

**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 III, IV, V & VI)*

Undergraduate Board of Studies in Physiology



**Council for Undergraduate Studies
Kalyani University**

**KALYANI – 741235
NADIA, WEST BENGAL, INDIA
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Subject: Physiology Major

Semester III

PHY – MJ- 3: Body Fluids and Human Immunity [6 credits; Marks 60+15=75]

Course Code: PHY-MJ-T-3	[4 Credits]	No. of Hours: 60
1. Plasma proteins-normal values, origins, functions; Plasmapheresis, Bone Marrow- stem cells.		5 Hrs.
2. Formed elements of blood-origin, formation, function and fate.		5 Hrs.
3. Haemoglobin-Chemistry, biosynthesis, functions, compounds and derivatives, Fetal haemoglobin, abnormal haemoglobin, thalassaemia, sickle cell anemia.		8 Hrs.
4. Anaemia: types and their causes.		4 Hrs.
5. ESR, Haematocrit, PCV, MCV, MCH, MCHC, Blood volume		2 Hrs.
6. Blood haemostasis-vasoconstriction, platelet aggregation and clot formation, anticoagulants and their mechanism of action, coagulation hastening factors, prothrombin time, disorders of coagulation, haemolysis		10 Hrs.
7. Blood groups- ABO system and Rh factor, Blood transfusion & hazards		4 Hrs.
8. Blood immune system, Definition and types of immunity, Development and processing of Lymphocytes, Antigens, antibody, haptens, adjuvants.		6 Hrs.
9. Development of cell-mediated immunity, Development of Humoral immunity, Immunoglobulin-Classification, basic structure and function.		6 Hrs.
10. APC, antigen and antibody reactions – RIA, ELISA Vaccine, toxins, toxoids, antiserum, Natural killer cell, cytokines Immunization, Immune deficiency diseases.		6 Hrs.
Immunopathology- basic principles of autoimmune disease and transplantation immunology 11. Allergy and immunological hypersensitivity reactions.		6 Hrs.
Course Code: PHY-MJ-P-3	[2 Credits]	No. of Hours: 60
1. Differential count of WBC		8 Hrs.
2. Total count of RBC and WBC		8 Hrs.
3. Bleeding time and clotting time		6 Hrs.
4. Hemoglobin estimation		6 Hrs.
5. Preparation of hemin crystal		6 Hrs.
6. Preparation and staining of Bone marrow		8 Hrs.
7. Reticulocyte staining		6 Hrs.

8. Blood group determination	6 Hrs.
9. Assignment	6 Hrs.

[COURSE LEARNING OUTCOMES: Graduates will learn about body fluid and its immune role in details. They will learn about body's defence mechanism and vaccination schedule. They will gain their practical knowledge related to the theory part.]

Semester IV

PHY-MJ-4: Metabolic Physiology

[6 credits; Marks 60+15=75]

Course Code: PHY-MJ-T-4	[4 Credits]	No. of Hours: 60
1. Metabolism of Carbohydrates: Glycogenesis, Glycogenolysis, Glycolysis, Gluconeogenesis, HMP Shunt pathway, Rapoport-Luebering Cycle. Regulation and energetics of Glycogenesis, Glycogenolysis, Glycolysis, and Gluconeogenesis,		7 Hrs.
2. Metabolism of Carbohydrates: TCA cycle and anabolic role of TCA cycle, Synthesis & Regulatory role of cyclic AMP, TCA cycle as the final common pathway of metabolism, Blood sugar, Glucose tolerance and Glycosylated Haemoglobin.		6 Hrs.
3. Metabolism of Lipids: Oxidation of fatty acids and its energetics, Synthesis of unsaturated fatty acids, Formation and fates of ketone bodies,		5 Hrs.
4. Metabolism of Lipids: Cytosolic biosynthesis of saturated fatty acids and eicosanoids, Metabolism of adipose tissue, Cholesterol metabolism, Lipoproteins - Classification and brief idea of functions, Blood lipid profile.		6 Hrs.
5. Metabolism of Proteins and Amino acids: Amino acid pool, non-protein nitrogen, Nitrogen balance, Deamination, Transamination, and Decarboxylation, Synthesis of urea,		5 Hrs.
6. Metabolism of Proteins and Amino acids: Basic idea of glucogenic and ketogenic amino acids, Metabolism of glycine, sulphur-containing amino acids and phenylalanine, Synthesis of physiological important biomolecules: Melatonin, Glutathione, Serotonin, Creatine phosphate, Histamine, GABA and Creatinine.		7 Hrs.
6 Biological Oxidations: Redox potential, Mitochondrial Electron Transport Chain, Oxidative phosphorylation and high-energy compounds.		10 Hrs.
7 Enzymology: Chemical nature, Classification, Mechanism of action, Active sites, Enzyme kinetics, Km value, Effect of temperature and pH, Inhibition of enzymes, Covalent modifications, Allosteric modulation, Isozymes, Ribozymes, Abzymes, Rate-limiting enzymes,		14 Hrs.
Course Code: PHY-MJ-P-4	[2 Credits]	No. of Hours: 60
1. Quantitative Experiments: Estimation of glucose and sucrose in aqueous solution and lactose in milk by Benedict's method.		10 Hrs.
2. Estimation of ammonia and amino nitrogen (Sorensen's formol titration method).		10 Hrs.
3. Identification of amino acids by paper chromatography or TLC		10 Hrs.
4. Demonstration: Paper electrophoresis.		8 Hrs.
5. Colorimetric Estimation of serum protein (Biuret method, by plotting standard curve).		8 Hrs.
6. Colorimetric Estimation of Cholesterol, SGPT and SGOT by kit method		8 Hrs.
7. Assignment		6 Hrs.

