THE UNIVERSITY OF BURDWAN

SYLLABUS OF TWO YEAR POSTGRADUATE PROGRAMME IN PHYSIOLOGY

Under

Curriculum and Credit Framework for Postgraduate Programme (CCFPP), as per N.E.P. 2020

w.e.f. 2026 – 2027

2- year PG Programme

Semester wise and Course wise Distribution of Credit & Marks under CCFPP as per NEP, 2020

Summary of the course and credit

SEMESTER I [Credits- 50]

Course Code & Level	Course Title	Total Credit	Credit Distribution	Total Marks	Marks Distribution
			L-T-P		Th.-P -I.A
PG2 PHSL 1011 (400-499)	**MJC: Research Methodology in Physiology**	6	4-0-2	75	40-20-15
PG2 PHSL 1012 (400-499)	**MJC: Techniques in Physiology**	6	4-0-2	75	40-20-15
PG2 PHSL 1013 (400-499)	**MJC: Cell Biology and Cytogenetics**	6	4-0-2	75	40-20-15
PG2 PHSL 1014 (400-499)	**MJC: Microbiology, Immunology And Molecular Biology**	6	4-0-2	75	40-20-15
PG2 PHSL 1021 (300-399)	**MN: Nerve & Muscle Physiology and Nervous System**	4	3-0-1	75	40-20-15.
Total in Semester - I		**28**		**375**	

L- Lecture, T- Tutorial, P-Practical, Th.- Theory, I.A- Internal Assessment

SEMESTER II (without Research Project / Dissertation)
[Credits- 50]

CourseCode	Course Title	Total Credit	Credit Distribution	Total Marks	Marks Distribution
			L-T-P		Th.-P -I.A
PG2 PHSL 2011 (400-499)	**MJC: Toxicology and Genetics**	6	4-0-2	75	40-20-15
PG2 PHSL 2012 (400-499)	**MJC: Electrophysiology of Membrane and Pharmacology**	4	3-0-1	75	40-20-15
PG2 PHSL 2013 (400-499)	**MJC: Ergonomics and Sports Physiology and Chronobiology**	4	3-0-1	75	40-20-15
PG2 PHSL 2014 (400-499)	**MJC: Homeostasis of Internal Environment in Human and Stress Physiology**	4	3-0-1	75	40-20-15
PG2 PHSL 2021 (300-399)	**MN: Nutrition and Dietetics, Toxicology, Ergonomics and Occupational Physiology, Sports and Exercise Physiology**	4	3-0-1	75	40-20-15.
Total in Semester - II		**22**		**375**	

L- Lecture, T- Tutorial, P-Practical, Th.- Theory, I.A- Internal Assessment

OR

SEMESTER II (with Research Project / Dissertation)
[Credits- 50]

CourseCode	Course Title	Total Credit	Credit Distribution	Total Marks	Marks Distribution
			L-T-P		Th.-P -I.A
PG2 PHSL 2011 (400-499)	**MJC: Toxicology and Genetics**	6	4-0-2	75	40-20-15

PG2 PHSL 2021 (300-399)	**MN: Nutrition and Dietetics, Toxicology, Ergonomics and Occupational Physiology, Sports and Exercise Physiology**	4	3-0-1	75	40-20-15.
PG2 PHSL 2031 (400-499)	**Research Project/ Dissertation**	12	0-0-12	225	Submission of research project/ dissertation, seminar presentation and interaction (135+90)
Total in Semester - II		**22**		**375**	

CONTENTS

M.Sc. Semester I Syllabus

PG2 PHSL 1011 (400-499)
(THEORY CORE)
MJC: Research Methodology In Physiology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Ttoxicological research methods
- Histochemical and Immunotechniques
- Electrophysiological and hematological techniques
- Anthropometric measurement in Ergonomics and Sports Physiology
- Biostatistics and Computer Application in Physiology
- Bioinformatics

Research Methodology in Physiology

Basic, clinical and applied physiological research; laboratory based research, field studies and survey research.

Designing of Physiological experiments- basic principle, guidelines for designing experiments, designing animal and human experiments, control, sham control (vehicle control) and experimental groups; acute, subacute, chronic and sub chronic exposure; toxicological research methods- methods for determining LD_{50} (LC_{50}), LOAEL, NOEL, mode of exposure-gavages oral ingestion, subcutaneous, intramuscular, intravenous etc. Emerging issues in occupational health and safety.

Bioethics and animal maintenance, animal anaesthetization and animal killings. National ethical guidelines for biomedical and health research involving human participants.

Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze fracture methods for EM, image processing methods in microscopy.

Electrophysiological techniques, ECG, EMG, EEG; microtomy and cryo-microtomy, immunohistochemistry, morphometric analysis, microscopy, SEM, TEM, absorption spectroscopy (UV, visible, IR), principle of NMR, X- ray crystallography, mass spectrometry; proteomics, colorimetry, ultracentrifugation, electrophoresis, chromatography, SDS-PAGE, PCR, RT- PCR.

Writing a research project- Preamble, the problem, objectives, study design, methodology of the study including experimental set up, probable research outcome, social relevance, references, recurring and non-recurring budgets; and work-plan during the tenure of project.

Concept of IPR, pre-requisites for filing a patent and granting patent in India, patent infringement, Indian Patent Act 1970 and its amendment.

Physiological Statistics

Course Contents : Applications of statistics in physiology, physiological variables, parameters, data, sample mean and variable, degrees of freedom, standard normal distribution, statistical hypothesis, Probability Distributions Dendrogram, Nonparametric Statistics; Correlations; Regressions statistical techniques for data analysis- ANOVA, paired and unpaired 't' test, P value, chi-square test, DMRT test, MANN-Whitney U test, post hoc test, disease incidence and prevalence, confounding factor, meta-analysis, correction and correlation. Applications of Statistical principles in physiological problems

Computer Applications in Physiology

Web search-Importance of Internet for searching research literatures, use of internet and WWW, use of search engine like yahoo, google etc., use of science specific search engine on the internet like SCOPUS, SCIRUS, PUBMED etc. Spreadsheet tool-statistical data analysis- data storing, generating table, graphs, charts and other features, use of Microsoft Excel for physiological data analysis, Presentation tool- introduction to presentation tools, making of research items for presentation in a meeting/seminar, Microsoft Power Point/open office/similar tools for presentation. Online research paper submission- modes and techniques, GenBank submission, registration and submission of papers for attending national and international conferences. Application of Computer for Solving Physiological Problems

Bioinformatics- Introduction to physiological informatics, health informatics, predicting toxicity of xenobiotics/pollutants, predicting physiological function at the cellular and molecular levels.

PG2 PHSL 1011 (400-499)
(PRACTICAL CORE)
MJC: Research Methodology In Physiology

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Biostatistics
- Computer Application in Physiology

Biostatistics

Computation of frequency distribution of continuous measurement variables, mean, median, mode, standard deviation and standard error of the mean with physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects.

