BLDE
(DEEMED TO BE UNIVERSITY)

Choice Based Credit System (CBCS)

Revised Curriculum

M.Sc. Medical Programme in Physiology

2025-26

Published by
BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956, vide notification No. F.9-37/2007-U.3 (A)
The Constituent College

SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA
Smt. Bangaramma sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
BLDE (DU) Phone: +9108352-262770, Fax : +918352-263303, Website : www.bldedu.ac.in, E-mail: office@bldedu.ac.in
College Phone : +918352-262770, Fax : +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956
Accredited A Grade by NAAC (Cycle-2)

BLDE(DU)/REG/M.Sc. Med. Curri./2025-26/ 5322 December 24, 2025

NOTIFICATION

Sub: Revision of Curriculum of M.Sc. Medical Programme in Anatomy, Physiology, Biochemistry, Microbiology & Pharmacology.

Ref: Approval of Hon'ble Vice-Chancellor vide no. 2245 dtd. 24.12.2025

On approval of the Hon'ble Vice-Chancellor, the revised curriculum for M.Sc. Medical Programme in Anatomy, Physiology, Biochemistry, Microbiology & Pharmacology by following the Choice Based Credit System (CBCS) offered under the Faculty of Medicine has been approved and is hereby notified.

The Curriculum shall be effective from the Academic Session 2025-26 onwards, for the M.Sc. Medical Programmes offered under the Shri. B. M. Patil Medical College Hospital & Research Centre.

REGISTRAR
REGISTRAR
BLDE(Deemed to be University)
Vijayapura-586103. Karnataka

Copy to:

- The Secretary, NMC, New Delhi
- The Secretary, UGC, New Delhi
- The Controller of Examinations
- The Principal, SBMPMCH&RC
- The Dean, Faculty of Medicine
- The HoD of Pre & Para Clinical Departments
- The Coordinator, M.Sc. Medical Programmes
- The Co-ordinator/ Director, IQAC
- The Assistant Registrar

Copy respectfully submitted to:

- The Hon'ble Pro-Chancellor
- The Hon'ble Vice-Chancellor

Vision:

- To be a Leader and be recognized as an Institution striving for maintenance and enhancement of Quality Medical Education and Healthcare"

Mission:

- To be committed to promote sustainable development of higher education including Health science education, consistent with the statutory and regulatory requirements.
- Reflect the needs of changing technology and make use of the academic autonomy to identify the academic programs that are dynamic.
- Adopt global concepts in education in the healthcare sector.

Preamble:

M.Sc medical physiology will be a three years course for graduates in the biological sciences that should facilitate them for teaching and research in health education sciences.

Duration:

Full time three years course.

Goal:

The goal of postgraduate M.Sc in medical sciences shall be:

1. To produce competent medical teachers.
2. To acquire scientific knowledge of research and principles of research methodology
3. To acquire the basic skills in teaching of the medical and Allied health courses

Objectives:

At the end of the M.Sc postgraduate training in the concerned subject the student shall be able to:

1. Demonstrate competence in basic concepts of research and be able to produce & analyze Research articles.
2. Develop excellent skills in the teaching of medical and paramedical health professionals.
3. Acquire the experimental skills necessary to analyze problems in their respective discipline.
4. Practice efficiently various investigative procedures backed by scientific knowledge including basic sciences and skills.
5. Get expertise in his/her field of interest.

Learning Objectives:

At the end of training course M.Sc student should have complete knowledge of the body with respect to.

I. Cognitive Domain:

All the systems of the body should be studied with respect to:

1. Historical aspect
2. Evolution and development
3. Comparative physiology
4. Structure-gross and electron microscopic and functions at cellular level
5. Qualitative and quantitative aspects.
6. Regulating mechanisms
7. Variations in physiological and pathological conditions

8. Applied physiology
9. Recent advances

II. Psychomotor Domain:

1. To perform human and animal (mammalian, amphibian) experiments. Hematology, Experiments based on biophysical principles.
2. To acquire history taking and clinical examination skills.

Affective domain:

1. Students should develop communication skills to interact with Students, colleagues and other staff members.
2. They should be able to work as a member of a team to carry out teaching as well as research activities.
3. They should have right attitude toward teaching profession.

Duration of Study Programme:

The duration of the study for M.Sc. Medical Microbiology will be of 3 years.

Eligibility Criteria:

A candidate seeking admission into this course shall have one of the following qualifications

a) B.Sc. Degree with life sciences as one of the optional
b) M.B.B.S Any of the following bachelor degree passing with not less than II class
c) B.Sc graduates of biological Sciences.
d) B.Sc. Zoology/Microbiology/Botany/Physiology
e) Other health sciences
f) BHMS
g) BAMS
h) B.Vsc

Medium of Instruction:

English shall be the Medium of Instruction for all the Subjects of study and for examinations.

Semester I Physiology
Course Code: MPHY 1.2
Course Contents
Physiology Theory

SEMESTER I								
Course Code	**Course Name Medical Anatomy**	**Credits**	**Teaching Hours pe week**			**Marks**		
			L	**SDL**	**P**	**Internal Assessment**	**Semester Exam**	**Total**
Theory								
MANA1.1 T	MedicalAnatomy	4	4	1		20	80	100
MPHY 1.2 T	MedicalPhysiology	4	4	1		20	80	100
MBCHM1.3 T	Medical Biochemistry	4	4	1		20	80	100
Practical								
MANA1.1 P	MedicalAnatomy	3			6	20	80	100
MPHY1.2 P	MedicalPhysiology	3			6	20	80	100
MBCHM1.3 P	Medical Biochemistry	3			6	20	80	100
Elective Course (Any One)								
1.4 GE	Introduction to Quality Patient & Safety	3	3			100	--	100
1.5 GE	Computer Application					100	--	100
Total		**24**	**36**			**220**	**480**	**700**

MPHY 1.2 Theory 60 Hrs

GENERAL PHYSIOLOGY **07 Hrs**

1. Homeostasis –definition & feedback mechanisms
2. Cell organelles, Structure of cell membrane
3. Transport Mechanisms- active and passive transport
4. Intercellular communications
5. Body fluids –compartments & measurement.

BLOOD AND BODY FLUIDS **15 Hrs**

1. Introduction, Fluid, compartments, composition of body fluids. Homeostasis - Definition, Composition and functions of blood.
2. Plasma Proteins - Types, Normal values, Origin, Functions, Variations in health and disease.
3. Red Blood cells. - Erythropoiesis, Definition. Sites and stages of Erythropoiesis: Regulation
4. Morphology of RBC, Functions, Normal values, variations, PCV and ESR, Determination. Normal values, Anemia, Clinical significance.
5. Haemoglobin - Structure, Functions, Types, Derivatives. Methods of estimatio Normal values, Anemia, Types and features.
6. Life span and destruction of RBC, RE system. Functions, Jaundice, Types.
7. Leucocytes - Leucopoiesis, Sites of Granulopoiesis, Lymphopoiesis and Monocytopoiesis.

8. Morphology of different types of leucocytes, Functions, Variations, Immunity, Transplantation of tissues and organs.
9. Platelets - Thrombopoiesis, Sites, Stages, Morphology, Functions, Normal values, Variations.
10. Homeostasis and Blood coagulation - Definition Clotting factors Mechanist of clotting.
11. Clot retraction, Fibrinolysis. Bleeding disorders Tests for clotting. Anticoagulants, Actions and uses.
12. Blood groups - ABO system and Rh factor. Blood Typing. Significance.
13. Blood transfusion - Indications, Types, Reactions, Lymph - Origin. Circulation, Functions of lymph and Lymph nodes.

NERVE MUSCLE PHYSIOLOGY: 08 Hrs

1. Types of neurons, Glia, with examples.
2. Structure of multipolar neuron and functions of each part
3. Types of nerve injuries, Wallerian degeneration. Retrograde degeneration, Chromatolysis, Regeneration of nerve fiber, factors affecting regeneration, Reaction of degeneration.
4. Properties of Nerve fiber :

a) Excitability. Electronic potentials, RMP Monophasic action potential, Ionic basis of RMP and AP, All or None Law, strength duration curve. Compound action potential.

b) Conduction - Classification of nerve fibers. Mechanism of conduction in myelinated and non-myelinated nerve fiber. Factors affecting conduction Orthodromic and antridromic conduction Susceptibility of Nerve fiber to various conduction blockers

5. Differences between 3 types of muscles Light microscopic and Electron microscopic structure of skeletal muscle. Sarcotubular system — Sarcomere.
6. Excitation contraction coupling.
7. Properties of skeletal muscle, factors affecting excitability and contractility. Treppe, Isometric and Isotonic contraction, Summation (wave and quanta!, tetanus, clonus). Energy sources for muscle contraction. Types of skeletal muscle, occurrence and differences.
8. N.M.J. structure, (electron microscopic). Transmission of impulse across the NMJ.

CARDIO VASCULAR SYSTEM: 15 Hrs

1. Functional anatomy of heart, blood vessels. Conducting system, systemic and pulmonary circulation.
2. Innervation of the heart and Blood vessels, VMC.
3. Hemodynamics.
4. Properties of cardiac muscle.
5. Cardiac cycle.
6. Heart rate and regulation of heart rate.
7. Cardiac output definitions, variations. Method of determination, Regulation.