[COURSE LEARNING OUTCOMES: Graduates will learn about some part of the fundamental Human Physiology like Homeostasis, Body Fluid, Cellular Physiology, Biophysics, Circulating Body Fluid, Functional Anatomy of Heart & Physiology of Breathing. They will gain their practical knowledge related to the theory part.]

PHY-MJ-5 Hormone and Reproduction

[6 credits; Marks 60+15=75]

Course Code: PHY-MJ-T-5	[4 Credits]	No. of Hours: 60
1. The Endocrine system		
a. Hormone receptors, types of receptors, signal transductions by hormones.		4 Hrs.
b. Neuroendocrinology -concept of neurosecretion, hypothalamic control of anterior and posterior pituitary, chemistry of releasing hormones, posterior pituitary hormones, effects, hypo and hyperfunctions.		6 Hrs.
c. Anterior Pituitary hormones: formation, secretion, chemistry, transport, regulation of anterior pituitary hormones, effects, hypo and hyperfunctions.		6 Hrs.
d. Thyroid hormones, Parathyroid hormones: histological structure of the glands, formation, secretion, chemistry, transport, regulation of thyroid hormones, parathyroid hormones: effects, hypo and hyperfunctions.		6 Hrs.
e. Endocrine Functions of the Pancreas: Islet cell structure, chemistry, biosynthesis and secretion of insulin and glucagon, regulation of insulin secretion, hormonal control of blood sugar, other Islet cell hormones, hypoglycaemia, Diabetes Mellitus (types, clinical manifestations, metabolic alterations).		6 Hrs.
f. Adrenal hormones: Histological structures of adrenal gland. Chemistry, biosynthesis, secretion, transport, regulation of cortical and medullary hormones, Renin-angiotensin system, effects, hypo and hyperfunctions of adrenal gland hormones.		6 Hrs.
g. GI Hormones: Chemistry, secretion and functions of the gastrointestinal hormones.		2 Hrs.
h. Pineal hormone: Chemistry and functions of melatonin.		1 Hr
i. Heart, Kidney, Thymus as an endocrine organ, Prostaglandin and kinins.		1 Hr

2. Reproduction	
a. Sex differentiation and development, importance of AMH, chromosomal abnormalities.	2 Hrs.
b. Primary and secondary sex characters, Puberty (Precocious and delayed puberty).	2 Hrs.
c. Male reproductive system –Structure of male reproductive system, structure of sperm, composition of semen, endocrine function of testis, Sertoli cells, Blood testes barrier. Spermatogenesis: stages, endocrine control, factors affecting.	6 Hrs.
d. Female reproductive system: Structure of female reproductive system, Oogenesis: process and endocrine regulation, hormonal functions of ovary, Phases of Menstrual cycle and Estrous cycle, Endocrine control of menstrual cycle, Ovulation-process and endocrine control, Abnormalities of ovulation and menstrual cycle, Ovulation induction.	6 Hrs.
e. Fertilization, Implantation, Placenta- formation and function, Pregnancy –mother’s physiological adaptations, parturition- process and factors controlling, Menopause , Mamogenesis and lactation- regulation and factors controlling. Birth control, physiological concepts of planned family.	6 Hrs.
Course Code: PHY-MJ-P-5	[2 Credits]
	No. of Hours: 60
1. Study of the effects of oxytocin on uterine contraction (Demonstration)	8 Hrs.
2. Study of the effects of adrenaline on intestinal/uterine movements. (Demonstration)	8 Hrs
3. Study of estrous cycle (Demonstration)	8 Hrs
4. Staining and identification of thyroid gland, adrenaline gland, pancreas, testis, ovary.	12 Hrs
5. Pregnancy test from human urine by kit method.	6 Hrs
6. Estimation of estrogen by spectrophotometric method.	6 Hrs
7. Estimation of Hormones using ELISA method	6 Hrs
8. Assignment	6 Hrs