Product- moment between two continuous measurement variables and testing of its significance, Partial correlation coefficient between two variables and testing of its significance, Multiple correlation coefficient between a continuous measurement variable and a combination of two other continuous measurement variables.

Model I linear regression equation for regression of one variable on another variable and plotting of the regression line.

Testing the normality of a continuous frequency distribution by Chi-square test for its goodness of fit with a best-fitting normal distribution.

Computer Application in Physiology

Basic computer operations, methods of data entry through key board, printing of programmes and results, biostatistical analysis- S.D., S.E., t-value, correlation coefficient, percentile values etc. Use of computer graphics in biostatistics.

PG2 PHSL 1012 (400-499)
(THEORY CORE)
MJC: Techniques in Physiology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45**

Course Learning Outcomes:

After completion of this course student will learn:

- Histopathological Techniques
- Haematological Techniques
- Clinical Biochemistry

Hours]

Histopathological Techniques

Preparation of tissue sections, H&E staining of tissue sections, Preparation and staining of bone marrow smear, measurement of diameter of megakaryocyte, reticulocyte staining, staining of collagen in tissue sections.

Haematological Techniques

Preparation of blood smear and identification of blood cells, Determination of haematocrit, MCV, MCH, MCHC, bleeding time, clotting time etc, Measurement of haemoglobin in blood. Preparation of serum, Estimation of SGOT and SGPT.

Clinical Biochemistry

Photo-colorimetric estimation of blood constituents, Measurement of blood glucose by Nelson-Somogyi method, measurement of blood inorganic phosphate by Fiske - Subbarow method, measurement of serum total protein by Biuret method and determination albumin globulin ratio, determination of serum amylase by iodometric method.

PG2 PHSL 1012 (400-499)
(PRACTICAL CORE)
MJC: Techniques in Physiology

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Histopathological Techniques
- Haematological Techniques
- Clinical Biochemistry

Histopathological Techniques

Preparation and staining of bone marrow smear, measurement of diameter of megakaryocyte, reticulocyte staining, staining of collagen in tissue sections.

Haematological Techniques

Preparation of blood smear and identification of blood cells.
Determination of haematocrit, MCV, MCH, MCHC, bleeding time, clotting time etc.
Measurement of haemoglobin in blood.
Preparation of serum.

Clinical Biochemistry

Determination albumin globulin ratio, determination of serum amylase by iodometric method.
Estimation of SGOT and SGPT.

PG2 PHSL 1013 (400-499)
(THEORY CORE)
MJC: Cell Biology and Cytogenetics

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Internal organization and cytoskeletal structures of the cell
- Cell and tissue culture techniques

Cell Biology

Internal organization of the cell, intercellular compartments and protein sorting, secretory and endocytic pathways. Compartmentalization of cells; transport of proteins into mitochondria; peroxisomes; endoplasmic reticulum; vesicular traffic in the secretory and endocytic pathway; transport from ER through the Golgi apparatus; transport from the trans-Golgi network; transport from plasma membrane via endosomes; endocytosis, transcytosis, transport from the trans-Golgi network to the cell surface; exocytosis; the molecular mechanism of vesicular transport and maintenance of compartmental diversity. Endocytosis.

Cell and tissue culture; primary culture; cell line; cell clones; soma clonal variation; somatic embryogenesis.

Cytogenetics

Introduction, scope and significance of cytogenetics; chromosome structure, organization and classification; chromatin organization; human karyotype, karyogram and ideogram; principles of karyotyping and ISCN nomenclature; mitosis and meiosis in relation to chromosome behaviour; numerical and structural chromosomal abnormalities and their mechanisms; cytogenetic techniques including chromosome preparation, banding techniques, fluorescence in situ hybridization (FISH), comparative genomic hybridization (CGH) and chromosome microarray analysis (CMA); cytogenetic basis of common genetic disorders and cancer; prenatal diagnosis, genetic counselling, and applications of cytogenetics in biomedical research.

PG2 PHSL 1013 (400-499)
(PRACTICAL CORE)
MJC: Cell Biology and Cytogenetics

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Clinical Biochemistry
- Cell organelle isolation, DNA, RNA estimation and Karyotyping in blood cells, bone-marrow
- and other cells

Biochemistry Practical

Estimation of protein, carbohydrate and lipid:
Measurement of serum total protein by Biuret method
Blood glucose by Nelson-Somogyi method (colorimetric)
Blood cholesterol by Liebermann – Burchard method (colorimetric).
Estimation of NPN Blood urea, uric acid, creatine and creatinine.
Estimation of Vitamins Ascorbic acid content of plasma by 2,6-dichlorophenol indophenol method.
Estimation of Minerals, Enzymes.

Determination of Enzyme Activity

Serum amylase activity.
Alkaline phosphatase activity in plasma in Bodansky units.
Serum lipase activity.
SGOT and SGPT values as liver function tests.
Serum calcium by the method of Kramer and Tisdall (titrimetric)
Serum/ blood inorganic phosphate by the method of Fiske and Subbarow (colorimetric)

Cytogenetics:

Isolation of cellular organelles (nuclei, mitochondria, lysosomes) from rat liver by differential centrifugation.
Estimation of total protein from different subcellular fractions of liver.
Estimation of DNA and RNA from rat liver by means of diphenylamine and orcinol reaction, respectively.
Separation of proteins by electrophoresis on SDS-PAGE.
Histochemical technique for identification of nucleic acid.
Karyotyping in blood cells, bone-marrow and other cells

PG2 PHSL 1014 (400-499)
(THEORY CORE)
MJC: Microbiology, Immunology and Molecular Biology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Structures of different bacteria and virus
- Elements of immunology and their function
- DNA replication, transcription and translation

Microbiology

Microbial physiology – Structure and function; capsules, slime layer, holdfast, pili, flagella, tactic movements, chemotaxis, cell wall – peptidoglycan, matrix materials – teicloic acid and outer membranes, periplasm, mesosomes. Bacteria – gram positive and gram negative – bacterial growth, growth kinetics, nutrition, preparation and importance of different nutritional media for growth and their sterilization. Bacterial genetics and plasmids, mutation. Viruses: RNA viruses – Polio virus, VSV (vesicular stomality virus), influenza virus – molecular basis of flu epidemic; herpes group of viruses – control of gene expression, use of herpes virus genes in genetics; small pore and hepatitis B virus; retrovirus-structure and life cycle, control of gene expression, HIV (AIDS), lysogen and lytic cycle in bacteriophages.

Immunology

Elements of immunity; immunogens and antigens – structure and function of different classes of Igs; primary and secondary immune responses; immunization/vaccination of programme in infants and its importance; valence and affinity of antibodies; molecular basis and Patho-physiological importance of Ag-Ab interactions; immunological diversity and generation of diversity of Ab and T-cell receptor molecules; structure of MHC molecules; genetic control of immune response; complement system and hypersensitivity reactions; effector mechanics; cell-mediated immunity – T-cells and B cells; subset of T-cells and their role, theory of clonal selection; acquired immune deficiency; autoimmunity. Immunological techniques – ELISA, RIA and others; chemotherapy and modes of action of antibodies – a brief idea of first to fourth generation of antibodies.