8. Blood pressure.
9. Shock
10. Regional circulation
11. Cardio vascular changes during muscular exercise.

RESPIRATORY SYSTEM: 15 Hrs

1. Introduction - Functional anatomy of respiratory tract. Pulmonary ventilation Mechanism of ventilation. Muscles, pressure changes, Pressure volume inter relationship, compliance. Airway resistance.
2. Surfactant - Source. Chemical nature. Functions. Lung volumes and capacities Definition. Determination. Normal values. Significance
3. Alveolar ventilation - Dead space. Significance. Pulmonary circulation Ventilation, Perfusion Ratio & its significance
4. Respiratory membrane. Partial pressure of gases. Diffusion of gases. Discussion capacity. Factors affecting diffusion of gas.
5. Oxygen transport – Forms of transport O2, Oxygen Hemoglobin dissociation, Factors affecting it Myoglobin.
6. CO2 Transport – forms of transport. CO2 dissociation curve. Chloride shift. Haldane effect.
7. Regulation of respiration - Organization of respiratory centers. Neural regulation. Chemical regulation.
8. Non-chemical regulation. Respiration and Acid Base balance.
9. Hypoxia types, effects, voluntary Hyperventilation, Periodic breathing.
10. Dyspnoea, Asphyxia, Cyanosis Decompression sickness. Artificial Respiration, Methods.
11. Pulmonary function tests. Respiratory adjustments during muscular exercise.

SDL – 15 Hrs

1. SDL - Hemostasis
2. SDL- Sarcomere & Sarcotubler System
3. SDL Hemoglobin & its variants
4. SDL RMP & AP
5. SDL- N M Junction
6. SDL - Immunity
7. SDL- Properties of Cardiac Muscle
8. SDL Regulation of Respiration
9. SDL – Anemia
10. SDL- Hemophilia
11. SDL – Shock
12. SDL- Heart Blocks
13. SDL- Arrhythmia
14. SDL- Hypoxia
15. SDL – High altitude Physiology

Semester I Physiology
Course Code: MPHY 1.2 P
Physiology Practical

I. Hematology - 60 hrs

1. Study of the Microscope
2. Estimation of Hemoglobin
3. Study of haemocytometer and determination of red blood cell count
4. Determination of blood group
5. Determination of White Blood cell count
6. Erythrocyte sedimentation rate & packed cell volume. (Demonstration)
7. Osmotic fragility (Demonstration)
8. Blood indices.
9. Preparation and staining of a peripheral smear; differential leucocyte count.
10. Bleeding time & Clotting time.

Semester I
Elective Course Name: Introduction to Quality and Patient safety
Course Code: 1.4 GE
Course Content

Sr. No.	Topics	No. of Hrs
1	Quality assurance and management– Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Introduction to NABH guidelin	7
2	Basics of emergency care and life support skills- Basic life support (BLS), Vital signs and primary assessment, Basic emergency care– first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods, One and Two-rescuer CPR	7
3	Bio medical waste management and environment safety-Definition of Biomedical Waste, Waste minimization, BMW– Segregation, collection, transportation, treatment and disposal (including color coding), Liquid BMW, Radioactive waste, Metals/ Chemicals / Drug waste, BMW Management & methods of disinfection, Modern technology for handling BMW, Use of Personal protective equipment (PPE), Monitoring & controlling of cross infection(Protective devices)	8
4	Infection prevention and control - Evidence-based infection control principles and practices [such as sterilization, disinfection, effective hand hygiene and use of Personal protective equipment (PPE)], Prevention & control of common healthcare associated infections, Components of an effective infection control program, Guidelines (NABH and JCI) for Hospital Infection Control	8
5	Antibiotic Resistance - History of Antibiotics, How Resistance Happens and Spreads, Types of resistance- Intrinsic, Acquired, Passive, Trends in Drug Resistance, Actions to Fight Resistance, Bacterial persistence, Antibiotic sensitivity, Consequences of antibiotic resistance	8
6	Disaster preparedness and management - Fundamentals of emergency management, Psychological impact management, Resource management, Preparedness and risk reduction, information management, incident command an institutional mechanisms	7

Semester I
Elective Course Name: Computer Applications
Course Code: 1.5 GE
Course Content

Unit-I

Computer fundamentals, Introduction to digital computers, Organization, Number system, I/O devices, Storage devices, MS-Windows basics, MS-office, MS-Word-Meaning of word Processing, Creating, Saving, Printing Documents, Page Setup, Formatting, Spell-Check, Adding page numbers, Header and Footer, Macros, Creating tables, Converting table to text and vice versa, Mail Merge Ms-Excel-spreadsheets, Using different types of formulae, Creating graphs and charts, Exporting charts to MS-Word, MS-Power Point, Creating presentations, Formatting, Adding effects and timings

Unit-II

Introduction to Data, Information, Database, DBMS (Advantages and disadvantages), MS Access, Basics of MS Access, Introduction to SQL (Data retrieval) Data analysis and database-Brief description and tabulation of data Measure of central tendency and dispersion-Mean, Median, Mode, Range, Standard Deviation, Variance and Correlation coefficient using SPSS. Types of errors and level of significance, Tests of significance, (F and t-test); Chi-square tests

Unit-III

Internet basics, Introduction to internet and its applications-www, email, ftp. Virtual library and some useful sites on Internet-Searching MEDLINE on the Pubmed system from National Centre for Biotechnology and Information, Assessing full text journals on the internet and printing articles using End Note Databases (Genes Bank), search tools and software at http://www.ncbi.nlm.nih.gov. Restriction enzyme site digestion web cutter2.0 at http://www.firsmarket.com/cutter/cut2.html PCR and multiplex PCR guide and troubleshooting at http://www.med.yale.edu/genetics/ward/tavi/Trblesht.html Image analysis program at http//www.scioncorp.com

Books Recommended:

- Sinha, P.K. (2004). Computer Fundamentals
- Peter Norton's Introduction to Computers, 6th.Ed.
- Windows Based Computer Courses, Sumit Kumar, Maalti, Sandeep Sood JBD Publishers.
- Gupta, S.C. (2008).Fundamentals of Statistics. Himalaya Publishing Ho

Semester II Physiology
Course Code: MPHY T 2.2
Course Contents
Medical Physiology Theory

SEMESTER II								
Course Code	**Course Name**	**Credits**	**Teaching Hours Per week**		**Marks**			
			L	**SDL**	**P**	**Internal Assessment**	**Semester Exam**	**Total**
Theory								
MANA 2.1	Medical Anatomy	4	4	1		20	80	100
MPHY 2.2	Medical Physiology	4	4	1		20	80	100
MBCHM 2.3	Medical Biochemistry	4	4	1		20	80	100
MCOM 2.4	Research Methodology & Biostatistics	3	3			20	80	100
Practical								
MANA 2.1P	Medical Anatomy	3			6	20	80	100
MPHY 2.2 P	Medical Physiology	3			6	20	80	100
MBCHM 2.3 P	Medical Biochemistry	3			6	20	80	100
Total		**24**	**36**			**140**	**560**	**700**

MPHY 2.2 T – 60 Hrs

Digestive System: **08 Hrs**

1. Introduction - Anatomy of G.I. Tract. Salivary secretion. Types of salivary glands, Innervations, composition of saliva, regulation, functions.
2. Gastric secretion- Structure of gastric mucosa. Innervations, Origin, composition and functions of gastric juice. Mechanism of secretion of Hcl. Functions
3. Regulation of gastric secretion. Methods of study. Phases of gastric secretion. Factors influencing gastric secretion, Peptic ulcer.
4. Pancreatic secretion - structure of Pancreas. Innervations of origin, composition and functions of pancreatic juice. Mechanism of secretion, Regulation, Tests for pancreatic exocrine function.
5. Liver and gall bladder - Functions of liver structure, Composition and functions of bile. Regulation, functions of gall bladder. Filling an emptying, Regulation, Cholecystectomy, Gall stones.
6. Small intestine - structure, composition and functions of success enteric us, regulation, Large intestine - structure, functions, secretion
7. Gastro-intestinal movements: Stages of deglutition. Mechanism Disturbances, Gastric motility. Types of movement. Gastric emptying and regulation.
8. Movements of small intestine - Types, Regulation, Ileo-caecal valve functions, movements of colon, Defecation.
9. Gastro-intestinal hormones and their actions. Digestion of Carbohydrates Proteins and fats.
10. Absorption of carbohydrates, Proteins, fats, vitamins, water and electrolytes.

Kidney, Skin and Temperature Regulation: **10 Hrs**

1. Functional anatomy of kidney, Renal blood flow, its determination, regulation and peculiarities.
2. G.F.R. Definition, Measurement: filtration membrane, forces involved, Control of GFR.
3. Tubular function - reabsorption, secretion and concentration mechanism.
4. Nerve supply to urinary bladder Micturition, Non excretory functions of kidney.
5. Renal function tests. Skin and its functions
6. Body temperature control.

Reproductive System: **08 hrs**

1. Introduction
2. Male reproductive system.
3. Female reproduction system
   a) Menstrual cycle
   b) Pregnancy and parturition
   c) Lactation and family planning.

Endocrines: **15 Hrs**

1. Introduction to Endocrinology. Classification, General properties and mechanism of action of hormones.
2. Pituitary gland:
   a) Anterior pituitary hormones, their actions, control and disorders.
   b) Actions, control and disorders of posterior pituitary hormones
3. Thyroid gland:
   a) Synthesis, actions of iodine containing thyroid hormones.
   b) Control of secretion, Thyroid function tests and disorders.
4. Calcium:
   a) Synthesis, Functions, Regulation & Disorders of Parathormone, Calcitonin & 1 25 (OH) 2 D 3
5. Endocrine Pancreas – Insulin & glucagon
   a) Source
   b) Actions
   c) Regulation
   d) Clinical disorders.
6. Adrenal gland:
   a) Adrenal cortex – Nomenclature, Actions, Control, Disorders
   b) Adrenal medullary hormones – Synthesis, actions and control.

Central Nervous System: **14 Hrs**

1. Synapse, definition, types of synapse, synaptic transmission. Properties of synapse.
2. Receptors, definition, Classification, properties.
3. Reflexes - Monosynaptic and poly synaptic reflexes.