[COURSE LEARNING OUTCOMES: Graduates will learn about secretion, formation, chemistry, biosynthesis, mechanism, control and functions of several hormones. They will also learn about the reproductive parts of our body and their mechanisms and functions. They will gain their practical knowledge related to the theory part.]

Semester V

PHY-MJ-6 Advanced Cellular Physiology

[6 credits; Marks 60+15=75]

Course Code: PHY-MJ-T-6	[4 Credits]	No. of Hours: 60
1. Cell cycle – Events and regulatory role of cyclins and CDK, Role of proto-oncogenes (focus on Ras gene) and tumour.		4 Hrs.
2. Cell Division: Phases and Significance of Mitosis & Meiosis. Cell death: Necrosis, Autophagy, Apoptosis.		8 Hrs.
3. Cell signalling: G-proteins, G-protein coupled receptors. Calcium, IP3 & DAG, cAMP, cGMP as second messengers. JAK-STAT pathway. RAS pathway. MAP kinase pathway. PI3 kinase pathway.		10 Hrs.
4. Colloids: Classification, properties – optical, electrical, electrokinetic. Biological importance of colloids, Ultrafiltration, Ultracentrifugation, Definition and physiological importance of Dialysis, Chromatography, Electrophoresis, Adsorption, Gibbs-Donnan membrane equilibrium.		15 Hrs.
5. Thermodynamics: Type of surroundings and systems. Laws, Living body as a thermodynamic system, thermodynamic equilibrium and physiological steady state. Reversible and Irreversible processes, Equilibrium constant.		12 Hrs.
6. Autoradiography, Cell fractionation and tracer techniques (principle and use of P32, C14, O18, H3).		5 Hrs.
7. Nano particles: Classification, Properties, Synthesis, Application in health and medicine.		6 Hrs.
Course Code: PHY-MJ-P-6	[2 Credits]	No. of Hours: 60
Fresh tissue experiments: Suitable staining and examination of fresh tissues- Squamous and columnar epithelium (methylene blue), areolar and adipose (Sudan III or IV. Specimens should be taken strictly from mammals.		30 Hrs
Study of charts on Cell signalling.		10 Hrs
Assignment		20 Hrs

[COURSE LEARNING OUTCOMES: Graduates will develop an understanding of the principles and physical phenomena underlying cellular processes and apply basic principles of chemistry and physics and their application in human health. They will also learn to develop a molecular understanding of the complex system of communication that governs basic cellular activities and coordinates cell actions. They will gain their practical knowledge related to the theory part.]

