SYLLABUS FOR
M.Sc. COURSE IN PHYSIOLOGY

(With effect from the session 2020–22)
[CHOICE BASED CREDIT SYSTEM]

DEPARTMENT OF PHYSIOLOGY
THE UNIVERSITY OF BURDWAN
WEST BENGAL
INDIA

The M.Sc. syllabus (2020-2022) has been endorsed in the meeting of Ad-hoc Board of Post Graduate Studies in Physiology held on 29/03/2021. Subsequently approved the in the meeting of Faculty Council of Science on _____.

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M.Sc. SYLLABUS

Annexure-I

Department of PHYSIOLOGY

Summary of the course and credits

Semester I [Credits – 24]

Course				Lect. Hr /week	Duration of Exam (in Hrs.)	Marks			Credit
Course code	Type	T/P	Name			I.A.	E.T	Total	
MSPY101	Core	T	Cell Biology, Molecular Biology, Cytogenetics, and Immunology	4T	2	10	40	50	4
MSPY102	Core	T	Enzyme, Bioenergetics, Metabolism and Microbiology	4T	2	10	40	50	4
MSPY103	Core	T	Homeostasis of Internal Environment in Human, Stress Physiology, Alimentation, and Excretion	4T	2	10	40	50	4
MSPY104	Core	T	Biophysics, Nutrition and Histochemistry	4T	2	10	40	50	4
MSPY105	Core	P	Clinical Enzymology and Cytogenetics	8P	4	10	40	50	4
MSPY106	Core	P	Histology and Histochemistry	8P	4	10	40	50	4
					Total credit			300	24

T/P: Theory/Practical

Semester II [Credits – 24]

Course				Lect. Hr /week	Dur. of Exam (in H)	Marks			Credit
Course code	Type	T/P	Name			I.A.	E.T	Total	
MSPY201	Core	T	Cell Membrane Dynamics	4	2	10	40	50	4
MSPY202	Core	T	Central Nervous System and Sensory Physiology	4		10	40	50	4
MSPY203	Core	T	Sports and Exercise Physiology	4	2	10	40	50	4
MSPY204	Core	T	Ergonomics & Chronobiology	4	2	10	40	50	4
MSPY205	Core	P	Amphibian Experimental Physiology and Educational field tour report	8	4	10	40	50	4
MSPY206	Core	P	Mammalian Physiology Experiments and Human Physiology Experiments	8	4	10	40	50	4
					Total credit			300	24

T/P: Theory/Practical

Semester III [Credits – 24]

Course				Lect. Hr /week	Dur. of Exam (in H)	Marks			Credit
Course code	Type	T/P	Name			I.A.	E.T	Total	
MSPY301	Core	T	Endocrinology and Bioinstrumentation	4	2	10	40	50	4
MSPY302	Core	T	Biostatics and Computer Application	4	2	10	40	50	4
MSPY303	Core	P	Biostatistics and Computer Application	8	4	10	40	50	4
MSPY304	GE	T	Environmental Physiology and Occupational Health	2	1	5	20	25	2
MSPY305*	DE1	T	Nutrition and Dietetics	4	2	10	40	50	4
MSPY305**	DE2	T	Endocrinology and Reproduction	4	2	10	40	50	4
MSPY305***	DE3	T	Ergonomics and Occupational Health	4	2	10	40	50	4
MSPY305****	DE4	T	Environmental Physiology	4	2	10	40	50	4
MSPY305*****	DE5	T	Sports and Exercise Physiology	4	2	10	40	50	4
MSPY306*	DE1	P	Nutrition and Dietetics	8	4	10	40	50	4
MSPY306**	DE2	P	Endocrinology and Reproduction	8	4	10	40	50	4
MSPY306***	DE3	P	Ergonomics and Occupational Health	8	4	10	40	50	4
MSPY306****	DE4	P	Environmental Physiology	8	4	10	40	50	4
MSPY306*****	DE5	P	Sports and Exercise Physiology	8	4	10	40	50	4
MSPY307	CE	(NA) T/P	Community Health Assessment #	N.A.	N.A.	5	20	25	2
					Total credit			300	24

T/P: Theory/Practical

CE: Community Engagement Activities; DE: Discipline-centric Elective; GE: Generic elective

* MSPY305 / 306-DE1; **MSPY305 / 306-DE2, ** * MSPY305 / 306-DE3;
**** MSPY305 / 306-DE4, ***** MSPY305 / 306- DE5

DE: Discipline-centric Elective (Students need to take any one of these Discipline-centric Electives)