4. Organization of CNS Cross section of spinal cord - location of Ascending and Descending tracts Composition and functions of Posterior nerve root and anterior nerve root. Effect of lesions of Posterior Nerve root and anterior nerve root.
5. Description of posterior column tract, Lateral spinothalamic tract (Neo and paleo), ventral spinothalamic tract. Tracts for carrying all modalities of sensations.
6. Referred pain, Theories, Central inhibition of pain, Tabes dorsalis, syringomyelia.
7. Complete section of spinal cord and effects of hemisection.
8. Corticospinal tract in detail, including lesions at different levels of the tract. Effects of Upper motor neuron and lower motor neuron lesion.
9. Extra pyramidal tracts and their functions.
10. Brain stem Major Components of brain stem and their functions Reticular formation, location and functions - EEG.
11. Cerebellum:

a) Brief description of gross anatomy and histology of cerebellum. Major connections and functions of spino-cerebellum, Cerebrocebellum and vestibulocerebellum, effects of lesions of cerebellum.

12. Hypothalamus: Major nuclei, major afferent and efferent connections and functions.
13. Thalamus: Major afferent and efferent connections and function, thalami syndrome.
14. Basal ganglia: Components, major circuits, functions and Parkinson's disease.
15. Limbic lobe – components, major connections and functions.
16. Cerebral cortex: brief description of gross anatomy, functions of each lobe and higher functions of cerebral cortex.
17. CSF: formation, composition, circulation and functions.
18. Autonomic nervous system.

Special Senses: 05 Hrs

1. Smell Structure of olfactory mucous membrane and olfactory tract.
2. Taste Structure of Taste bud. Basic taste modalities. Taste pathway.
3. Ear Structure of the ear (E.M. & internal) components and functions of middle ear structure of organ of corti Physiological of hearing, Auditory pathway Theories of hearing and Deafness Turning fork tests Vestibular apparatus
4. Structure Visual pathway, physiology of vision Field of vision, effects of lesion at different levels In visual pathway, Light reflexes and accommodation, reflexes and accommodation, reflexes principles of optics. Common errors of refraction. Dark and light adaptation Photo chemical changes. Colour vision, colour blindness.

SDL – 15 Hrs

1. Peptic Ulcer
2. Jaundice
3. Functions of Cerebrum
4. Parkinson's disease
5. Physiology of Menopause
6. Preciouses puberty
7. Spermatogenesis
8. Thyrotoxicosis

9. Crushing Syndrome
10. Renal Clearance
11. Visual pathway
12. Auditory Pathway
13. Gustatory Pathway
14. Olfactory Pathway
15. Glaucoma

Semester II Physiology
Course Name: Medical Physiology Practical
Course Code: MPHY 2.2 P

Practical's – 60 Hrs
Human Physiology Experiments – 30 hrs

1. Spirometry, PEFR
2. Ergography
3. Artificial Respiration
4. Arterial Pulse
5. Recording Blood Pressure a. Normal & Effect posture
   b. Effect of Exercise
6. ECG – Demo
7. Perimetery
8. Determination of MVV, DI, BMI, Body fat percentage

CLINICAL EXAMINATION. – 30 hrs

1. General physical examination
2. Introduction to clinical examination
3. Interpretation of charts, problems & case histories.

Semester II
Name of the Course: Research Methodology & Biostatistics
Course Code: MCOM 2.4
Course Content

Teaching Objectives	To teach the basic principles of research methodology To teach the basic aspects of biostatistics
Learning Outcome	The course will make students capable of choosing an appropriate study design and apply required statistical tests to derive inferences.

S. No	Topics	No of Hours
1	Introduction to research methodology: Purpose of research, Meaning & objectives of research, Types & approaches of research, Criteria for good research	2 hours
2	Research Designs: Need of study designs, Features of good design, Types of research designs - Descriptive, Analytical & Experimental study designs; Concept of Confounding & Bias	10 hours
3	Measurement & Scaling: Types of data, Measurement scales, Scaling techniques, Sources of error	5 hours
4	Data Collection: Primary & Secondary data; Methods for data collection; Data preparation	3 hours
5	Descriptive statistics: Measures of central tendency & dispersion.	5 hours
6	Sampling: Types of samples; Sample size estimation	5 hours
7	Testing of Hypothesis: Concept oh null hypothesis, Inferential statistics; Parametric & Non parametric Tests	10 hours
8	Interpretation & Report Writing	5 hours
	TOTAL	**45 hours**

References:

- K. Park. Textbook of Preventive & Social Medicine. 26th Edition. Bhanot Publishers
- Dr. J.V. Dixit. Principles & Practices of Biostatistics. 2nd Edition. Bhanot Publishers
- C. R. Kothari & Gaurav Garg. Research Methodology Methods & Techniques. 4th Edition New Age International Publisher

Semester III Physiology
Course Name: Medical Physiology Theory
Course Code: MPHY 3.1 T
Course Content

SEMESTER III						
Course Code	**Course Name**	**Credits**	**Teaching Hours per week**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
MPHY 3. 1 T	General Physiology	4	4	20	80	100
MPHY 3. 2 T	Nerve Muscle Physiology	4	4	20	80	100
MPHY 3.3 T	Blood & Immune System	4	4	20	80	100
Practicl						
MPHY3. 1P	Nerve Muscle Physiology	3	6	20	80	100
MPHY3. 2P	Blood & Immune System	3	6	20	80	100
Elective Course (Any Two)						
3.4 GE	Nano Biotechnology	3	3	100	--	100
MPHY 3.5 DSE	Mamalian Physiology	3	3	100	--	100
3.6 GE	Moleclular Biology	3	3	100	--	100
3.7 GE	Research Praposal Writing	3	3	100	--	100
	Total	**24**	**30**	**300**	**400**	**700**

Theory 60 Hrs

MPHY 3.1 T: General Physiology – Duration **10 Hrs**

1. Describe the structure and functions of a mammalian cell
2. Describe & discuss the principals of Homeostasis
3. Describe intercellular communication
4. Describe apoptosis – programmed cell death
5. Describe & discuss transport mechanism across cell membrane
6. Describe the fluid compartments of body, its ionic composition & measurements
7. Describe the concept of pH & buffer systems in the body
8. Describe & discuss the molecular basis of resting membrane potential & action Potential in excitable tissue
9. Demonstrate the ability to describe & discuss the method used to demonstrate the functions of the cells & its products, its communications & their applications in clinical care & research

MPHY T – 3.2 T- Nerve and muscle: **25 hours**

1. Structure of a neuron and classification of nerve fibers, properties, potential in nerve fibers, degeneration and regeneration of Nerve fibers, Neuroglia
2. Muscle: types, physiological anatomy of skeletal muscle
3. Neuromuscular junction and myasthenia gravis and NMJ blocking drugs
4. Mechanism of muscle contraction and its molecular basis, types of contraction – isotonic and isometric contractions
5. Energetic of muscle contraction – Rigor mortis
6. Types and properties of muscle fiber
7. Structure and types of smooth muscle
8. Contraction of smooth muscle

MPHY T – 3.3 T - Blood: **25 hours**

1. Composition and functions of blood
2. Plasma proteins – Types, normal values, origin, functions, variation in health and diseases
3. Red blood cells – erythropoiesis definition, sites and stages of erythropoiesis, regulation Morphology of RBC, functions, normal values, variations, PCV and ESR, determination, anemias and its clinical significance
4. Hemoglobin – structure, functions, types, derivatives, methods of estimation, normal values, anemias, types and features
5. Life span and destruction of RBC, RE system, functions, jaundice, types Leucocytes – leucopoiesis, sites of granulopoiesis, lymphopoiesis and monocytopenia's
6. Morphology of different types of leucocytes, functions, variations, immunity, transplantation of tissues and organs
7. Platelets – thrombopoiesis, sites, stages, morphology, functions, normal values and variation

8. Hemostasis and blood coagulation – definition, clotting factors, mechanism of clotting
9. Clot retraction, fibrinolysis, bleeding disorders, tests for clotting, anticoagulants, actions and uses
10. Blood groups – ABO system and Rh factor
11. Blood transfusion – indications, types, reactions, lymph – origin, circulation, functions of lymph and lymph nodes, blood volume, determination, regulations

Medical Physiology
Practical Duration 60 hrs
Course Name: Medical Physiology Practical
Course code MPHY 3.1 P

I. MPHY 3.1 P - Nerve Muscle Physiology - 30 hrs

1. N.M. Physiology: Electromyography.

A. Amphibian nerve - muscle experiments and interpretation of graphs

List of graphs on nerve-muscle experiments:

1. Simple muscle twitch
2. Effect of various strengths of stimuli on Simple muscle twitch
3. Effect of changes in temperature on Simple muscle twitch
4. Effect of two successive stimuli on muscle contraction
5. Effect of multiple successive stimuli (treppe, clonus, tetanus)
6. Study of fatigue in skeletal muscle
7. Velocity of nerve conduction
8. Effect of load on muscle
9. Measurement of isometric contractions using nerve muscle preparation

II. MPHY 3.2 P - Hematology – 30 hrs

B. Blood groups

1. Erythrocyte sedimentation rate
2. Haematocrit
3. Reticulocyte count
4. Platelet count
5. Osmotic fragility
6. Hematology: Hematocrit, (PCV), ESR and Blood Indices.
7. RBC
8. WBC
9. AEC
10. Bleeding time & Clotting time
11. Estimation of Hemoglobin by Sahli's method

Elective Course Name: Nano Biotechnology
Course Code: 3.4 GE

UNIT I: Introduction, History & Applications
Various definitions and Concept of Nano-biotechnology & Historical background. Fundamental sciences and broad areas of Nanobiotechnology. Various applications of Nano-biotechnology. Cell – Nanostructure interactions

Unit II: Protein-based Nanostructures, Nano bio- machines & Signaling
Overview, chemistry and structure, Genetics & Secondary cell-wall polymers , Self-assembly in suspension, Re-crystallization at solid supports, Formation of regularly arranged Nano-particles, Cell as Nano bio-machine, link between the signaling pathways & molecular movements as well as neuron function ,Concepts in nano bio-machines for information processing and communications

UNIT III: Microbial Nanoparticle Production
Overview and concept of microbial nano-particle production, Methods of microbial nano-particle production, Applications of microbial nano-particles, Bacteriorhodopsin and its potential in technical applications – overview, structure, photoelectric

Unit IV: DNA-Protein Nanostructures
Overview and introduction, Oligonucleotide-Enzyme conjugates, DNA conjugates of binding proteins, Non-covalent DNA-Streptavidin conjugates, DNA-Protein conjugates in microarray technology.