PHY-MJ-7 Skin and Muscle Function**[6 credits; Marks 60+15=75]**

Course Code: PHY-MJ-T-7	[4 Credits]	No. of Hours: 60
1. Skin & Integumentary system: Structure and functions of skin. Sweat gland – structure, composition of sweat. Physiology of sweat secretion and its regulation. Insensible perspiration.		2 Hrs.
2. Skin & Integumentary system: Regulation of body temperature in homeotherms – its physical and physiological processes, roles of neural and hormonal processes. Physiology of hyperthermia, hypothermia and hibernation. Temperature regulation in non - sweating animals.		3 Hrs.
3. Nerve Physiology: Structure, classification, and functions of neurons and neuroglia. Cytoskeletal elements and axoplasmic flow. Myelinogenesis. Measurement of Electrical Events, Ionic Basis of Excitation & Conduction - different potentials and propagation of nerve impulse in different types of nerve fibres.		5 Hrs.
4. Nerve Physiology: Properties of nerve fibres, Chronaxie, rheobase, and utilization time, co-transmitters, neuromodulators.		6 Hrs.
5. Nerve Physiology: Injury to peripheral nerves – degeneration and regeneration in nerve fibre, changes in the nerve cell body, transneuronal degeneration, changes in receptors and motor end-plates, denervation hypersensitivity. Thermal changes of the nerve during activity. Nerve growth factors.		10 Hrs.
6. Muscle physiology: Microscopic and electron microscopic structures of striated, smooth and cardiac muscles- Skeletal Muscle-Morphology, Properties of Muscle in the Intact Organism, Electrical Phenomena & Ionic Fluxes, Contractile Responses, Energy Sources & Metabolism.		8 Hrs.
7.Muscle physiology: Cardiac Muscle -Morphology, Electrical Properties, Mechanical Properties, Metabolism, Pacemaker Tissue. Smooth Muscle - Morphology, Visceral Smooth Muscle, Multi-Unit Smooth Muscle. Sarcotubular system.		6 Hrs.
8.Muscle physiology: Red and white muscle, fast and slow muscle. Rigor mortis. Mechanism of muscle contraction and relaxation. Sliding filament theory. Excitation-contraction coupling. Isometric and isotonic contractions. Chemical, thermal and electrical, Excitation changes in striated muscle during contraction and relaxation. Muscle spindle: structure, innervations and behaviours.		8 Hrs.
3. Synaptic & Junctional Transmission: a. Synaptic Transmission: Introduction, Functional Anatomy, Electrical Events at Synapses, Inhibition & Facilitation at Synapses, Chemical Transmission of Synaptic Activity, Principal Neurotransmitter Systems, Synaptic Plasticity & Learning,		8 Hrs.
b. The Neuromuscular Transmission: Structure, transmission, end-plate potential, MEPP, post-tetanic potentiation. Motor unit. Motor point.		4 Hrs.
Course Code: PHY-MJ-P-7	[2 Credits]	No. of Hours: 60
1. Suitable staining and examination fresh muscle tissues-Skeletal and Cardiac (methylene blue).		2 Hrs
2. Silver nitrate preparation of sciatic nerve for nodes of Ranvier.		4 Hrs.

3. Gastrocnemius-sciatic preparation and kymographic recording of isotonic muscle twitch. (Demonstration)	10 Hrs.
4. Effect of temperature on muscle twitch. (Demonstration)	10 Hrs.
5. Effect of load (after-load) on muscle twitch. Calculation of work done by the muscle. (Demonstration)	10 Hrs.
6. Effect of two successive stimuli on muscle twitch. (Demonstration)	10 Hrs.
7. Determination of nerve conduction velocity by kymographic recording of simple twitches. (Demonstration)	2 Hrs.
8. Ergographic recording of muscular fatigue by Moss's ergograph	2 Hrs.
9. Assignment	10 Hrs.

[COURSE LEARNING OUTCOMES: Graduates will get knowledge on the basics of transmission of external signal to the molecular level and outcome of that as a physiological action. They will understand different properties of nerve and muscle and the ionic movement leading to the action potential or impulse in excitable tissues of nerve and muscle. Students also learn about the integumentary system and regulation of body temperature. They will gain their practical knowledge following ethical protocol on both animal tissues and human subjects to know the basic properties of nerve/muscle function.]

Semester VI

PHY-M-T-8: Respiration and Cardiovascular Function

[6 credits; Marks 60+15=75]