DE1= Nutrition and Dietetics (COURSE CODE: MSPY 305-DE1 and MSPY 306-DE1)

DE 2= Endocrinology and reproductive Physiology (COURSE CODE: MSPY 305-DE 2 and MSPY 306-DE2)

DE 3= Ergonomics and Occupational health (COURSE CODE: MSPY 305-DE3 and MSPY 306-DE3)

DE4=Environmental Physiology (COURSE CODE: MSPY 305-DE4 and MSPY 306-DE4)

DE5= Sports & Exercise Physiology (COURSE CODE: MSPY 305-DE5 and MSPY 306-DE5)

 # Broad Community Engagement Programmes/ activities (UGC Prescribed)

1. Appreciation of Rural Society
2. Understanding Rural Society
3. Rural Institutions
4. Rural Development Programmes, etc.

(For details see National Curriculum Framework and Guidelines, UGC, January 2020, page 1

Semester IV [Credits – 24]

Course				Lect. Hr /week	Dur. of Exam (in H)	Marks			Credit
Course code	Type	T/P	Name			I.A.	E.T	Total	
MSPY401	Core	T	Developmental Biology and Population Science	4	2	10	40	50	4
MSPY402	Core	T	Reproductive biology, Environmental Physiology and Evolution	4	2	10	40	50	4
MSPY403	Core	T	Toxicology , Xenobiotics and human health ; Evolutionary Biology	4	2	10	40	50	4
MSPY404*	DE1	T	Nutrition and Dietetics	4	2	10	40	50	4
MSPY404**	DE2	T	Endocrinology and Reproduction	4	2	10	40	50	4
MSPY404***	DE3	T	Ergonomics and Occupational Health	4	2	10	40	50	4
MSPY404****	DE4	T	Environmental Physiology	4	2	10	40	50	4
MSPY404*****	DE5	T	Biomechanics, Kinesiology in sports and exercise	4	2	10	40	50	4
MSPY405*	DE1	P	Nutrition and Dietetics	8	4	10	40	50	4
MSPY405**	DE2	P	Endocrinology and Reproduction	8	4	10	40	50	4
MSPY405***	DE3	P	Ergonomics and Occupational Health	8	4	10	40	50	4
MSPY405****	DE4	P	Environmental Physiology	4	2	10	40	50	4
MSPY405*****	DE5	P	Biomechanics, Kinesiology in sports and exercise	4	2	10	40	50	4
MSPY406	Project	T/P (NA)	Dissertation $$ (Empirical or Non empirical)					50	4
								300	24

*MSPY404 / 405-DE1; **MSPY404 / 405-DE2, **MSPY404 / 405-DE3; **** MSPY404 / 405-DE4; ***** MSPY404 / 405-DE5

DE: Discipline-centric Elective: Based on Discipline-centric Elective taken in Semester -III
$$ Based on Discipline-centric Elective
DE Course Code: MSPY 404-DE1, MSPY 404-DE2, MSPY 404-DE3, MSPY 404-DE4, MSPY 404-DE5

DE Course Code: MSPY 405-DE1, MSPY 405-DE2, MSPY 405-DE3, MSPY 405-DE4, MSPY 405-DE5

Guidelines of Question Pattern:

In each course of 50 marks (4 credits/) the End-semester examination shall be of 40 marks (10 marks Mid-sem examination/Continuous Assessment based on class test, assignment, seminar, etc. modalities for which are to be decided by the concerned course-in-charge and to be notified to the students at the beginning of the semester). In End-semester, there shall be 8 questions of 10 marks each from which 4 questions are to be answered by the candidates (Time 2 hours).

2. In each course of 50 marks (4 credits) which has two groups within it the End-semester examination shall be of 40 marks. There shall be 4 questions of 10 marks from each group. Candidates are to answer 4 questions taking 2 from each group. (Time 2 hours).