Molecular Biology

DNA replication, amplification and rearrangements, Meselson-Stahl, Bonhoeffer-Grier and Cairns experiments; replication intermediates – (1) D-loop, theta form; rolling circle; asymmetric replication; enzymes involved in DNA replication; helicases, nucleases, DNA-binding and unwinding proteins, topoisomerases, DNA ligases, gyrases, methylases, endonucleases. The law

of DNA constancy and C-value paradox, plasmids, Cosmides and bacteriophage-based vectors for cDNA and genomic libraries. Principles and methods of protein and genetic engineering and gene targeting; application in health and industry. Mutation, DNA damage and repair; mechanism of mutation; spontaneous and induced role in evolution. Mutagenic agents, chromosome aberrations; transposons; sex-linked inheritance and genetic disorders; somatic cell genetics. Extrachromosomal inheritance (episomes, mitochondria), organization of transcriptional units – initiation, elongation and termination; mechanism of transcription of pro- and eukaryotes; DNA processing (capping, polyadenylation, splicing introns and editing exons); RNA-polymerase; transcription factors structure of m-RNA, t-RNA and r-RNA. Genetic code and protein synthesis-initiation, elongation and termination. Regulation of gene expression in pro- and eukaryotes; attenuation, anti-termination and induction; operon concept; DNA methylation; heterochromatinization; transportation; regulatory sequences and transacting factors; DNA polymerases in pro- and eukaryotes; motifs; environmental regulation of gene expression.

Biochemistry and molecular biology of cancer; cancer genes and oncogenes; chemical carcinogenesis; genetic and metabolic disorders; genetic load and genetic counselling, immunogenetics.

PG2 PHSL 1014 (400-499)
(PRACTICAL CORE)
MJC: Microbiology, Immunology and Molecular Biology

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Gram staining, spore staining and acid fast staining of different bacteria
- Preparation of media and buffer, ELISA, Immuno- electrophoresis and PCR technique

Microbiology and Immunology

Gram staining, Acid-fast staining, spore staining, Isolation, purification and identification of E. coli by using selective media, Estimation of antibodies and vitamins Ouchterlony double diffusion and single radial immune-diffusion, Agglutination and precipitation test, determination of bacterial growth curve by O.D.

Demonstration

Preparation of media and buffer, aseptic transfer to bacteria, ELISA, Immuno- electrophoresis and counter electrophoresis Autoradiography (observation of DNA) Southern, Northern and Western blotting techniques, Polymerase chain reaction, tissue culture.

PG2 PHSL 1021 (300-399)
(THEORY CORE)
MN: Nerve & Muscle Physiology and Nervous System

[Theory: Credits 3 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Structures and Functions of Nerve and Muscle cells
- Structures and Functions of Nervous System

Nerve & Muscle Physiology

Nerve: Introduction; structure, classification and functions of neurons; cytoskeletal elements and axoplasmic transport; excitation and conduction of nerve impulses; measurement of electrical events; propagation of nerve impulses in different types of nerve fibers; ionic basis of excitation and conduction including resting membrane potential, action potential, electrotonic potentials, current of injury and compound action potential; properties of mixed nerves and nerve fibers including excitability, conductivity, all-or-none law, accommodation, adaptation, summation, refractory period, indefatigability, chronaxie, rheobase and utilization time; degeneration and regeneration following peripheral nerve injury, changes in nerve cell body, trans neuronal degeneration, changes in receptors and motor end-plates, denervation hypersensitivity, thermal changes during nerve activity; nerve fiber types and functions; nerve growth factor (NGF) and neurotrophins; structure, classification and functions of neuroglial cells.

Muscle: Introduction; skeletal—light and electron microscopic structure, sarcotubular system, red and white muscle fibres, agonist and antagonist muscles, muscle proteins; chemical, thermal and electrical changes during contraction and relaxation, electromyography (EMG); mechanism of skeletal muscle contraction and relaxation, excitation–contraction coupling, role of dihydropyridine and ryanodine receptors; energy sources and metabolism; mechanical components of muscle, isometric and isotonic contractions, muscle length–tension and force–velocity relationships; functional properties of skeletal muscle including excitability, contractility, all-or-none law, summation, tetanus, fatigue, refractory period, tonicity, conductivity, extensibility, elasticity, optimal load and optimal fibre length; cardiac muscle—structure, electrical and mechanical properties, metabolism and pacemaker tissue; smooth muscle—light and electron microscopic structure, single-unit and multi-unit smooth muscle, visceral smooth muscle and multi-unit smooth muscle.

Synaptic and Junctional Transmission: Introduction; functional anatomy of synapses, types and structure of synapses, synaptic transmission; electrical events at synapses and synaptic potentials; synaptic inhibition and facilitation; chemical transmission at synapses; neurotransmitters, co-transmitters and neuromodulators; principal neurotransmitter systems; synaptic plasticity and learning; neuromuscular junction—structure and transmission, end-plate potential, miniature end-plate potential (MEPP), post-tetanic potentiation, motor unit and motor point; denervation hypersensitivity.

Initiation of Impulses in Sense Organs: Introduction; classification of general and special senses; receptors as biological transducers; ionotropic and metabotropic receptors; structure, subtypes and functions of nicotinic and muscarinic acetylcholine receptors, adrenergic receptors, glutamate receptors (NMDA and AMPA), GABA, opioid, serotonin, dopamine and histamine receptors; sensory modalities; electrical and ionic events in receptors; Müller's law of specific nerve energies, Weber–Fechner law and Stevens' power law; sensory transduction in the Pacinian corpuscle; receptor adaptation including phasic and tonic receptors; coding of sensory information.

Nervous System

Reflexes: Introduction; monosynaptic reflexes (stretch reflex); polysynaptic reflexes (withdrawal reflex); general properties of reflexes.

Cutaneous, Deep and Visceral Sensations: Introduction; ascending and descending tracts—origin, course, termination and functions; upper and lower motor neurons; functions of the spinal cord with special reference to physiological changes following hemi section and complete transection; Brown–Séquard syndrome; spinal animal; pain production, perception and modulation; referred pain; sensory pathways; touch; proprioception; temperature sensation; pain; and other somatic and visceral sensations.

Arousal Mechanism, Sleep and Electrical Activity of the Brain: Introduction; reticular formation and reticular activating system—organization, connections and functions of ascending and descending reticular formation; physiological basis of sleep and wakefulness; thalamus and cerebral cortex; evoked cortical potentials; electroencephalogram (EEG); physiological basis of EEG, consciousness and sleep; interpretation of abnormal EEG patterns.

Control of Posture and Movement: Introduction; corticospinal and corticobulbar systems; anatomy and functions; posture and its regulation; decerebrate rigidity; decorticate rigidity; postural reflexes; basal ganglia; cerebellum; movement disorders.

