staining of bacteria and identification of Gram-positive and Gram-negative bacteria. Demonstration: Spore Staining, Radial immuno-diffusion.	<b>20 Hrs</b>
<b>Genetics:</b> DNA gel electrophoresis (agarose gel).	<b>20 Hrs</b>
<b>Molecular Biology and Biotechnology:</b> Measurement of concentration of CT-DNA in a solution.	<b>20 Hrs</b>

**[COURSE LEARNING OUTCOMES:** Graduates will have in depth knowledge of Basic principles of genetics and learn about the different techniques’ molecular biology and

biotechnology. They will gain their knowledge how bacterial growth and spread can occur, and it can be prevented from spreading and causing pathogenesis. They will gain their practical knowledge related to the various genetics and molecular biology techniques used in the biomedical field.]

**PHY-MJ-13: Perspective of Men at Work (6 credits; Marks 60+15= 75)**

<b>Course Code: PHY-MJ-T-13 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>1. Ergonomics and Occupational Physiology:</b> Genesis and concept of ergonomics.	<b>2 Hrs</b>
Importance of ergonomics in occupational health and well being.	<b>2 Hrs</b>
Classification of physiological work load.	<b>2 Hrs</b>
Concept of work rest cycle.	<b>2 Hrs</b>
Physical work environment: a) Thermal environment, its effect, Heat stress indices, b) Noise and vibration, its effect on workers; Occupational deafness, c) Illumination level and its effect on visual performances, d) Ergonomic principles of control of Physical hazards.	<b>4 Hrs</b>
Static anthropometry, Application of anthropometric data in design.	<b>2 Hrs</b>
User interface and control display compatibility.	<b>2 Hrs</b>
Prevention of accident, concept of industrial safety.	<b>2 Hrs</b>
Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work related Musculo-skeletal disorders.	<b>2 Hrs</b>
<b>2. Sports and Exercise Physiology:</b> Importance of regular exercise in health and wellbeing.	<b>2 Hrs</b>
Basic concept of Bioenergetics, energy sources during exercise (Phosphagen, Anaerobic system and aerobic system).	<b>2 Hrs</b>
Cardio-respiratory responses during different grades of exercise.	<b>2 Hrs</b>
Concept of excess post exercise oxygen consumption (EPOC), physiological fatigue and recovery.	<b>2 Hrs</b>
Aerobic work capacity: Measurement, physiological factors and applications.	<b>2 Hrs</b>
Training: Principles of physical training, Training to improve aerobic and anaerobic power.	<b>2 Hrs</b>
Effect of overtraining and detraining.	<b>2 Hrs</b>
Nutritional supplements and ergogenic aids.	<b>2 Hrs</b>
Sports injury and its management.	<b>2 Hrs</b>
Basic idea sports rehabilitation and sports medicine	<b>2 Hrs</b>
<b>3. Physiology of Yoga:</b> The concept of Yoga and Asanas.	<b>4 Hrs</b>
General benefits of Asanas.	<b>4 Hrs</b>

Basic Principles and precautions of asanas.	<b>4 Hrs</b>
Practice schedule of asanas.	<b>4 Hrs</b>
Pranayama: Types of pranayama, Benefits of pranayama, Schedule of pranayama, Surya namaskar,	<b>4 Hrs</b>
<b>Course Code: PHY-MJ-P-13 [2 Credits]</b>	<b>No of Lectures/Hours : 60</b>
Measurement of working heart rate by ten beats methods.	<b>4 Hrs</b>
Determine cardiac cost of specific work.	<b>4 Hrs</b>
Measurement of blood pressure before and after different grades of exercise.	<b>4 Hrs</b>
Measurement of some common anthropometric parameters. Calculation of BSA and BMI from anthropometric data.	<b>4 Hrs</b>
Measurement of WBGT indices.	<b>4 Hrs</b>
Measurement of noise level by noise level meter.	<b>4 Hrs</b>
Recording of recovery heart-rate after standard exercise.	<b>4 Hrs</b>
Determination of Physical Fitness Index by Harvard Step Test (Modified).	<b>4 Hrs</b>
Determination of $VO_{2max}$ by Queen college step test.	<b>4 Hrs</b>
Measurement of body fat percentage.	<b>4 Hrs</b>
Six-minute Walk test.	<b>4 Hrs</b>
Determination of endurance time by hand grip dynamometer.	<b>4 Hrs</b>
Pneumographic recording of effect of talking, laughing, coughing, breath holding and hyperventilation.	<b>4 Hrs</b>
Practice of some Asanas and Pranayama like: Vrikshasans, Ardhashandrasans, Padahastana, Trikonasana, Tribhujasana, Utkatasana, Sarvangasana, Matsyasana, Nauasana, Halasana, Salabhasana, Dhanurasana, Chakrasana, Bhujangasana, Bhadrasana, Gomukhasana, Ushtrasana, Ardhakurmasana, Janushirshana, Abdominal breathing, Shavasana.	<b>4 Hrs</b>
Kapalbhati Pranayama, Anuloma-viloma Pranayama, Chandranadi Pranayama, Bhramari Pranayama, Surya Namaskar.	<b>4 Hrs</b>