Unit V: Biomaterials & Bio-electronic Biomaterials- types, properties and applications, Biomaterial nano-particle systems for bio-electronic & biosensing applications, Biomaterial-based Nano-circuitry, Protein-based Nano-circuitry, DNA as functional template for Nano-circuitry

Elective Course Name: Mammalian Physiology
Course Code: MPHY 3.5 DSE

UNIT I: Digestion and Respiration

Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice

Respiration: Exchange of gases, Transport of O_2 and CO_2, Oxygen dissociation curve, Chloride shift.

UNIT II: Circulation

Composition of blood, Plasma proteins & their role, blood cells, Haemopoisis, Mechanism of coagulation of blood.

Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat.

UNIT III: Muscle physiology and osmoregulation

Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction.

Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.

UNIT IV: Nervous and endocrine coordination

Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, salutatory conduction, Neurotransmitters. Mechanism of action of hormones (insulin and steroids). Different endocrine glands– Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions.

PRACTICALS

1. Finding the coagulation time of blood
2. Determination of blood groups
3. Counting of mammalian RBCs
4. Determination of TLC and DLC
5. Demonstration of action of an enzyme
6. Determination of Hemoglobin

SUGGESTED READING

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Her court Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition.John wiley & sons, Inc.

Semester III
Elective Course Name: Molecular Biology
Course Code: 3.6 GE
Molecular Biology Course Content

Unit 1 Physical basis of Heredity:

Introduction, concepts and theories of Mendelian genetics, chromosome theory of inheritance, Unit of Heredity - Genes, Alleles, Multiple alleles, Cis and Trans test. Extra chromosomal inheritance. Nucleic acids as genetic material

Unit 2 DNA Replication:

Prokaryotic and Eukaryotic DNA replication. Mechanism of DNA replication, enzymes and accessory proteins involved in DNA replication and proof-reading mechanism.

Unit 3 Mutation:

Causes of DNA damage, types of DNA damage, types of DNA repair and molecular mechanism of recombination.

Unit 4 Transcription:

Central dogma, general feature of RNA synthesis, RNA polymerase, mechanism of transcription in Prokaryotic and eukaryotic. Introns and exons, Post transcriptional modification of RNA – capping, polyadenylation, Introns splicing. Reverse transcription.

Unit 5 Translation:

Genetic code and its elucidation - properties of genetic code, ribosome structure, wobble hypothesis, structure and composition, of Prokaryotic and eukaryotic ribosome, structure of mRNA and tRNA, aminoacyl t-RNA synthases. Events of Protein synthesis, (Amino acid activation, initiation, elongation and termination) in Prokaryotic and Eukaryotic. Post - Translation modification of proteins, inhibitors of translation.

Unit 6 Regulation of Gene expression:

The Operon concepts, Lactose Operon, Tryptophan Operon and catabolic repression, steroid induced gene expression.

Unit 7 Molecular Mapping of Genome:

Physical maps - Physical Mapping and map Based cloning, choice of mapping, simple sequence repeats loci, and florescence in situ hybridization for genome analysis, RFLP, RAPD, AFLP analysis and applications.

Unit 8 Genome sequencing:

Genome - Organelle genomes, Genomic library, YAC, BAC Libraries, strategies of genome sequencing. Human Genome Project. Application of sequence information for identification of defective genes.

Semester III
Elective Course Name: Research Proposal Writing
Course Code: 3.7 GE
Research Proposal Writing Course Content

Learning objectives of the elective

1. To collect data of parameters, prescribed in the protocol correctly
2. To document data in the electronic case record
3. To demonstrate the use of statistical software to do basic research calculations
4. To write an abstract based on the collated data
5. To present abstract to a group of peers and supervisor

Prerequisites for the elective

1. Students should be aware Parameters included in the research profiles.
2. Good laboratory practice.

Topics

1. Orientation to research- Research definition, Broad scope of research
2. What is research proposal & need for the research proposal
3. What is a research question? How to frame a research question.
   Activity -To frame research question
4. Title for the Research proposal- Charactstics of title good & bad title
   Activity – To frame a title for their own research proposal
5. Introduction of research proposal
   Activity – To write & present a introduction for their own research proposal
6. Research aim objective & hypothesis
   Activity – To write & Present, Research aim objective & hypothesis for their own research proposal
7. Literature search
   Activity – To do literature search for their research proposal
8. Methodology
   Activity – To design methodology for their research proposal
9. Ethical aspects of biomedical research
10. Presentation of research proposal by students

Records to be maintained

Log book entry should be done daily

Assessment

Objectives and logbook entry Successful completion of research Reflections, Feedback on the research project.

Semester – IV Physiology
Course Name: Medical Physiology Theory
Course Code: MPHY 4.1 T
Course Content

SEMESTER IV							
Course Code	**Course Name**	**Credits**	**Teaching Hours per week**		**Marks**		
			SDL		**Internal Assessment**	**Semester Exam**	**Total**
Theory							
MPHY 4.1 T	Cardiovascular System	4	4	1	20	80	100
MPHY 4.2 T	Renal System	4	4	1	20	80	100
MPHY 4.3 T	Endocrine System	4	4	1	20	80	100
Practical							
MPHY 4.1 P	Cardiovascular System	3	6		20	80	100
Elective Course (Any Two)							
4.4 GE	Basics of Biostatics	3	3		100	--	100
MPHY 4.5 DSE	Mammalian Physiology	3	3		100	--	100
4.6 GE	Basics of bioinformatics	3	3		100	--	100
4.7 GE	Intellectual Property Rights	3	3		100	--	100
	Total	**21**	**27**		**280**	**320**	**600**

Theory 60 hrs

MPHYT 4.1- Cardio vascular system: 25 hours

1. Functional anatomy of heart, blood vessels, conducting system, systemic and pulmonary circulation
2. Innervation of the heart and blood vessels, VMC
3. Hemodynamics
4. Properties of cardiac muscle
5. Cardiac cycle
6. Heart rate and regulation of heart rate
7. Cardiac output definitions, variations, method of determination, regulation
8. Blood pressure
9. Shock
10. Regional circulation
11. Cardio vascular changes during muscular exercises

Stress Relaxation Technique: Principles of Yoga, Breathing exercise, Meditation and Bio feedback techniques.

- Properties of Cardiac Muscle: Long refractory period, All or None Law.
- Extrasystole and Compensatory Pause, Beneficial effect
- Regulation of Heart, Vagus dissection and effect of vagal stimulation.
- Actions of acetylcholine, Adrenaline and Nicotine on Heart (Langley's)
- Perfusion of isolated frogs' heart – Role of Na+, K+, Ca+
- Decerebrate and Spinal frog.

MPHY 4.2 T - Renal system: 15 hrs

1. Functional anatomy of kidney, renal blood flow, its determination, regulation and peculiarities
2. GFR – definition, measurement, filtration membrane, forces involved, control of GFR
3. Tubular function – reabsorption, secretion and concentration mechanism
4. Nerve supply to urinary bladder, micturition, Non excretory functions of kidney
5. Renal function tests

MPHY 4.3 T - Endocrine system – 20 hours

1. Introduction to endocrinology, classification, general properties and mechanism of action of hormones
2. Pituitary gland – anterior pituitary hormones, their actions, control and disorders, actions, control and disorders of posterior pituitary hormones
3. Thyroid gland – synthesis, actions of iodine containing thyroid hormones, control of secretion, thyroid function tests and disorders
4. Calcium – functions, control- parathormone, calcitonin and 1-25 (OH) D -23 disorders
5. Endocrine pancreas – Insulin and Glucagon, source, actions, regulation, clinical disorders
6. Adrenal gland – adrenal cortex – nomenclature, actions, control, disorders, adrenal medullary hormones – synthesis, actions and control

Medical Physiology
Practical Duration 60 hrs
Course Name: Medical Physiology Practical
Course code MPHY 4.1 P

CVS – 30 Hrs

1. Clinical Examination of CVS
2. Components of History taking and General Physical examination & Clinical Examination of CVS
3. Recording of Blood Pressure, pulse rate at rest and effect of posture
4. Effect of mild and moderate exercise on blood pressure, pulse rate and respiratory rate
5. Demonstrate Harvard step test and describe the impact on induced physiologic parameters.
6. Record and interpret Lead II ECG. Given a normal ECG, determine cardiac axis.
7. Clinical Examination of Radial Pulse.

Amphibian cardiac experiments and interpretation of graphs – 30 Hrs

List of graphs on cardiac experiments:

1. Normal cardiogram
2. Effect of temperature on frog heart
3. Effect of Stannius ligatures
4. Properties of cardiac muscle – all or none law, staircase effect, refractory period in a beating heart (extra systole and compensatory pause), refractory period in a quiescent heart
5. Effect of vagus on frog's heart
6. Action of drugs on vagus (nicotine and atropine)
7. Perfusion of isolated heart and effect of ions (NaCl, KCl, CaCl2)
8. Perfusion of isolated heart and effect of drugs (adrenaline, acetyl choline, atropine)

Elective Course Name: Basics of Biostatics

Course Code: 4.4 GE

Learning Outcome

- This course imparts the knowledge of basic statistical methods to solve problems
- Students are taught to operate various statistical software packages
- By the end of the course, the students are able to appreciate the importance of statistics in research and prepares them for a career in research.

UNIT I

Types of Data, Collection of data; Primary & Secondary data, Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis.

UNIT II

Probability classical & axiomatic definition of probability, Theorems on total and compound probability, Elementary ideas of Binomial, Poisson and Normal distributions.

UNIT III

Methods of sampling, confidence level, critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance (ANOVA)

UNIT IV

Correlation and Regression. Emphasis on examples from Biological Sciences.