Autonomic Nervous System: Introduction; anatomical organization of autonomic outflow; chemical transmission at autonomic junctions; responses of effector organs to autonomic nerve impulses; cholinergic and adrenergic transmission.

Central Regulation of Visceral Functions: Introduction; medulla oblongata; hypothalamus—anatomical organization, hypothalamic functions, autonomic regulation, sleep, biological rhythms, hunger, thirst, regulation of posterior and anterior pituitary secretion, temperature regulation and fever.

Neural Basis of Instinctive Behaviour and Emotion: Introduction; anatomical organization of the limbic system; limbic functions; structure, connections and functions of the limbic system; physiology of emotion; sexual behaviour; fear; rage; motivation.

Higher Functions of the Nervous System: Introduction; methods of studying higher brain functions; conditioning; learning; short-term and long-term memory; speech and aphasia; hemispheric specialization and split-brain phenomenon; functions of the neocortex; electrophysiology of the brain including spontaneous electrical activity, EEG, electrocorticography (ECoG), evoked potentials, DC potentials and isolated cortex; disorders of learning and memory.

PG2 PHSL 1021 (300-399)
(PRACTICAL CORE)
MN: Nerve & Muscle Physiology and Nervous System

[Practical: Credits 1 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Structures and Functions of Nerve and Muscle cells
- Structures and Functions of Nervous System

Nerve Muscle Physiology

Isolation and staining of staining of nerve fibres with node (s) of Ranvier (AgNO3) and muscle fibre (H and E).

Preparation of Sciatic nerve innervated Gastrocnemius muscle of toad.

Study of Kymograph, Induction coil, Key and other instruments used to study mechanical responses of skeletal muscle.

Kymographic recording of mechanical responses of Gastrocnemius muscle to a single stimulus and two successive stimuli.

Kymographic recording of the effects of variations of temperature and load (after-load) on single muscle twitch.

Calculation of work done by the muscle.

Determination of nerve conduction velocity.

Nervous System

Experiments on superficial (plantar) and deep (knee jerk) reflex

Measurement of grip strength

Reaction time by stick drop test

Short term memory test (shape, picture word)

Two point discrimination test **(**General Principles)

RECOMMENDED BOOKS FOR PHYSIOLOGY

(The latest edition available should be used for all books)

1. Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murry and others. Lange Medical Book. Prentice-Ha l International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D.Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J Carneiro, McGraw- Hill .
12. Histology- A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell – A Molecular Approach, G.M. Cooper & R.E.Hausman, ASM Press SINAUER.
15. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, Mc Graw Hil Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibel & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwe l Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby. T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczer & Others; Tata McGraw Hill Publishing Co Ltd.
23. Cellular & Molecular Biology,by EDP De Robertis & EMF De Robertis; Lea & Febiger.
24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin-Cummings.

25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellignton, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.
31. Molecular Cel Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.
32. Genetics: Analysis of Genes and Genomes, by DL Hartl and EW Jones & Burtlet Publishers.
33. William's Text Book of Endocrinology Larsen et al.,: An Imprint of Elsevier.
34. Endocrinology, Mac E. Hadley, Pearson Education.
35. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
36. Physiology of Respiration by J.H. Comroe. Year Book Medical Publihsers.
37. Text Book of Physiology. Vols. I & II by H.D. Patton. A.F. Ruchs. B.Hille. A.M. Scher and R. Sleiner. W.B. Saunders of Co.
38. The Physiological Basis of Physical Education and Athletics by E.L. Fox and D.K. Mathews. Saunders College Publishing.
39. Statistics in Biology and Psychology by D.Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
41. Pesticides by P.K. Gupta, Interprint.
42. Environmental Chemistry by P.V. De. Wiley Eastern Ltd.
43. Exercise Physiology – Energy, Nutrition and Human
Performance by W.D. McArdle, F.Katch and V.L. Katch. Lippincott,Wi liams and Wilkins.
44. Essentials of Exercise Physiology by L.G. Shaver, Surjeet Publications.
45. Text Book of Environmental Physiology by C. Edger Folk Jr. Lea and Febiger.
46. Goodman & Gilman's The Pharmacological Basis of Therapeutics, McGraw-Hill.
47. Quintessence of Medical Pharmacology, S.K. Chaudhuri, New Central Book Agency.
48. Essentials of Medical Pharmacology, KD Tripathi, Jaypee.
49. Text book of Work Physiology by P.O. Astrand and K. Rodahl. Mc Graw- Hill Book Co.
50. Human Factors in Engineering and Design by E.O. McCormick and M. Sanders. Tata McGraw Hill.
51. Energy,Work and Leisure J.V.G.A.Durin and R.Passmore,Heinemann Educational Books.
52. Sports Physiology by E.L. Fox, Saunders College Publishing. Holt-Saunders.
53. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
54. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
55. Medical Physiology by A.B. Mahapatra, Current Books International.
56. Endocrinology. Vols.I , II and III by L.O. DeGroot. W.B. Saunders Co.
57. The Physiology of Reproduction, Vols.I & II, by E. Knobil and J.D. Neil. Raven Press.
58. Park's Text Book of Preventive and Social Medicine by K. Park, M/s. Banarsidas Bhanot Publishers.
59. Langman's Medical Embryology by J.W. Sadler, Lippincott,Williams and Wilkins.

60. Essentials of Human Embryology by A.K. Datta. Current Books International.
61. Human Embryology by I. Singh & G.P.Pal, McMillan.
62. The Circadian System of Man by R.A. Wever, Spinger-Verlag.
63. The Clocks That Time Us, by M.C. Moore- Ede and others, Harvard University Press.
64. Circadian Rhythms and the Human, by D.S. Minors and J.M. Waterhouse. Wright. PSG.
65. The Physiological Clock: Circadian Rhythms and Biological Chronometry, E. Bunning, Springer-Verlag.
66. Textbook of Pharmacology, SD Seth, B.I. Churchil Livingstone.
67. Basic and Clinical Pharmacology by E.G. Katzung. Appleton and Lange.
68. An Introduction to Biological Rhythms, by D. Palmer, Academic Press
69. Medical Statistics by B.K. Mahajan. Jaypee Brothers, Medical Publishers Pvt. Ltd.
70. Statistical Methods by G.W. Snecedor and W.G. Cochran, Oxford & IBH Publishing Co. Pvt. Ltd.
71. Theory and Practice of Histological Techniques by J.D. Bancroft & A. Stevens, Churchill Livingstone.
72. Practical Biochemistry in Medicine by Srinivas Rao., Academic Publishers
73.Genomes, 3rd edition, Terence A Brown, Garland Science
74.Human Molecular Genetics, 4th Edition, By Tom Strachan, Andrew Read, Published April 2nd 2010 by Garland Science
75.Discovering Genomics, Proteomics and Bioinformatics (2nd Edition) by A. Malcolm Campbell (Paperback - March 12, 2006)
76.Introducing Proteomics: From concepts to sample separation, mass spectrometry and data analysis by: Josip Lovric, publisher: Wiley, published: 2011-04-0577. Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
78. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K.Brobeck. The William and Wilkins Co.