Course Code: PHY-MJ-T-8	[4 Credits]	No. of Hours: 60
1. Cardiovascular system: Histological structures and properties of cardiac muscle. Myogenic heart, specialized tissue, Origin and propagation of the cardiac impulse, Pacemaker, reserve pacemaker, artificial pacemaker. Stannius ligature.		8 Hrs.
2. Cardiovascular system: The cardiac cycle - Pressure and volume changes. Heart sounds. Electrocardiography - the normal electrocardiogram, electrocardiographic leads, vectorial analysis, the vectorcardiogram, the mean electrical axis of the heart. Principles of echocardiography. Cardiac output - measurement by application of Fick's principle and dye dilution method, factors affecting. Starling's law of heart.		12 Hrs.
3. Cardiovascular system: <i>Cardiovascular homeostasis:</i> Factors affecting blood pressure. neural and chemical control of cardiac functions and blood vessels, cardiac and vasomotor centres, baroreceptors and chemoreceptors, innervation of the heart and blood vessels, cardiac and vasomotor reflexes. Coronary Circulation. Cardiovascular diseases- cardiomyopathy, coronary artery disease (CAD), valve stenosis, cardiac arrhythmia. Causes of common cardiovascular diseases, dietary factors, smoking, diabetes mellitus, alcoholism, cyanosis.		10 Hrs.
4. Respiratory system: Transport of gases in the body. Partial pressure and composition of inspired, expired and alveolar airs and the blood. Oxygen dissociation curve of haemoglobin and myoglobin, factors affecting. Carbon dioxide dissociation curve.		10 Hrs.
5. Respiratory system: Regulation of respiration, Neural and chemical, respiratory centres, chemoreceptors, baroreceptors, pulmonary receptors, Hypoxia: types, effects, Asphyxia. Voluntary hyperpnoea. Apnoea.		12 Hrs.
6. Respiratory system: Ventilation-Perfusion ratio, Lung function tests-FVC, MVV and their significance. Common respiratory diseases and their causes-asthma, lung carcinoma, emphysema.		8 Hrs.
Course Code: PHY-MJ-P-7	[2 Credits]	No. of Hours: 60
1. Preparation of Amphibian Ringer solution.		2 Hrs
2. Kymographic recording of the movements of perfused heart of toad.		10 Hrs
3. Study of the effects of changes in perfusion fluid pressure, changes in temperature, excess calcium and potassium ion concentration, acetylcholine, adrenaline on the movement of heart.		20 Hrs
4. Measurement of oxygen saturation by pulse oximeter before and after exercise.		12 Hrs
5. Measurement of forced expiratory volume (FEV) in first second.		8 Hrs

6. Pneumographic recording of effects of hyperventilation, breath-holding and talking. Lung function tests using Spirometry (Digital) and analysis of the results.	8 Hrs
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[COURSE LEARNING OUTCOMES: Graduates will learn about the Physiology and Function on vital organ like Heart and Lungs. Auto rhythmicity of Heart & how its function is regulated, common cardiovascular diseases and its causes. How gaseous exchange occurs in Lungs and its detailed mechanism, how its function is regulated. Also learn about the Respiratory Adjustments in Health & Disease They will gain their practical knowledge related to the theory part.]

PHY-M-T-9: Brain Function

[6 credits; Marks 60+15=75]

Course Code: PHY-MJ-T-9	[4 Credits]	No. of Hours: 60
1. Spinal cord-Structural organization, CSF formation, circulation and function, Ascending and descending tracts, origin, courses, termination and functions. Lower motor neurons and upper motor neurons.		3 Hrs.
2. Reflexes - Reflex Arc, Classification of Reflexes, General properties of reflexes, Monosynaptic and polysynaptic reflexes with example.		2 Hrs.
3. Senses- Classification of senses.		2 Hrs.
4. Pain- Physiology of pain		2 Hrs.
5. Reticular formation –Structure, connection and functions of reticular formation, Decerebrate rigidity		3 Hrs.
6. Thalamus- Structure, nuclear groups and function, Lesions of thalamus.		4 Hrs.
7. Hypothalamus-Structure, nuclei, afferent and efferent connections, functions: endocrine, temperature regulations, feeding and drinking behaviour and other behavioural functions.		4 Hrs.
8. Basal Ganglia-Functional anatomy, Circuitry and functions of Basal Ganglia, Parkinson's Disease		2 Hrs.
9. Vestibular apparatus-Structure and functions of vestibular organ, posture regulation.		2 Hrs.
10. Cerebellum- Structure, afferent and efferent connections, nuclei of cerebellum, tone, posture and equilibrium, Cerebellar disorders.		2 Hrs.
11. The Autonomic Nervous System- Organization, ganglia, centres and functions, Autonomic plexuses, Chemical transmission in autonomic ganglia, Cholinergic and adrenergic discharge, control of autonomic nervous system.		2 Hrs.
12. Cerebral Cortex- Cortical layers, Cytoarchitectonic areas, functions of Neocortex		2 Hrs.