PRACTICALS

1. Based on graphical Representation
2. Based on measures of Central Tendency & Dispersion
3. Based on Distributions Binomial Poisson Normal
4. Based on t, f, z and Chi-square

SUGGESTED READING

1. Le CT (2003) introductory biostatistics. 1st edition, John Wiley, USA
2. Glaser AN (2001) High Yield TM Biostatistics. Lippincott Williams and Wilkins, USA
3. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.
4. Danial W (2004) Biostatistics: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

Elective Course Name: Mammalian Physiology
Course Code: MPHY 4.5 GE

UNIT I: Digestion and Respiration

Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice

Respiration: Exchange of gases, Transport of O2 and CO2, Oxygen dissociation curve, Chloride shift.

UNIT II: Circulation

Composition of blood, Plasma proteins & their role, blood cells, Haemopoisis, Mechanism of coagulation of blood.

Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat.

UNIT III: Muscle physiology and osmoregulation

Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction.

Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.

UNIT IV: Nervous and endocrine coordination

Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters. Mechanism of action of hormones (insulin and steroids). Different endocrine glands– Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions.

PRACTICALS

1. Finding the coagulation time of blood
2. Determination of blood groups
3. Counting of mammalian RBCs
4. Determination of TLC and DLC
5. Demonstration of action of an enzyme
6. Determination of Hemoglobin

SUGGESTED READING

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Her court Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John wiley & sons, Inc.

Elective Course Name: Bioinformatics

Course Code: MPHY 4.6 GE

Bioinformatics

Learning Objectives

- To know the importance of computers in biology
- To understand software tools for biological sequence analysis
- To learn the concepts associated to Genomics and apply the same in various fields

Course Content

UNIT I Computer Fundamentals

Characteristics of computer, history, generations, types, classification – Hardware, Software;

Operating System - Linux, Windows. Internet and search engines, Office Packages - MS Word, MS Excel, MS PowerPoint, internet.

UNIT II Biological Databases

Bioinformatics and its relation with molecular biology, Molecular Resources, Primary & Secondary databases, Public databases - NCBI, EBI, DDBJ, PDB, KEEG Database File formats, Submission & retrieval tools

UNIT III Sequence Alignment

Introduction, Sequence similarity, identity and homology, Dot matrix analysis, Local and global alignments, Sequence based searches; BLAST– Introduction, Definition, Types, Scoring matrices

UNIT IV Multiple Sequence Alignment & Phylogeny Introduction, Progressive alignment method – Clustal W, Phylogenetic trees - types & topology,

Methods - Maximum Parsimony, Distance methods, Maximum Likelihood approach

UNIT V Genomics

Introduction – Evolution – Genome Organization of Prokaryotes, Eukaryotes & Organelles – Human

Genome Project − Genome Annotation – SNPs & Mutation – Gene & Genome Duplication – Gene Loss

UNIT VI

Proteomics Components – Protein Struture Prediction – Mass Specectro photometer - Analysis in Proteomics – Disease link

UNIT VII Computer Aided Drug Design

Principles - Molecular Modelling – docking – QSAR – Applications

PRACTICAL: 30 HOURS

1. MS Office Packages
2. Submission & Retrieval tools
3. Sequence Editing & Alignment
4. BLAST
5. Phylogenetic analysis
6. Genome Browsers
7. Model Organism Databases
8. Mutation Databases
9. Proteomics & St. Bioinformatics (Demo only)

LEARNING OUTCOMES

1. Get to know effective use of Office package
2. Understand the biological sequence analysis
3. The student will be able to understand the concepts associated to Genomics and apply the same in various fields

REFERENCES

1. Introduction to computers & Data processing – Shelly, Gray. B2. Mastering Microsoft office 2007 – Alison Balter's
2. Bioinformatics sequence and Genome analysis – David W. Mount, 2004, 2nd
3. BLAST. The Definitive Guide. Basic Local Alignment Search Tool – Korf, Yandell, Bedell
4. Introduction to Bioinformatics - Attwood, Smith, Parry-Smith
5. Introduction to Genomics, Arthur M. Lesk, 2007, Oxford University Press.
6. Handbook of Comparative Genomics – Principles & Methodology 2003 Saccone & G.Pesole (Publication) Wiley-Liss
7. Microbial Functional Genomics – 2004 Jizhong Zhou, Dorothea K. Thompson, Ying Xu & James.M.Tiedje (Publication) Wiley-Liss

Elective Course Name: Intellectual Property Rights
Course Code: 4.7 GE
Intellectual Property Rights Course Content

Learning Objectives:

This subject seeks to equip students with a broad understanding of the international intellectual property rights system, the main forms of intellectual property rights and the relevant international

Institutional framework. Its specificity is to provide students with a broad understanding of intellectual property in the context of sustainable development. Overall, it seeks to equip students with the necessary analytical tools to understand intellectual property in its broader environment, with particular emphasis on the situation of developing countries.

The objectives of this subject are to:

1. Acquaint the learners with the basic concepts of Intellectual Property Rights
2. Develop expertise in the learners in IPR related issues
3. Sensitize the learners with the emerging issues in IPR and the rationale for the protection of IPR.

Learning outcomes

At the end of the course, students would be able to

1. Understand the implications of Patents, Copyrights and Designs, Trademarks and Geographical Indications.
2. Understand the relevance and impact of IP Law on academic/scientific works/studies.
3. Recognize the intellectual property likely to be produced in the academic and professional environment.
4. Understand the different forms of infringement of intellectual property rights.
5. Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
6. Demonstrate and develop basic skills of legal reasoning, individual critical thinking and group interaction, as well as interpretative, analytical and argumentative skills in oral and written forms of communication.

Syllabus

Theory (45 Hours) Credit-3

Unit 1: Concepts of Intellectual Property (9 Hours)

Concept, Theories, Types of Intellectual Property Rights- An Overview,

Role of International Institutions: World Intellectual Property Organization (WIPO), WTO.

Unit 2: Patent Law and Act (9 Hours)

Introduction to Patent Law, Paris Convention, Patent Cooperation Treaty, WTO- TRIPS, The Patents Act, 1970, Amendments to the Patents Act

Unit 3: Patentability Criteria (9 Hours)

Patentable Subject Matter, Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Access and Benefit Sharing Issues

Unit 4: Types of IPR (10 Hours)

Patents, Copyright, Trademarks, Trade secrets, Industrial Design, Geographical Indications, Layout designs of Integrated Circuits and Protection of Plant Varieties and Farmers' Rights, Biodiversity and traditional Knowledge

Unit 5: IPR in different sectors (8 Hours)

IPR in Cyber space, IPR in Pharma sector, IP licensing, IP insurance, Securitization of IP.

REFERENCES:

Compulsory Reading:

1. Managing IPR by Vinod D.Sople
2. Law relating to Intellectual Property by Dr..B.L.Wadhera.
3. The Indian Patent Act 1970.

Suggested Reading:

1. The Gazette of India. The Patent act 1970 and its latest amendments.
2. Mittal, B.M., A Textbook of Forensic Pharmacy.
3. Patent Law Essentials: A Concise Guide by Alan L. Durham

Online Reading:

1. http://www.uspto.gov/patent
2. www.wipo.org
3. www.wto.org

Semester – V Physiology
Course Name: Medical Physiology Theory
Course Code: MPHY 5.1 T
Course Content

Course Code MPHY T & P	Course Name Medical Physiology	Credits	Teaching Hours per weak	Marks		
				Internal Assessment	Semester Exam	Total
Theory						
MPHY 5.1	Reproductive System	4	4	20	80	100
MPHY 5.2	Gastrointestinal System	4	4	20	80	100
MPHY 5.3	Respiratory System	4	4	20	80	100
Medical Physiology Practical Course Code: MPHY 5.1 P						
MPHY 5.2 P	Gastrointestinal System	3	6	20	80	100
MPHT 5.3 P	Respiratory System	3	6	20	80	100
Elective Course (Any Two)						
5.4 GE	Molecular Biology	3	3	100	--	100
5.5 GE	Biotechnology	3	3	100	--	100
5.6 GE	Immunology	3	3	100	--	100
5.7 GE	Manuscript Writting	3	3	100	--	100
	Total	**24**	**30**	**300**	**400**	**700**

Theory 60 Hrs

MPHYT- 5.1 T- Reproductive system: 20 hours

1. Male reproductive system – physiological anatomy, spermatogenesis and its regulation, testicular hormones, composition of semen.
2. Female reproductive system – menstrual cycle, pregnancy and parturition Lactation and family planning.

MPHY – 5.2 T- Gastrointestinal system: 20 hrs

1. Introduction – Anatomy of GI tract, salivary secretion, types of salivary glands, innervations, composition of saliva, regulation, functions.
2. Introduction – Anatomy of GI tract, salivary secretion, types of salivary glands, innervations, composition of saliva, regulation, functions.
3. Gastric secretion – structure of gastric mucosa, innervation, origin, composition and function of gastric juice, mechanism of secretion of HCL, functions.

4. Regulation of gastric secretion, methods of study, phases of gastric secretion, factors influencing gastric secretion, peptic ulcer.
5. Pancreatic secretion – structure of pancreas, innervations, composition and functions of pancreatic juice, Mechanism of secretion, regulation, tests for pancreatic exocrine function.
6. Liver and gall bladder – function of liver, composition and functions of bile, function of gall bladder, filling and emptying, regulation, cholecystectomy, gall stones.
7. Small intestine – structure, composition and function of succus entericus, regulation, large intestine – structure, function, secretion.
8. Gastro-intestinal motility – stages of regulation, mechanism, disturbances, types of movement, gastric emptying regulation.
9. Movement of small intestine – types, regulation, ileo-caecal valve, functions, movements of colon, defecation.
10. Gastro-intestinal hormones and their actions, digestion of carbohydrates, proteins and fats.
11. Absorption of carbohydrates, proteins, fats, vitamins, water and electrolytes.