M.Sc. Semester II Syllabus

PG2 PHSL 2011 (400-499)
(THEORY CORE)
MJC: Toxicology and Genetics

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Basic principles of Mendelian genetics
- Concepts of toxins and toxicology

Toxicology

Introduction to toxins and toxicology; factors affecting toxicity; concepts of dose–response relationship including LD_{50}, LD_0, ED_{50}, NOEL and LOEL; acute and chronic toxic effects; teratogens and their role in birth defects; biomagnification and bioconcentration of environmental toxicants; food additives and food adulterants; Prevention of Food Adulteration Act, 1954 and related food safety regulations; major food and environmental toxicants including bisphenol A (BPA), bisphenol S (BPS), pesticides, polycyclic aromatic hydrocarbons (PAHs), dioxins, polychlorinated biphenyls (PCBs), and heavy metals such as lead (Pb), mercury (Hg), cadmium (Cd) and arsenic (As).

Genetics

Basic principles of Mendelian genetics - monohybrid and dihybrid, test and back crosses, Bacterial genetics-transformation, transduction, conjugation (mention of F^+ /F^- , Hfr strain, function of pillus). Extension of Mendelism - Epistasis and its different types present in plants and animals. Penetrance, expressivity, pleiotropism.

Crossing over and Gene mapping. Numerical and Structural variations in chromosome - basic concepts of aneuploids and polyploids. Human Cytogenetics - human karyotype, banding technique, use of human cytogenetics in medical science, inborn errors of metabolism, aneuploidy in humans. Sex determination and sex linkage.

PG2 PHSL 2011 (400-499)
(PRACTICAL CORE)
MJC: Toxicology and Genetics

Course Learning Outcomes:

After completion of this course student will learn:

- Toxic effects of Hg, Pb and As compounds
- Effects of food additives and arsenic compounds on liver, kidney etc.
- DNA gel electrophoresis (agarose gel electrophoresis)

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Physiological (experimental) Experiments

Kymographic recording of the effects of Hg, Pb and As compounds on: the contraction of perfused heart of toad, the intestinal movements of rats in Dale's bath.

Histo-chemical Experiments

Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.

Genetics

DNA gel electrophoresis (agarose gel), Human Cytogenetics, human karyotype analysis (Demonstration)

PG2 PHSL 2012 (400-499)
(THEORY CORE)
MJC: Electrophysiology of Membrane and Pharmacology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Voltage-gated channels and Electrical activities in post synaptic membrane
- Alimentation

Electrophysiology of Membrane

Voltage-gated channels

Na^+ channels – protein pore and selectivity, pharmacology, gating, Ca^{2+} channels – strength, selectivity and block, K^+ channels – diversity, selectivity and block, Cl-channels. -----SGB 4. Electrical properties of cell membrane – The origin of bioelectric potential, Goldman – Hagkin-Katz voltage equation. Action potential – different channels; action potential in different excitable cells. Voltage clamp and patch clamp – rationales and methods. Gating current.

Molecular mechanism

synapse – Different receptors in pre- and post-synaptic membrane (ionotropic receptors in synaptic transmission and sensory transduction) – acetylcholine, NE, GABA, DA, 5-HT, glutamate, histamine receptors; nicotinic receptor – receptor molecule, pharmacology; myasthenia gravis.

The second messenger systems in post synaptic membrane

G-protein, cAMP, IP_3 and DAG. GEF or GAP, Ca^{2+} signaling; Phospholipase C (PLC); Nitric oxide (NO)/cyclic GMP signaling pathway; Desensitization of cell signaling. Neurotransmitters and neuromodulators. Nerve impulse – neurotransmitter coupling mechanism – molecular components of synaptic vesicles; synaptic plasticity.

Pharmacology

General Pharmacology

History and scope of pharmacology, sources and classification of drugs, routes of drug administration, pharmacokinetics including absorption, distribution, metabolism and excretion of drugs, pharmacodynamics, drug receptors, dose–response relationship, agonists and antagonists, factors modifying drug action, and drug interactions.

Autonomic and Cardiovascular Pharmacology

Cholinergic and anticholinergic drugs, adrenergic agonists and antagonists, pharmacology of antihypertensive drugs, antianginal drugs, drugs used in heart failure, antiarrhythmic drugs, and diuretics including their mechanisms of action, therapeutic uses and adverse effects.

Central Nervous System and Endocrine Pharmacology

General and local anaesthetics, sedatives and hypnotics, opioid and non-opioid analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), antiepileptic drugs, antidepressants, antipsychotic drugs, hormones and hormone antagonists, drugs used in diabetes mellitus, and pharmacology of thyroid disorders.

Chemotherapy and Recent Advances

Principles of chemotherapy, classification and mechanism of action of antibacterial, antiviral, antifungal and antiparasitic drugs, anticancer drugs, adverse drug reactions, pharmacovigilance, drug resistance, precision medicine, personalized pharmacotherapy, biologics, and biosimilars.

PG2 PHSL 2012 (400-499)
(PRACTICAL CORE)
MJC: Electrophysiology of Membrane and Pharmacology

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Amphibian Physiology Experiments on muscle
- Students will learn Educational Field Tour Report to different laboratories and National Institute for exposure to modern techniques, population survey e.g. diet survey

Amphibian Physiology Experiments

Isometric contraction of gastrocnemius muscle of toad, on application of two successive stimuli, showing summation and several quick successive stimuli, loading to tetanus; measurement of tension produced.

Effect of K^+ free and Ca^{2+} free Ringer's solution, alteration of pH of the perfusion fluid, adrenaline and acetylcholine on the perfused heart of toad; effect of vagus stimulation on the heart before and after application of atropine and nicotine; effect of drug and change of pressure on cardiac output.

Effect of drug on atrial strip of toad in a Dale's bath.

Effect of acetylcholine, using rectus abdominis muscle of toad in a Dale's bath before and after application of eserine.

Pharmacology

Calculation of drug dosage (adult and pediatric dose; body surface area-based dose calculation).

Construction and interpretation of graded dose–response curves using computer simulation; demonstration of agonist and antagonist actions.

Pharmacokinetic exercises: Calculation of biological half-life, clearance, volume of distribution, and bioavailability.

Prescription analysis of drugs used in hypertension, diabetes mellitus, and common infectious diseases, with emphasis on rational drug use.

Adverse Drug Reaction (ADR) reporting and pharmacovigilance using clinical case studies and ADR reporting forms.

Educational Field Tour Report

Consult standard Guideline

Students are to attend **Compulsory Educational Field Tour Report** to different laboratories and National Institute for exposure to modern techniques, population survey e.g. diet survey, anthropometric survey, group projects and / or to undertake field studies on tour. A field tour report is to be submitted by each student during the practical examination.