**[COURSE LEARNING OUTCOMES:** Graduates will have in depth knowledge on Ergonomics and Occupational Physiology, Sports and Exercise Physiology, and Physiology of Yoga and Asanas.]

## Semester VIII

### PHY-MJ-14: Physical and Biological Environment (4 credits; Marks 40+10= 50)

Course Code: PHY-MJ-T-14 [4Credits]	No of Lectures/Hours : 60
1. <b>Environmental Physiology:</b> Air Pollution: definition, sources, air pollutants, effect of air pollution on human health, concept of ozone hole, green house effects and global warming.	8 Hrs
Water Pollution: definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, concept of safe drinking water standards.	8 Hrs
Soil Pollution: causes, health hazards, solid waste managements- bioremediation, phytoremediation. Sound Pollution: definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (noise standards).	10 Hrs
Radionuclide Pollution: ionizing radiations, effects of ionizing radiation on human health, permissible doses. Arsenic Pollution: sources, sources of arsenic in ground water, drinking water standard for arsenic (WHO, USEPA), health effects of chronic arsenic poisoning.	10 Hrs
Arsenic, fluoride, cadmium ,lead ,mercury pollution- sources, health effects of chronic poisoning.	8 Hrs
<b>2. Toxicology:</b> Toxins and Toxicology. Factors Affecting toxicity , LD50, LOD50, ED50, NOEL, LOE	8 Hrs
Concept of Acute and Chronic Effects , Birth defects and Teratogens , Concepts of Bio-magnification and Bio-concentration , Popular Food Additives and Food Adulterants	8 Hrs

**[COURSE LEARNING OUTCOMES:** Students will learn about the causes and effects of pollution and how to prevent and reduce it. Students will learn the principles of toxicology. including the importance of risk analysis, management and communication. Students will be able to identify and discuss contemporary issues in toxicology.]

**PHY-MJ-15: Life in Challenging Environment (4 credits; Marks 40+10=50)**

<b>Course Code: PHY-MJ-T-15 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>1. Body temperature regulation</b> - Homeothermic & poikilothermic animals, Factors influencing body temperature, Principles of heat generation and transfer, Heat balance. Regulation of body temperature.	<b>10 Hrs</b>
<b>2. Acclimatization:</b> Effects of exposure to hot and cold environments. Acclimatization to hot and cold environments. Heat disorders and their preventive measures.	<b>10 Hrs</b>
<b>3. Deep Sea Physiology:</b> Effects of hypobaric and hyperbaric environment, Preventive measures against hypobaric and hyperbaric effects, Hyperbaric and Hypobaric Pressure Chamber, Ionizing and non-ionizing radiations - physiological effects and preventive measures. Decompression sickness- cause & treatment, caisson disease, scuba diving.	<b>12 Hrs</b>
<b>4. Stress Physiology:</b> Oxidative stress, Free radicals-formation and scavengers, Effects of free radicals, Antioxidants.	<b>8 Hrs</b>
<b>5. Space Physiology:</b> Introduction, Aviation physiology during flight, G force- positive G, negative G, Weightlessness and microgravity, Effects on body system, Radiation effects. Motion Sickness.	<b>8 Hrs</b>
<b>6. High Altitude Physiology:</b> Acclimatization to high altitudes. Control of breathing at high altitude, Limiting factors at extreme altitude, High altitude populations, Acute mountain sickness, High altitude cerebral edema, High altitude pulmonary edema, Chronic mountain sickness and high altitude pulmonary hypertension, Pre-existing medical conditions at altitude, Extremes of age at altitude: children and the elderly.	<b>12 Hrs</b>

**[COURSE LEARNING OUTCOMES:** Graduates will develop an understanding of the principles and physiological functions of kidney and underlying processes of urine formation and its role in human health. They will also learn to identify different normal and abnormal constituents of urine which will help them to gain their practical knowledge related to the theory part.]