MPHY 5.3 T - Respiratory System: **20 hours**

1. Introduction – functional anatomy of respiratory tract Pulmonary ventilation – mechanism of ventilation, muscles, pressure changes, pressure volume inter relationship, compliance, airway resistance.
2. Surfactant – source, chemical nature, functions, lumg volumes and capacities, definition, determination, normal values, significance.
3. Alveolar ventilation – dead space, significance, pulmonary circulation, ventilation perfusion ratio and its significance.
4. Respiratory membrane, partial pressure of gases, diffusion of gases, diffusion capacity, factors affecting diffusion of gas.
5. Oxygen transport – forms of transport, O2 – Hb dissociation curve, factors affecting it, myoglobin.
6. CO2 transport – form of transport, CO2 dissociation curve, chloride shift, Haldane effect.
7. Regulation of respiration – organization of respiratory centers, Non-chemical regulation, respiration and acid-base balance.
8. Hypoxia – types, effects, voluntary hyperventilation, periodic breathing Dyspnoea, Asphyxia, Cyanosis, Decompression sickness, Artificial respiratory methods.
9. Pulmonary function tests, respiratory adjustments during muscular exercise.

Medical Physiology
Practical Duration 60 hrs
Course Name: Medical Physiology Practical
Course code MPHY P 5.1

MPHY 5. 2 P - GIT – 30 hrs

1. Clinical Examination of GIT
2. GIT: Identification and uses of Ryle's Tube
   Gastro-intestinal system
3. Liver function tests

MPHY 5.3 P- Respiratory System – 30 hrs

1. Clinical Examination of Respiratory system.
2. Spirometry - Lung volumes and capacities, MVV and Dyspnoeic Index, Timed vital capacity.
3. Peak Expiratory Flow Rate
4. Demonstrate Basic Life Support in a simulated environment

Elective Course Name: Molecular Biology
Course Code: 5.4 GE

Unit 1 Physical basis of Heredity:

Introduction, concepts and theories of Mendelian genetics, chromosome theory of inheritance, Unit of Heredity - Genes, Alleles, Multiple alleles, Cis and Trans test. Extra chromosomal inheritance. Nucleic acids as genetic material

Unit 2 DNA Replication:

Prokaryotic and Eukaryotic DNA replication. Mechanism of DNA replication, enzymes and accessory proteins involved in DNA replication and proof-reading mechanism.

Unit 3 Mutation:

Causes of DNA damage, types of DNA damage, types of DNA repair and molecular mechanism of recombination.

Unit 4 Transcription:

Central dogma, general feature of RNA synthesis, RNA polymerase, mechanism of transcription in Prokaryotic and eukaryotic. Introns and exons, Post transcriptional modification of RNA – capping, polyadenylation, Introns splicing. Reverse transcription.

Unit 6 Translation:

Genetic code and its elucidation - properties of genetic code, ribosome structure, wobble hypothesis, structure and composition, of Prokaryotic and eukaryotic ribosome, structure of mRNA and tRNA, aminoacyl t-RNA synthases. Events of Protein synthesis, (Amino acid activation, initiation, elongation and termination) in Prokaryotic and Eukaryotic. Post - Translation modification of proteins, inhibitors of translation.

Unit 7 Regulation of Gene expression:

The Operon concepts, Lactose Operon, Tryptophan Operon and catabolic repression, steroid induced gene expression.

Unit 8 Molecular Mapping of Genome:

Physical maps - Physical Mapping and map Based cloning, choice of mapping, simple sequence repeat loci, and florescence in situ hybridization for genome analysis, RFLP, RAPD, AFLP analysis and applications.

Unit 9 Genome sequencing:

Genome - Organelle genomes, Genomic library, YAC, BAC Libraries, strategies of genome sequencing. Human Genome Project. Application of sequence information for identification of defective genes.

Elective Course Name: Biotechnology
Course Code: MPHY 5.5 GE

Biotechnology, being one of the youngest branch of Life Science, has expanded and established as advanced interdisciplinary applied science. The study of life itself is at the core of it and the interdisciplinary networking potential of biotechnology has given it a separate status in fundamental research as well as in modern industrial enterprise. Global and local focus has slowly shifted to not only current "Century of Knowledge" but also on to technology development and application in life sciences. In the milieu of research and industrialization for economic development and social change, biotechnology is an ideal platform to work.

The interdisciplinary nature of biotechnology integrates living systems including animal, plant and microbes and their studies from molecular biology to cell biology, from biochemistry to biophysics, from genetic engineering to stem cell research, from bioinformatics to genomics-proteomics from environmental biology to biodiversity, from microbiology to bioprocess engineering, from bioremediation to material transformation and so on. The relevance and application of these studies on living organisms and their bioprocesses is extensively covered in this field with the help of technology. Green revolution and white revolution was possible in India thanks to the deeper and intrinsic understanding of biotechnology.

Economic and social renaissance is staged on biotechnology especially, since it's biomedical and cutting-edge technological applications are tremendously powerful in shaping this century and exciting future.

Biotechnologists are always in demand as an efficient work force in fundamental research and industries. Education and research sectors require such interdisciplinary trained workforce to develop future generations of science leaders. Career opportunities for graduate students are created and expanding at the biotechnology parks and in manufacturing industries, teaching, research institutes and IT industry.

Introduction:

The syllabi till today had been sufficient to cater to the needs of students for building up their careers in industry and research. However, with the changing scenario at local and global level, we feel that the syllabus orientation should be altered to keep pace with developments in the education and industrial sector. The need of the hour is to design appropriate syllabi that emphasize on teaching of technological as well as the economic aspects of modern biology. Theory supplemented with extensive practical skill sets will help a graduate student to avail the opportunities in the applied fields (research, industry or institutions) , without any additional training. Thus, the university / college itself will be developing the trained and skilled man-power.

Biotechnology being an interdisciplinary subject, this restructured syllabus will combine the principles of physical, chemical and biological sciences along with developing advanced technology. Biotechnology curricula are operated at two levels viz. undergraduate and postgraduate. The undergraduate curricula are prepared to impart primarily basic knowledge of the respective subject from all possible angles while postgraduate syllabus emphasizes on more applied courses. In addition, students are to be trained to apply this knowledge particularly in day-to-day applications of biotechnology and to get a glimpse of research.

Aims of Bachelor's degree programme in Biotechnology

The overall aims of Bachelor's degree programme in Biotechnology are to:

- Provide students with learning experiences that help in still deep interests in learning biotechnology.
- Expose the students to a wide range of careers that combine biology, plants and medicine.
- Provide students with some work experience, for example a summer internship or a research project in a research laboratory to further boost the career prospects.

Objectives to be achieved:

- To introduce the concepts in various allied subjects
- To enrich students' knowledge
- To help the students to build interdisciplinary approach

- To inculcate sense of scientific responsibilities and social and environment awareness
- To help students build-up a progressive and successful career

Eligibility

1. **First Year B.Sc.:**

   Higher Secondary School Certificate (10+2) or its equivalent Examination with English and Biology; and two of the science subjects such as Physics, Chemistry, and Biotechnology.

2. **Second Year B.Sc.:**

   Students are not directly admitted to second year of B.Sc. for Biotechnology course. Those who complete first year biotechnology course are promoted to second year.

3. **Third Year B. Sc.:**

   Students are not directly admitted to third year of B.Sc. for Biotechnology course.

   Rules and Regulations of Curriculum B.Sc. Biotechnology

   Definitions of Key Words:

   1. Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year. Choice Based Credit System (CBCS).
   2. The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).
   3. Course: Usually referred to, as "papers" is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/ laboratory work/ outreach activities/ project work/ viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these.
   4. Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.
   5. Credit: A unit by which the course work is interpreted. It functions the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
   6. Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the sum total of the credit points obtained by the student in various courses in all semesters and the sum of the total credits of all courses in all the semesters.
   7. Grade Point: It is a numerical marking allotted to each letter grade on a 10-point scale.
   8. Letter Grade: It is an appreciated point of the student's performance in a selected course. Grades are denoted by letters O, A+, A, B, C and RA x. Programme: An educational programme leading to award of a Degree certificate.

9. Semester Grade Point Average (SGPA): It is index of performance of all performance of work in a semester. Its total credit points obtained by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal place.
10. Semester: Each semester will consist of minimum of 180 working days. The odd semester may be scheduled from June/ July to December and even semester from December/ January to June.

Duration of Study Programme: The duration of the study for B.Sc. Biotechnology will be of 3 years including 6 Months of Internship.

Program pattern:

- First Semester: July
- Second Semester: January
- Third Semester: July
- Fourth Semester: January
- Fifth Semester-July
- Sixth Semester-January

Eligibility Criteria:

- He/she has passed the Higher Secondary (10+2) with Science (PCB) or equivalent examination recognized by any Indian University or a duly constituted Board with pass marks in Physics, Chemistry, and Biology.
- Minimum percentage of marks: 45% aggregate.

Medium of Instruction:

- English shall be the Medium of Instruction for all the Subjects of study and for examinations.
- CBCS – Definition and benefits: Choice Based Credit System is a flexible system of learning.

The distinguishing features of CBCS are the following:

- It permits students to learn at their own pace.
- The electives are selected from a wide range of elective courses offered by the other University Departments.
- Undergo additional courses and acquire more than the required number of credits.
- Adopt an inter-disciplinary and intra-disciplinary approach in learning.
- Make best use of the available expertise of the faculty across the departments or disciplines
- Has an inbuilt evaluation system to assess the analytical and creativity skills of students in addition to the conventional domain knowledge assessment pattern.
- Semester System and Choice Based Credit System:

Elective Course Name: Immunology

Course Code: 5.6 GE

IMMUNOLOGY

Learning Outcome

- This course provides you with knowledge and understanding of immunology and the way it is applied in diagnostic and therapeutic techniques and research.
- It trains the students with essentiality of molecules, cells, tissues, and organs involved in the defense mechanism.
- It's a paper which accomplishes the learning of techniques involved in understanding the immunological aspects of physiology and biological samples

Unit I

Immune Response: An overview, components of mammalian immune system, molecular structure of Immuno-globulins or Antibodies, Humoral & Cellular immune responses, T-lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, genome rearrangements during B-lymphocyte differentiation, Antibody affinity maturation class switching, assembly of T-cell receptor genes by somatic recombination.