PG2 PHSL 2013 (400-499)
(THEORY CORE)
MJC: Ergonomics, Sports Physiology and Chronobiology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Importance of ergonomics in occupational health and well-being
- Importance of regular exercise in health and wellbeing
- The Circadian Clock and circadian rhythms

Ergonomics and Occupational Physiology

Genesis and concept of ergonomics, Importance of ergonomics in occupational health and well-being, Classification of Physiological work load. Concept of work rest cycle, Physical work environment; Thermal environment, its' effect, Heat stress indices, Noise and vibration, its' effect on workers. Occupational deafness, Illumination level and its' effect on visual performances, Ergonomic principles of control of Physical hazards, Static anthropometry, Application of anthropometric data in design, User interface and control display compatibility, Prevention of accidents, concept of Industrial safety, Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.

Sports and Exercise Physiology

Importance of regular exercise in health and wellbeing, Basic concept of Bioenergetics, Energy sources during exercise (Phosphagen, Anaerobic system and Aerobic system), Cardio-respiratory responses during different grades of exercise, Concept of excess post exercise oxygen consumption (EPOC), physiological fatigue and recovery, Aerobic work Capacity: Measurement, physiological factors and applications, Training: Principles of physical training, Training to improve aerobic and anaerobic power. Effect of overtraining and detraining, Nutritional supplements and ergogenic aids, Sports injury and its' management, Basic idea sports rehabilitation and sports medicine.

Chronobiology

The Circadian Clock; Circadian clock location , Peripheral circadian clocks, Definition of terms, types of rhythms, zeitgebers, circadian rhythms, basic types of exogenous rhythms in the human and their significance. Concept of chronobiology and biological rhythms – endogenous and exogenous, circadian, ultradian, infradian, circatrigintan and circhoral, circannual rhythms, nycthermal rhythms and seasonal rhythms. Rhythms of ACTH and cortisol, anterior pituitary hormones, body temperature and B.M.R. urinary excretion of Na^+, K^+ etc. G-Ifunctions and metabolic enzymes. Sleep-wakefulness, photoperiods, pineal gland and gonad. Time-zone transitions and shift work. Concept of biological clock and master clock, Circadian clock molecular mechanism PER regulatory loop BMAL1 regulatory loop , evolution and adaptive significance, genetic and molecular mechanisms, resonating clocks, clocks for constant environments, the role of SCN in the human, photic and non-photic pathways, pacemaker function of the SCN, role of melatonin and other neuro transmitters in circadian control.

Disorders of Circadian Rhythms

Entertainment related blindness, jet lag, work-shift syndrome, delayed and advanced sleep-phase syndrome. Pacemaker related: irregular s/w syndrome, decreased amplitude syndrome, aging and its endocrine consequences. Affective disorders: Definition, SAD and light therapy.

PG2 PHSL 2013 (400-499)
(PRACTICAL CORE)
MJC: Ergonomics, Sports Physiology and Chronobiology

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Importance of ergonomics in occupational health and well-being
- Importance of regular exercise in health and wellbeing

Ergonomics and Occupational Physiology

Measurement of working heart rate by ten beats methods.

Determine cardiac cost of specific work.

Measurement of blood pressure before and after different grades of exercise.

Measurement of Some common anthropometric parameters. Calculation of BSA and BMI from anthropometric data.

Measurement of WBGT indices.

Measurement of noise level by noise level meter

Sports and Exercise Physiology

Measurement of blood pressure before and after different grades of exercise.

Recording of recovery heart-rate after standard exercise.

Determination of Physical Fitness Index by Harvard Step Test (Modified).

Determination of VO2max by Queen College step test.

Measurement of body fat percentage.

Six minute walk test.

Determination of endurance time by hand grip dynamometer.

Pneumographic recording of effect of talking, laughing, coughing, breath holding and hyperventilation

PG2 PHSL 2014 (400-499)
(THEORY CORE)
MJC: Homeostasis of Internal Environment in Human and Stress Physiology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Importance of Homeostasis of Internal Environment in Human
- Brief concept of stress – stressor, strain and general adaptation syndrome

Homeostasis of Internal Environment in Human (Cardiovascular, respiratory, blood and body fluid and body temperature)

Homeostasis – a brief concept – sensor, set point, integrating centers, afferent and efferent pathways, effectors; negative and positive feedback control – long, short and multiple loop systems. Homeostasis of cardiac output; atherosclerosis, coronary occlusion and cardiac ischemia; work of heart and cardiac metabolism, Homeostasis of arterial blood pressure; hypo- and hypertension, Modern concept of the respiratory centers and homeostasis of pulmonary ventilation neural and chemical control; spirometry, mechanics of respiration; lung function tests, Homeostasis of blood and body fluid volume; hemorrhage and blood transfusion, homeostasis and platelets; role of plasma proteins, kidney, neural and endocrine factors, Homeostasis of osmotic pressure in blood. Homeostasis of body temperature

physiological, behavioral, neural and endocrine mechanisms; responses to hot and cold climates – heat acclimatization.

Stress Physiology

Brief concept of stress – stressor, strain and general adaptation syndrome (GAS); bodily adjustments under acute and chronic stress conditions like hypo- and hyperglycemia, severe work load, mental stress; hypertension and thermal stress; indices of thermal stress.

Cell Dynamics, Movements, Special Cells and In Vitro Cell Management Techniques

Cellular movements: Muscle cells -Smooth muscle – contractile mechanism, mechanical properties and energetics. Contraction in non-muscle cells –motion of cilia and flagella, microtubule based motility, actomyosin system; microtubules and intracellular transport Motor proteins. Uterine, Detrusor Ureter Airway Vascular and Gastrointestinal smooth muscle cell. Muscle mechanics – Mechanical components in different types of muscle.

PG2 PHSL 2014 (400-499)
(PRACTICAL CORE)
MJC: Homeostasis of Internal Environment in Human and Stress Physiology

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Techniques
- Experiments on pulse rate and Experiments on respiration in Human
- Experiments on nervous system in Human

Human Physiology Experiments

Experiments on pulse rate:-

Diurnal variations, In different postures at rest, On breath holding, With variation of static workload, Maximum rate with variation of dynamic exercise

Experiments on blood pressure:

In different postures at rest, with variation of static workload, Following dynamic exercise.

Experiments on respiration: Effect of breath holding and hyperventilation-pneumographic record.

Determination of respiration rate (i) diurnal variations, (ii) in different postures at rest.

Effect of a standard exercise on the vital capacity.

Experiments on nervous system: Measurement of the velocity of nerve impulse in the ulnar nerve. Mapping of hot and cold spots on skin. Measurement of skin temperature at rest and during exercise. Threshold determination of the sensations of smell and taste. Measurement of visual acuity. Measurement of visual fields by a perimeter. Tests for colour blindness. Blinking rate measurements with different levels of illumination

Anthropometric and other experiments: Anthropometric measurements of the body dimensions.

Determination of body fat and lean body mass. Determination of muscle power with dynamometer.