**PHY-MJ-16: Biological Rhythms, Population and Developmental Phenomenon (4 credits; Marks 40+10=50)**

<b>Course Code: PHY-MJ-T-16 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>1. Biological Rhythm-</b> Circadian, Ultradian, infradian rhythm, concept of biological clock, Sleep cycle, Rhythms and behaviour.	<b>8 Hrs</b>
<b>2. Population Science:</b> Concept of population, birth rate, death rate, infant mortality rate, fertility rate. Reasons for rapid population growth in country and its impact on the society. Population growth and problem in family life situation-stress and strain in family. Methods of fertility control, family planning, population growth.	<b>8 Hrs</b>
Sex-education-fertility, Sexually transmitted diseases, effects of early marriage, family life education-types of family, age at marriage, concept of happy family, spacing of child and survival measure.	<b>8 Hrs</b>
National population policy/programme- education, women, children. Environment, housing, food, drinking water policy.	<b>6 Hrs</b>
Major child killer diseases, immunization and preventive measures, immunization schedule.	<b>8 Hrs</b>
<b>3. Developmental Biology:</b> Basic concept of development: potency, commitment, specification, induction, competence, determination and differentiation.	<b>8 Hrs</b>
Gametogenesis, fertilization, Cleavage process in mammals. Blastula formation: mammals Morphogenetic movements: Types and examples.	<b>8 Hrs</b>
Early development, process of organogenesis.	<b>6 Hrs</b>

**[COURSE LEARNING OUTCOMES:** Students will get the theoretical insights and methods of chronobiology. Students will also learn the concept of population science and its implication in society, measures/policies taken by Government to address community based health issues. Students will also be able to gain knowledge about the basic concept of development and. embryology.]

**PHY-MJ-17: Public Health (6 credits; Marks 60+15=75)**

<b>Course Code: PHY-MJ-T-17 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
Population problem- principles and methods of family planning.	<b>12 Hrs</b>
Problems of infertility and brief idea about in vitro fertilization and intrauterine embryo transplantation.	<b>12 Hrs</b>
Malnutrition- PCM, marasmus, kwashiorkor, endemic goiter, nutritional anemias, rickets, osteomalacia, xerophthalmia, beriberi and their social implications.	<b>12 Hrs</b>
Principles and social importance of immunization against infectious diseases.	<b>12 Hrs</b>
Epidemiology and prevention of AIDS and hepatitis.	<b>12 Hrs</b>
<b>Course Code: PHY-MJ-P-17 [2 Credits]</b>	<b>No of Lectures/Hours : 60</b>
<b>Field Study Record:</b> A report to be submitted on the day of examination containing the results of the field study on topic of social variable(s).	<b>60 Hrs</b>

**[COURSE LEARNING OUTCOMES:** Students will get the theoretical knowledge on the Population problems, problems of Infertility and brief idea about In Vitro fertilization and malnutrition. Students will also learn the concept of Principles and social importance of immunization, Epidemiology and Prevention of AIDS and hepatitis.]

**PHY-MJ-18: Biomedical Instrumentations and Literature Studies in Physiology (6 credits; Marks 60+15=75)**

<b>Course Code: PHY-MJ-T-18 [4Credits]</b>	<b>No of Lectures/Hours : 60</b>
Principle of construction and use of compound microscope, phase – contrast microscope, fluorescence microscope, electron microscope (Transmission and scanning),	<b>12 Hrs</b>
Photoelectric colorimeter, sound level meter and audiometer.	<b>12 Hrs</b>
Principles of X-ray diffraction and NMR Imaging systems. Immunologically sensitive FET.	<b>12 Hrs</b>
Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.	<b>12 Hrs</b>
Elementary idea about clinical importance of ECG, Holter monitor, Defibrillators, EEG, Diathermy, USG, Doppler effect, Endoscopy, Lithotripsy, MRI, fMRI, CT scan and PET.	<b>12 Hrs</b>
<b>Course Code: PHY-MJ-P-18 [2 Credits]</b>	<b>No of Lectures/Hours</b>

	<b>: 60</b>
<b>Industrial training and workshops.</b>	<b>30 Hrs</b>
<b>Literature Review:</b> A report to be submitted on the day of examination containing the review of literature on a topic of physiological importance and Seminar Presentation.	<b>30 Hrs</b>

**[COURSE LEARNING OUTCOMES:** Graduates will learn about different techniques for the measurement of various physiological parameters and modern imaging techniques for medical diagnosis. They will gain their practical knowledge related to the various therapeutic equipment's used in biomedical field.]

**PHY-SI-4: Research project/ Dissertation (12 Credits; Marks=150)**

**Advanced instrumentation in Physiological Research and Recent Advances in the Topic Proposed.**

(Hypothesis proposed, Protocol Designing, methodology, Work Execution, Data Interpretation, Preparation of Report)