Unit II

Regulation of immunoglobulin gene expression: clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity, hypotheses (germ line & somatic mutation), antibody diversity.

Unit III

Major Histocompatibility complexes: class I & class II MHC antigens, antigen processing. Immunity to infection – immunity to different organisms, pathogen defense strategies, avoidance of recognition. Autoimmune diseases, Immunodeficiency-AIDS.

Unit IV

Vaccines & Vaccination: adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization. Introduction to immunodiagnostics – RIA, ELISA.

PRACTICAL

1. Differential leucocytes count
2. Total leucocytes count
3. Total RBC count
4. Hemagglutination assay
5. Hemagglutination inhibition assay
6. Separation of serum from blood
7. Double immunodiffusion test using specific antibody and antigen.
8. ELISA.

SUGGESTED READING

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt I M. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Elective Course Name: Manoscript Writing
Course Code: 5.6 GE

Learning objectives of the elective

1. To understand how to concise research work
2. To understand how to include research plan
3. To identify 3 goals of the Introduction section of a research paper (introduce problem, develop literature review, research plan)
4. To understand what to include in the Method section of a research paper (participants, materials, procedure, statistical analysis)
5. To understand how to write result section

Prerequisites for the elective

1. Students must be aware of parts of research article: Title page, abstract, Introduction, Materials and Method, Results, Discussion and conclusion.
2. Aware of plagiarism check
3. Identify indexing of journals

List of activities in which the student will participate

1. Work with supervisor in making research plan and need of the research
2. Frame research objectives.
3. Work with statistician to provide a statistical analysis of the data
4. Write discussion part by literature search.
5. Write abstract of work done
6. Learn style of citation and Write bibliography

Portfolio entries required

Read the selected articles
Write the Introduction and Method sections of research paper

Documents to be maintained

Daily Log book entry

Assessment

Objectives and logbook entry
Successful completion of research Reflections, Feedback on the research article writing

Semester – VI Physiology
Course Name: Medical Physiology Theory
Course Code: MPHY 6.1 T
Course Content

SEMESTER VI						
Course Code	**Course Name Medical Physiology**	**Credits**	**Teaching Hours per weak**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
MPHY 6.1 T	Central Nervous System	4	4	20	80	100
MPHY 6.2 T	Special Senses	4	4	20	80	100
MPHY 6.3 T	Specialised Integrated Physiology	4	4	20	80	100
Medical Physiology Practical Course Code: MPHY 6.1 P						
MPHY 6.1 P	Central Nervous System	3	6	20	80	100
MPHY6.2 P	Special Senses	3	6	20	80	100
Elective Course (Any Two)						
MPHY 6.3 DSE	Cell Biology	3	3	100	--	100
6.4 GE	Animal Biotechnology	3	3	100	--	100
6.5 GE	Yoga Science	3	3	100	--	100
6.6 GE	Lifestyle Medicine	3	3	100	--	100
	Total	**24**	**30**	**300**	**400**	**700**

Theory 60 hrs

MPHY 6.1 T - Central nervous system: 30 hrs

1. Organization of central nervous system
2. Synapse – transmission and properties, neurotransmitters
3. Receptors and properties
4. Sensory system – primary sensations, ascending tracts and sensory cortex Pain sensation and thalamus
5. Spinal cord – reflexes
6. Motor tracts, basal ganglia, cerebellum, control of motor activities, vestibular apparatus, cavity and postural reflexes
7. Hypothalamus, ANS, Limbic system, prefrontal lobe
8. Higher mental functions
9. Sleep and EEG
10. Learning and memory
11. Language and Speech

12. CSF and blood brain barrier (BBB)
13. A.N.S: Divisions & functions
14. Physiology of yoga &Meditation
15. Physiology of ageing & theories

MPHY 6.2 T - Special senses: **15 hrs**

1. Vision – functional anatomy of eye
2. Aqueous humour, IOP, Glaucoma
3. Optics of eye
4. Image forming mechanism
5. Visual activity
6. Errors of refractions
7. Retina – structure and electrical activity of photoreceptors
8. Visual pathway and its lesion, visual cortex, depth perception
9. Accommodation, dark adaptation, papillary reflexes
   Color vision with applied aspect.
10. Hearing – functional anatomy of ear
11. Physics of sound
12. Role of tympanic membrane, middle ear and cochlea in hearing
13. Auditory pathway and auditory cortex
14. Tests for hearing and deafness.
15. Taste and smell – modalities, receptors, pathways, cortical and limbic areas associated
    with taste and smell, olfaction and memory.

MPHY 6.3 T - Specialised Integrated Physiology – **15 hrs**

1. Physiology of Body Temprature rgulations
2. Physiology of growth & behavioural developmemnt
3. Physiology of Fetus, Neonate & childhood
4. Geratric physiology

Course Name: Medical Physiology Practical
Course code: MPHY 6.1 P & MPHY 6.2 P
Total Duration 60 hrs

MPHY 6.1 P

Clinical Examination of CNS – 30 hrs

1. Clinical examination of the central nervous system and autonomic nervous system and its physiological basis.
2. Examination of higher mental functions.
3. Clinical examination of Motor system I
4. Clinical examination of Motor system II
5. Clinical examination of Sensory system
6. Clinical examination of Cranial Nerve 1 to 12

MPHY 6.2 P - Special Sense – 30 hrs

Clinical examination of the special senses.

1. Clinical examination of the eye and papillary reflex
2. Visual acuity
3. Perimetry
4. Accommodation reflexes
5. Color vision and color blindness
6. Determination of Taste Sensation
7. Determination of Olfactory sensation
8. Determination of Hearing tests

Elective Course Name: Cell Biology
Course Code: MPHY 6.3 GE

Learning Outcome

- This course introduces the students to the basics of cell and its components.
- This gives them a strong foundation on the basic unit of life.
- At the end of the course, the student has a strong foundation on the functions of the cell.

Unit I

Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation. cytosol and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.

Unit II

Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments. Endoplasmic reticulum: Structure,

function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion.

Unit III

Lysosomes: Vacuoles and micro bodies: Structure and functions

Ribosomes: Structures and function including role in protein synthesis.

Mitochondria: Structure and function, Genomes, biogenesis.

Chloroplasts: Structure and function, genomes, biogenesis

Nucleus: Structure and function, chromosomes and their structure.

Unit IV

Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.

Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer.

PRACTICALS

1. Principle and utility of microscopy.
2. Observation of distinguishing features of different eukaryotic cells.
3. Measurement of **Measurement of Onion epidermal cell**
4. Preparation of blood smear and differential staining of blood cells.
5. Study of divisional stages in Mitosis.
6. Study of divisional stages in Meiosis.
7. Isolation of plant cellular DNA.
8. Observation of growth and differentiation in single cells.
9. Isolation of chloroplasts.

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Elective Course Name: Animal Biotechnology
Course Code: 6.4 GE

Learning Outcome

- This course teaches organization and expression of animal genome and animal tissue culture
- Students learn about transgenic animal, their application in pharmaceutical industry, cloning and its importance.
- This course prepares the students in appreciating the its benefits and applications in biotechnological, pharmaceutical, medical

UNIT I

Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer.

UNIT II

Introduction to transgenesis. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Animal diseases need help of Biotechnology – Foot-and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.

UNIT III

Animal propagation – Artificial insemination, Animal Clones. Conservation Biology – Embryo transfer techniques. Introduction to Stem Cell Technology and its applications.

UNIT IV

Genetic modification in Medicine - gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human genetic engineering, problems & ethics.

PRACTICALS

- Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization
- Sources of contamination and decontamination measures.
- Preparation of Hanks Balanced salt solution
- Preparation of Minimal Essential Growth medium
- Isolation of lymphocytes for culturing
- DNA isolation from animal tissue
- Quantification of isolated DNA.
- Resolving DNA on Agarose Gel.

SUGGESTED READING

1. Brown, T.A. (1998). Molecular biology Lab fax II: Gene analysis. II Edition. Academic Press, California, USA.
2. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers.
3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
4. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- genes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.

Elective Course Name: Elective course of Yoga

Course Code: 6.5 GE

Yoga Physiology

Learning Objectives

- To know the importance of yoga to maintain health
- To understand physiology behind yogic asana, pranayanma and dhyana
- To learn the techniques of asanas, pranayama and dhyana

Learning Outcome:

The course will make students capable of performing asanas, pranayama and dhyana with correct techniques to maintain their health.

Unit	Topics
1	Introduction to Yoga and Yogic Practice – 1.1 Yoga: Etymology, Definitions, Aim, Objectives and Misconceptions. Yoga: Its origin, history and development. Guiding principles to be followed by Yoga practitioners. 1.2 Principles of Yoga (Triguna, Antahkarana Chatushtaya, Tri - Sharira Panchakosha). 1.3 Introduction to major schools of Yoga (Jnana, Bhakti, Karma, Patanjala, Hatha). 1.4 Introduction to Yoga practices for health and wellbeing. 1.5 Introduction to Shatkarma: meaning, purpose an d their significance in Yoga Sadhana. 1.6 Introduction to Yogic Sukshma Vyayama, Sthula Vyayama and Surya Namaskara. Introduction to Yogasana: meaning, principles, and their health benefits. 1.7 Introduction to Pranayama and Dhyana and their health benefit s.
2	Unit 2. Introduction to Yoga Texts 2.1 Introduction and study of Patanjala Yoga , Bhagavad, Hathapradipika, Prasthanatrayi. 2.2 Concepts and principles of Ahara (Diet) in Hathapradipika and Bhagavad Gita (Mitahara and Yuktahara).