Audiometry

PG2 PHSL 2021 (300-399)
(THEORY CORE)

MN: Nutrition and Dietetics, Toxicology, Ergonomics and Occupational Physiology, Sports and Exercise Physiology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Concepts of Ergonomics and Occupational Health, Sports and Exercise Physiology
- Concepts of Nutrition and Dietetics, Toxicology

Occupational Physiology

Measurement of working heart rate by the ten-beat method; determination of cardiac cost of work; measurement of blood pressure before and after different grades of exercise; anthropometric measurements including height, weight, body surface area (BSA) and body mass index (BMI); assessment of heat stress using Wet Bulb Globe Temperature (WBGT) index; measurement of occupational noise using a sound level meter.

Exercise Physiology

Measurement of blood pressure before and after graded exercise; recording of recovery heart rate following standard exercise; determination of Physical Fitness Index (PFI) by the Modified Harvard Step Test; estimation of maximal oxygen uptake (VO_2max) by the Queen's College Step Test; assessment of body fat percentage; Six-Minute Walk Test (6MWT); determination of endurance time using a hand-grip dynamometer; pneumographic recording of respiratory changes during talking, laughing, coughing, breath-holding and hyperventilation.

Physiological Toxicology

Introduction to toxicology and toxins; factors affecting toxicity; dose–response relationship including LD_{50} (Median Lethal Dose), ED_{50} (Median Effective Dose), LD_0 (Minimum Lethal Dose), NOEL (No Observed Effect Level), LOEL (Lowest Observed Effect Level). concepts of acute and chronic toxicity; teratogens and birth defects; biomagnification and bioconcentration; food additives and food adulterants; Prevention of Food Adulteration Act, 1954; toxicants in food and the environment including bisphenol A (BPA), bisphenol S (BPS), pesticides, polycyclic aromatic hydrocarbons (PAHs), dioxins, polychlorinated biphenyls (PCBs), and heavy metals such as lead (Pb), mercury (Hg), cadmium (Cd) and arsenic (As).

Nutritional Physiology

Constituents of food and their physiological significance; basal metabolic rate (BMR), factors affecting BMR and its determination by Benedict–Roth apparatus; respiratory quotient (RQ); specific

dynamic action (SDA); concepts of energy and energy units; calorific value of foods; energy requirements and adult consumption unit (ACU); dietary requirements of carbohydrates, proteins, lipids, vitamins and minerals; balanced diet and formulation of diets for children, adults, pregnant and lactating women; nitrogen balance; essential amino acids; biological value of proteins; supplementary value of proteins; protein efficiency ratio (PER) and net protein utilization (NPU); dietary fibre; vitamins and minerals—their sources and physiological significance; principles of diet survey; composition and nutritional value of common foodstuffs; physiology of starvation and obesity; and space nutrition.

PG2 PHSL 2021 (300-399)
(PRACTICAL CORE)

MN: Nutrition and Dietetics, Toxicology, Ergonomics and Occupational Physiology, Sports and Exercise Physiology

[Practical: Credits 1 / 20 Marks] **[Practical Hour: 30**

Course Learning Outcomes:

After completion of this course student will learn:

- Sports and Exercise Physiology
- Concepts of Nutrition and Dietetics, Toxicology
- Diet Survey (Field Study Record)

Hours]

Ergonomics and Occupational Health, Sports and Exercise Physiology

A report (hand-written) on the basis of field survey from ONE of the followings:

Physiological parameters of human (at least three parameters).

Anthropometric measurements on human (at least three parameters).

Epidemiological studies on human.

Toxicology

Physiological Experiments

Kymographic recording of the effects of Hg, Pb and As compounds on: the contraction of perfused heart of toad, the intestinal movements of rats in Dale's bath.

Histo-chemical Experiments

Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.

Nutrition and Dietetics

Diet Survey (Field Study Record)

Diet survey report (hand-written) of a family (as per ICMR specification) : Each student has to submit a report on his/her own family.

OR

PG2 PHSL 2011 (400-499)
(THEORY CORE)
MJC: Toxicology and Genetics

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Basic principles of Mendelian genetics
- Concepts of toxins and toxicology

Toxicology

Introduction to toxins and toxicology; factors affecting toxicity; concepts of dose–response relationship including LD_{50}, LD_0, ED_{50}, NOEL and LOEL; acute and chronic toxic effects; teratogens and their role in birth defects; biomagnification and bioconcentration of environmental toxicants; food additives and food adulterants; Prevention of Food Adulteration Act, 1954 and related food safety regulations; major food and environmental toxicants including bisphenol A (BPA), bisphenol S (BPS), pesticides, polycyclic aromatic hydrocarbons (PAHs), dioxins, polychlorinated biphenyls (PCBs), and heavy metals such as lead (Pb), mercury (Hg), cadmium (Cd) and arsenic (As).

Genetics

Basic principles of Mendelian genetics - monohybrid and dihybrid, test and back crosses, Bacterial genetics-transformation, transduction, conjugation (mention of F^+ /F^- , Hfr strain, function of pillus). Extension of Mendelism - Epistasis and its different types present in plants and animals. Penetrance, expressivity, pleiotropism.

Crossing over and Gene mapping. Numerical and Structural variations in chromosome - basic concepts of aneuploids and polyploids. Human Cytogenetics - human karyotype, banding technique, use of human cytogenetics in medical science, inborn errors of metabolism, aneuploidy in humans. Sex determination and sex linkage.

PG2 PHSL 2011 (400-499)
(PRACTICAL CORE)
MJC: Toxicology and Genetics

Course Learning Outcomes:

After completion of this course student will learn:

- Toxic effects of Hg, Pb and As compounds
- Effects of food additives and arsenic compounds on liver, kidney etc.
- DNA gel electrophoresis (agarose gel electrophoresis)

[Practical: Credits 2 / 20 Marks] **[Practical Hour: 30 Hours]**

Physiological (experimental) Experiments

Kymographic recording of the effects of Hg, Pb and As compounds on: the contraction of perfused heart of toad, the intestinal movements of rats in Dale's bath.

Histo-chemical Experiments

Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.

Genetics

DNA gel electrophoresis (agarose gel), Human Cytogenetics, human karyotype analysis (Demonstration)

PG2 PHSL 2021 (300-399)
(THEORY CORE)

MN: Nutrition and Dietetics, Toxicology, Ergonomics and Occupational Physiology, Sports and Exercise Physiology

[Theory: Credits 4 / 40 Marks] **[Lecture Hour: 45 Hours]**

Course Learning Outcomes:

After completion of this course student will learn:

- Concepts of Ergonomics and Occupational Health, Sports and Exercise Physiology
- Concepts of Nutrition and Dietetics, Toxicology

Occupational Physiology

Measurement of working heart rate by the ten-beat method; determination of cardiac cost of work; measurement of blood pressure before and after different grades of exercise; anthropometric measurements including height, weight, body surface area (BSA) and body mass index (BMI); assessment of heat stress using Wet Bulb Globe Temperature (WBGT) index; measurement of occupational noise using a sound level meter.