13. Higher cortical functions-learning and memory, Hippocampus-anatomy and synaptic organization. Disorders of learning and memory. Speech - Broca's area, neurophysiological mechanism, speech disorders.	2 Hrs.	
14. Limbic system and emotion- Structure, functions, fear and rage, motivation.	2 Hrs.	
15. Electrical activity of the brain: Electroencephalogram, Physiological basis of EEG, Clinical significance.	2 Hrs.	
16. Sleep wakefulness- Physiological basis and types of sleep	2 Hrs.	
17. Special senses Classification of general & special senses & their receptors. Muller's law of specific nerve energies. Weber – Fechner law, mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors- phasic & tonic adaptations.	4 Hrs.	
18. Olfaction & gestation: Structure of receptors, neural pathway, physiology of taste and smell.	4 Hrs.	
19. Audition-Structure and functional significance of auditory apparatus, external, middle and internal ears, Organ of Corti, Auditory pathways and centres, Mechanism of hearing, Audiometry.	6 Hrs.	
20. Vision-: Anatomy & structure of eyeball, principal characteristics of ocular system compared to a camera. The structures of lens. Formation, circulation of aqueous & vitreous humor. Pupillary reflexes, light reflex, near response. Argyll- Robertson pupil. Errors of refraction & their corrections. Histological details of retina, peripheral retina, fovea, blind spot. Visual pathway, photopic & scotopic vision. Chemical & electrical changes in retina on exposure to light. Electroretinogram, positive & negative after image. Light & dark adaptation. Colour visions & its modern concept. Colour blindness. Visual field, perimetry, visual acuity-measurement, mechanism, factors controlling visual acuity. Binocular vision & depth perception. Lux, measurement of illumination, critical fusion frequency.	6 Hrs.	
Course Code: PHY-MJ-P-9	[2 Credits]	No. of Hours: 60
Staining of histological sections of spinal cord, cerebellum and cerebral cortex.	14 Hrs	
Experiments on superficial (plantar) and deep (knee jerk) reflex	14 Hrs	
Measurement of grip strength. Reaction time by stick drop test. Short term memory test (shape, picture word). Two-point discrimination test.	12 Hrs	
Determination of visual acuity by Snellen's chart / Landolt's C chart. Determination of colour blindness by Ishihara chart.	10 Hrs	
Assignment	10 Hrs.	

[COURSE LEARNING OUTCOMES: Graduates will learn about the structure & function of different parts of brain, the neural circuit of brain, sleep, ECG and a details mechanism and structure of sensory organs. This portion will help to better understanding of brain functioning.]

PHY-M-T-10: Human Nutrition**[6 credits; Marks 60+15=75]**

Course Code: PHY-MJ-T-10	No. of Hours: 60
1. Composition, functions, mechanism and control of salivary secretion; hyposalivation, hypersalivation	6 Hrs.
2. Composition, functions, mechanism of secretion of gastric juice; gastritis, gastric atrophy, peptic ulcer, Zollinger-Ellison syndrome, physiology of vomiting	6 Hrs.
3. Composition, functions, mechanism of secretion and regulation of pancreatic juice; pancreatic exocrine function tests, pancreatitis	6 Hrs.
4. Composition and function of bile; control of bile secretion; bilirubin metabolism, excretion; jaundice; gallbladder; hepatitis; gallstones, liver function tests	6 Hrs.
5. Composition, functions and control of intestinal juice; digestion in small intestine, malabsorption syndrome, gastro-ileal reflex.	4 Hrs.
6. Defecation; absorption and secretion of large intestine; blind loop syndrome; The faeces.	4 Hrs.
7. Constituents of food and their significance.	2 Hrs.
8. BMR, SDA, Basic concept of energy and units, Calorific values of food, ACU, Dietary requirement of carbohydrate, protein, lipid and other nutrients.	6 Hrs.
9. Balanced Diet and principles of formulation of balanced diets for growing child, adult man and woman, pregnant woman and lactating mother, elder people	8 Hrs.
10. Dietary fibres, Vitamins, Minerals,	6 Hrs.
11. Starvation, Obesity, Space nutrition.	6 Hrs.
Course Code: PHY-MJ-P-10	[2 Credits]
	No. of Hours: 60
1. Kymographic recording of normal movement of rat's intestine in Dale's apparatus. (Demonstration)	8 Hrs
2. Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements. (Demonstration)	12 Hrs
3. Staining and identification of liver, pancreas, salivary gland, duodenum, jejunum, ileum, pancreas, large intestine, oesophagus.	10 Hrs
4. Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report.	10 Hrs
5. A report (hand-written) on the basis of field survey from ONE of the following: a) Physiological parameters of Human (at least three parameters). b) Anthropometric measurements of Human (at least three parameters) c) Epidemiological studies on Human.	20 Hrs

[COURSE LEARNING OUTCOMES: Graduates will learn about the composition, function, mechanism and regulation of different parts of GIT and glandular organ and also

learn about their nutritional demand in their daily life and how they will fulfil their demand in low-cost budget.]