3	Unit 3. Yoga for Health Promotion 3.1 Brief introduction to Human body. 3.2 Yogic positive attitudes (Maîtri, Karuna, Mudita, Upeksha). Concept of Bhavas (Dharma, Jnana, Vairagya, Aishvarya) and their relevance in well being. 3.3 Dincharya and Ritucharya with respect to Yogic life style. 3.3 Holistic approach of Yoga towards health and diseases. 3.4 Introduction to First Aid and Cardio Pulmonary Resuscitation (CPR). 3.5 Yogic management of stress and its consequences. 3.6 Yoga in prevention of metabolic and respiratory disorders. 3.7 Yoga for personality development
4	Unit 4: 1 Prayer: Concept and recitation of Pranava and other hymns. 2 Yoga Cleansing Techniques Knowledge of Dhauti, Neti and practice of Kapalabhati. 3 Yogic Sukshma Vyayama and Sthula Vyayama a. Yogic Sukshma Vyayama (Micro Circulation Practices) Neck MovementŸ Griva Shakti Vikasaka (I,II,III,IV) Shoulder MovementŸ Bhuja Balli Shakti Vikasaka Purna Bhuja Shakti Vikasaka Trunk MovementŸ Kati Shakti Vikasaka (I, II, III, IV, V) K nee MovementŸ Jangha Shakti Vikasaka (II -A&B) Janu Shakti Vikasaka Ankle movementŸ Pada -mula shakti Vikasaka – A&B Gulpha -pada-pristha-pada-tala shakti Vikasaka • Yogic Sthula Vyayama (Macro Circulation Practices) Sarvanga PushtiŸ Hrid Gati (Engine Daud)Ÿ
5	Unit 5: Yogic Surya Namaskara
6	Unit 6: Yogasana 5.1 Tadasana, Vrikshasana, Ardha Chakrasana, Padahastasana, Kati Chakrasana, Trikonasana 5.2 Dandasana, Sukhasana, Padmasana, Vajrasana, 5.3 Bhadrasana, Mandukasana, Ushtrasana, Shashankasana, Uttana Mandukasana 5.4 Paschimottanasana, Purvottanasana 5.5 Vakrasana, Gomukhasana 5.6 Bhujangasana, Shalabhasana, Makarasana 5.7 Pavanamuktasana, Uttanapadasana, Ardha Halasana, Setubandhasana 5.8 Viparitakarani, Saral Matsyasana, Shavasan a
7	Unit 7: Pranayama 7.1 Concept of Puraka, Rechaka and Kumbhaka 7.2 Anuloma Viloma/Nadi Shodhana 7.3 Shitali (without Kumbhaka) 7.4 Bhramari (without Kumbhaka) 8 Understanding of Bandha 8.1 Jalandhara Bandha 8.1 Uddiyana Bandha 8.1 Mula Bandha 9 Underst anding of Mudra 9.1 Hasta Mudras (Chin, Chinmaya, Brahma,Adi, Jnana, Dhyana and Nasika) 10 Practices leading to Meditation and Dhyana

Book for Reference for Theory

1. Goyandka, Harikrishandass: Yoga Darshan, Geeta Press, Gorakhpur (Samvat 2061).
2. Swami Vivekananda : Jnana Yoga, Bhakti Yoga, Karma Yoga, Raja Yoga, (4separate books) Advaita Ashrama, Kolkata, 2011 & 2012
3. Sahay G. S. : Hathayogapradipika, MDNIY, New Delhi, 2013
4. Gita press Gorakhpur : Shreemad Bhagavadgita, Gita press Gorakhpur, Samvat 2073
5. Kotecha, Vaidya Rajesh : A Beginner's Guide to Ayurveda, Chakrapani Publications, Jaipur 2016

6. Quality Council of India : Yoga professionals Official Guidebook for Level 1, (QCI) Excel Books, New Delhi 2016
7. Brahmachari Swami Dhirendra : Yogic Sukshma Vyayama, Dhirendra Yoga Publications, New Delhi, 1986
8. Sahay G. S. : Hathayogapradipika, MDNIY, New Delhi, 2013
9. Kalayan : Upanishads (23rd year Special), Geeta Press, Gorakhpur
10. Gore M. M. : Anatomy and Physiology of Yogic Practices, Kanchana Prakashana, Lonavala, 2004
11. Swami Karmananda : Management of Common Diseases, Bihar Yoga Publication Trust, 2006, Munger
12. Basavaraddi, I. V. & others : Yoga Teachers Manual for School Teachers, MDNIY, New Delhi, 2010

Books for Reference for Practical's

1. Brahmachari Swami Dhirendra: Yogic Sukshma Vyayama, Dhirendra Yoga Publications, New Delhi
2. Brahmachari, Swami Dhirendra : Yogasana Vijnana Dheerendra Yoga Prakashana, New Delhi
3. Iyengar, B. K. S.: Light on Yoga, Harper Collins Publisher, New Delhi, 2005
4. Saraswati, Swami Satyananda: Asana, Pranayama, Mudra, Bandha, Bihar School of Yoga, Munger, 2006
5. Basavaraddi, I.V.: A Monograph on Yogic Sukshma Vyayama, MDNIY, New Delhi, 2016
6. Basavaraddi, I.V.: A Monograph on Shatkarma, MDNIY, New Delhi, 2016
7. Basavaraddi, I.V.: A Monograph on Yogasana, MDNIY, New Delhi, 2016
8. Basavaraddi, I.V.: A Monograph on Pranayama, MDNIY, New Delhi, 2016
9. Tiwari O.P.: Asana Why & How? Kaivalyadhama, SMYM Samiti, Lonavla
10. Saraswati, Swami Satyananda : Suryanamaskara, Bihar School of Yoga, Munger, 2006
11. Quality Council of India: Yoga professionals Official Guidebook for Level 1, (QCI) Excel Books, New Delhi 2016
12. Basavaraddi, I. V. & others: Yoga Teachers Manual for School Teachers, MDNIY, New Delhi, 2010
13. Gharote, M.L.: Teaching Methods for Yogic practices, Kaivalyadhama Ashram, Lonavla
14. Iyengar, B.K.S: Yoga Shastra (Vol-I & II) Ramamani Iyenger Memorial Yoga, Institute, Pune YOG, Mumbai
15. Ramdev, Swami: Pranayama Rahasya

Elective Course Name: Fundamentals of Lifestyle Medicine
Course Code: 6.6 GE

Learning objectives of the elective
Introduction to Lifestyle Medicine

1. Interventional and Epidemiological studies
2. Nutrition Pillar
3. Physical activity Pillar
4. Sleep Pillar
5. Mental Health and Emotional Well-being
6. Healthy Relationship Pillar
7. Minimizing Harmful Substances and Behavioral Pillar
8. Lifestyle Medicine Skill Learning at Hospital.

Prerequisites for the elective
Students should be aware basics of nutrition and exercise physiology

Learning resources for students
Journal articles and ISLM, BSLM, ACLM websites

List of activities in which the student will participate

1. Case Discussions
2. Workshops – Primal Play
3. Physical activities
4. Meditation
5. Mindfulness practice

Document should be maintained
Daily Log book entry

Assessment
Case Presentations & Logbook Entry

Recommended PG Reference books and Journals

1. Ganong, Review of Medical Physiology, 24thedition. McGraw hill (serial no changed)
2. Guyton and Hall, Text Book of Medical Physiology, 12th edition. Elseveir
3. Best & Taylor's, Physiological basis of Medical Practice, 13th edition. Williams & Wilkins

4. Campbell, Clinical Physiology. ELBS & Blackwell
5. John Bullock, Joseph Boyle, III Michael B. Wang, NMS Physiology 3rdEdn, B.I. Waverley.
6. Sir. John V Dacie S M Lewis, Practical Hematology, Churchill Livingstone
7. Donald Emslie-Smith, Colin R Paterson, Textbook of Physiology, ELBS/Churchill Livingstone
8. Vernon B Mount Castle, Medical Physiology, vol. 1 & vol. 2, CV Mosby Company.
9. Berne & Levy, Physiology, 6th edition. Mosby Year book
10. Carl J Wiggers, Physiology in health and disease, Lea Febiger
11. Williams, Text book of Endocrinology, W.B.Saunders
12. Harrison's Principles of Internal Medicine, 16th edition. McGraw hill
13. Harper, Illustrated Biochemistry, 27th edition. McGraw Hill
14. Hand Book of Neurophysiology, Vol 1,2,3. Williams & Wilkins
15. Wallance O Fem, Hand Book of respiratory Physiology, vol 1. Williams & Wilkins
16. Wintrobe, Clinical Hematology, 10th edition. Lea Febiger
17. Kathryn L Mc. Cance Sue E Huether, Text Book of Pathophysiology, Mosby
18. Gyrila Keele& Eric Neil, Samson wright's Applied Physiology, ELBS, Oxford University Press.
19. Understanding Medical Physiology, RL Bijalani, 4th edition. Jaypee
20. Human Physiology, The mechanisms of body functions, Vander, 7th edition. McGraw hill

Journals:

1. Journal of Applied Physiology, By American Physiological Society
2. Physiological Reviews, By American Physiological Society
3. Annual Review of Physiology, By American Physiology Society
4. Advances in Physiology Education, By American Physiological Society.
5. Recent advances in Physiology, By American Physiological Society
6. Recent advances in Physiology, By American Physiological
7. Indian Journal of Physiology and Pharmacology.
8. Indian Journal of Medical Research
9. News in Physiological Sciences
10. New England Journal Medicine
11. British Medical Journal
12. Nature
13. Lancet

Type of questions and distribution of marks for Theory examination

Type of Questions	No of Questions	Marks for each Question	Total
Long Essay	03	10	30
Short Essay	10	05	50
Total			**80**

Note: Internal Assessment 20 Marks add to the theory paper Practical -100 Marks

1st & 2nd Semester Anatomy, Physiology & Biochemistry Practical -100 Marks

Type of questions for Practical	Marks
Practical	40
Viva	40
Internal Assessment Marks	20
Total	**100**