Exercise Physiology

Measurement of blood pressure before and after graded exercise; recording of recovery heart rate following standard exercise; determination of Physical Fitness Index (PFI) by the Modified Harvard Step Test; estimation of maximal oxygen uptake (VO_2max) by the Queen's College Step Test; assessment of body fat percentage; Six-Minute Walk Test (6MWT); determination of endurance time using a hand-grip dynamometer; pneumographic recording of respiratory changes during talking, laughing, coughing, breath-holding and hyperventilation.

Physiological Toxicology

Introduction to toxicology and toxins; factors affecting toxicity; dose–response relationship including LD_{50} (Median Lethal Dose), ED_{50} (Median Effective Dose), LD_0 (Minimum Lethal Dose), NOEL (No Observed Effect Level), LOEL (Lowest Observed Effect Level). concepts of acute and chronic toxicity; teratogens and birth defects; biomagnification and bioconcentration; food additives and food adulterants; Prevention of Food Adulteration Act, 1954; toxicants in food and the environment including bisphenol A (BPA), bisphenol S (BPS), pesticides, polycyclic aromatic hydrocarbons (PAHs), dioxins, polychlorinated biphenyls (PCBs), and heavy metals such as lead (Pb), mercury (Hg), cadmium (Cd) and arsenic (As).

Nutritional Physiology

Constituents of food and their physiological significance; basal metabolic rate (BMR), factors affecting BMR and its determination by Benedict–Roth apparatus; respiratory quotient (RQ); specific dynamic action (SDA); concepts of energy and energy units; calorific value of foods; energy requirements and adult consumption unit (ACU); dietary requirements of carbohydrates, proteins, lipids, vitamins and minerals; balanced diet and formulation of diets for children, adults, pregnant and lactating women; nitrogen balance; essential amino acids; biological value of proteins; supplementary value of proteins; protein efficiency ratio (PER) and net protein utilization (NPU); dietary fibre; vitamins and minerals—their sources and physiological significance; principles of diet survey; composition and nutritional value of common foodstuffs; physiology of starvation and obesity; and space nutrition.

PG2 PHSL 2021 (300-399)
(PRACTICAL CORE)

MN: Nutrition and Dietetics, Toxicology, Ergonomics and Occupational Physiology, Sports and Exercise Physiology

[Practical: Credits 1 / 20 Marks] **[Practical Hour: 30**

Course Learning Outcomes:

After completion of this course student will learn:

- Sports and Exercise Physiology
- Concepts of Nutrition and Dietetics, Toxicology
- Diet Survey (Field Study Record)

Hours]

Ergonomics and Occupational Health, Sports and Exercise Physiology

A report (hand-written) on the basis of field survey from ONE of the followings:

Physiological parameters of human (at least three parameters).

Anthropometric measurements on human (at least three parameters).

Epidemiological studies on human.

Toxicology

Physiological Experiments

Kymographic recording of the effects of Hg, Pb and As compounds on: the contraction of perfused heart of toad, the intestinal movements of rats in Dale's bath.

Histo-chemical Experiments

Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.

Nutrition and Dietetics

Diet Survey (Field Study Record)

Diet survey report (hand-written) of a family (as per ICMR specification) : Each student has to submit a report on his/her own family.

PG2 PHSL 2031 (400-499)
(RESEARCH CORE)
MJC: Research Project/ Dissertation

[Credits 12 / 225 Marks (135+90)**]**

Course Learning Outcomes:

After completion of this course student will learn:

- Rresearch project/ dissertation, seminar presentation and interaction

Submission of research project/ dissertation, seminar presentation and interaction.

RECOMMENDED BOOKS FOR PHYSIOLOGY

(The latest edition available should be used for all books)

1. Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
3. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
4. Harper's Biochemistry, by R.K. Murry and others. Lange Medical Book. Prentice-Ha l International.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. By D.Das, Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E Neil & N. Toels. Oxford University Press.
10. Physiology, by R.M. Berne & M.N. Levy, C.V. Mosby Co.
11. Basic Histology, by L.C. Junqueira & J Carneiro, McGraw- Hill .
12. Histology- A Text and Atlas, by M.H. Ross & E.J. Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
14. The Cell – A Molecular Approach, G.M. Cooper & R.E.Hausman, ASM Press SINAUER.
15. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
16. The Human Nervous System, by Charles Nobach, Mc Graw Hil Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibel & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System. By M.L. Barr & J.A. Kierman, Harper & Row.
19. Essential Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwe l Scientific Publications.
21. Kuby Immunology, by R.A. Goldsby. T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
22. Microbiology, by M.J. Pelczer & Others; Tata McGraw Hill Publishing Co Ltd.
23. Cellular & Molecular Biology,by EDP De Robertis & EMF De Robertis; Lea & Febiger.

24. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin- Cummings.
25. Molecular Biology of the Cell, by B. Alberts and others, Garland.
26. Textbook of Medical Physiology, Indu Khurana, Elsevier.
27. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellignton, Oxford University Press.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.
31. Molecular Cel Biology, by H. Lodish, D. Baltimore & others. Scientific American Book.
32. Genetics: Analysis of Genes and Genomes, by DL Hartl and EW Jones & Burtlet Publishers.
33. William's Text Book of Endocrinology Larsen et al.,: An Imprint of Elsevier.
34. Endocrinology, Mac E. Hadley, Pearson Education.
35. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
36. Physiology of Respiration by J.H. Comroe. Year Book Medical Publihsers.
37. Text Book of Physiology. Vols. I & II by H.D. Patton. A.F. Ruchs. B.Hille. A.M. Scher and R. Sleiner. W.B. Saunders of Co.
38. The Physiological Basis of Physical Education and Athletics by E.L. Fox and D.K. Mathews. Saunders College Publishing.
39. Statistics in Biology and Psychology by D.Das Academic Publishers.
40. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
41. Pesticides by P.K. Gupta, Interprint.
42. Environmental Chemistry by P.V. De. Wiley Eastern Ltd.
43. Exercise Physiology – Energy, Nutrition and Human Performance by W.D. McArdle, F.Katch and V.L. Katch. Lippincott,Wi liams and Wilkins.
44. Essentials of Exercise Physiology by L.G. Shaver, Surjeet Publications.
45. Text Book of Environmental Physiology by C. Edger Folk Jr. Lea and Febiger.
46. Goodman & Gilman's The Pharmacological Basis of Therapeutics, McGraw-Hill.
47. Quintessence of Medical Pharmacology, S.K. Chaudhuri, New Central Book Agency.
48. Essentials of Medical Pharmacology, KD Tripathi, Jaypee.
49. Text book of Work Physiology by P.O. Astrand and K. Rodahl. Mc Graw- Hill Book Co.
50. Human Factors in Engineering and Design by E.O. McCormick and M. Sanders. Tata McGraw Hill.
51. Energy,Work and Leisure J.V.G.A.Durin and R.Passmore,Heinemann Educational Books.
52. Sports Physiology by E.L. Fox, Saunders College Publishing. Holt-Saunders.
53. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
54. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
55. Medical Physiology by A.B. Mahapatra, Current Books International.
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