Guidelines for Evaluation Pattern:

Notes on marks distribution:

 The performance of a candidate in a theoretical course (paper) will be assessed for a maximum of 50 marks as explained below (except the courses DEPT 307 and DEPT 406 which are discussed later):

 40 marks as end-semester examination
 10 marks as Continuous Assessment based on class test, assignment, seminar etc, modalities for which are to be decided by the concerned course-in-charge and notified to the students at the beginning of the semester

MSPY 406 (Project paper/Practical Paper):
Based on Survey Report, Assignment, Presentation and Viva-Voce.
Field survey and project Writing: 40 marks
Presentation and Viva-Voce (in the presence of external experts from other Universities/Institutions): 10 marks

** **MSPY 307 CE**: Community Engagement Activities
Students have to participate in the Community Engagement programmes/ activities of the department for the concerned year and follow it up with a written Report & Presentation and Viva-Voce. The main objectives are to develop an appreciation of rural culture, lifestyle and wisdoms among students, to learn about the states of various agricultural and rural development programmes, to understand causes for rural distress and poverty and explore solutions for the same and to apply class room knowledge of courses to field realities. Evaluation pattern would be as follows:
 Report writing: 20 marks

 Presentation and viva-voce: 5 marks (in the presence of external expert(s) from other Departments of the Home University)

CONTENTS

M.Sc. Semester I Syllabus

MSPY 101

(THEORY CORE)

Cell Biology, Molecular Biology, Cytogenetics, and Immunology

Full marks: 50 (40+10) **Total Credits: 4**

1. **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
   Cytoskeleton – its nature; nucleus, mitochondria, intermediate filaments, microtubules, cilia and centrioles; actin filaments, actin-binding proteins; muscle cell division cycle-general strategies of the cell cycle; cell division control in multi-cellular animals; the mechanism of cell division; M-phase; mitosis and meiosis; cell differentiation; cell-cell interaction; cell junctions; the extra cellular matrix and its receptors – the integrins; malignant growth.

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

2. **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, cosmids 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 mRNA, tRNA and rRNA. 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; motiffs; 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.

3. **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 S.D.S. – polyacrylamide gel. Histochemical technique for identification of nucleic acid. Karyotyping in blood cells, bone-marrow and other cells
4. **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

MSPY 102

(THEORY CORE)

Enzyme, Bioenergetics, Metabolism and Microbiology

Full marks: 50 (40+10) **Total Credits: 4**

1. **Enzyme and Bioenergetics:**
   Biochemical reaction mechanisms, enzyme substrate reaction kinetics; Michaelis-Menten equation – derivation, significance and graphical representation of kinetics; kinetics of competitive and non-competitive inhibition; enzymatic catalysis and modern concept of active sites of enzymes; turnover number; allosteric enzymes and their kinetics; enzyme induction, repression and modification – regulation of enzyme activity; functional and non-functional plasma enzymes and their diagnostic significance.

   Bioenergetics and metabolism; concept of free energy; thermodynamic principles in biology; electron transport chain of mitochondria-redox potentials; coupled reactions and oxidative phosphorylation and its mechanism – role of ATP synthase; coenzymes, group transfers and biological energy transducers; citric acid cycle and ATP production.

2. **Metabolism**:

   Carbohydrate metabolism: Control of glycogen metabolism and molecular mechanism of its inborn errors; mechanism of action of pyruvate dehydrogenase and metabolism of pyruvate; interconversion of hexoses and pentoses – mechanism of action of trans-ketolases and transaldolases; its significance and clinical comment; anaplerotic reactions and CO_2 fixation in animal tissues – importance of gluconeogenesis; asymmetric behaviour of citrate in metabolism; biosynthesis of biopolymers.

   Lipid metabolism: Fatty acid synthase and de novo biosynthesis of fatty acid; regulation and mechanism of chain elongation; biosynthesis of eicosanoids – prostaglandins, thromboxanes. Leucotrienes and lipoxins and their physiological importance; metabolism of lipoproteins and their biomedical importance; metabolism of cholesterol, its control and pathophysiological importance; relation between lipoproteins and cholesterol metabolism.

   Protein metabolism: Biological importance of amino acids; biosynthesis of physiologically important substances from amino acids; cyanocobalamin, folic acid, methionine and one-carbon metabolism; molecular basis of inborn errors of metabolism of phenylalanine and tyrosine; biosynthesis of protein-initiation, elongation and termination; antibiotics and protein synthesis; genetic code, operon and regulation of gene expression in prokaryotes and eukaryotes – lac operon, tryptophan operon and

arabinose operon; regulation of operon by motifs. Biosynthesis and catabolism of purines and pyrimidines; pathophysiology of gout.

Integration and hormonal regulation of metabolism of carbohydrate, lipid and protein. Metabolism of free radicals and the role of vitamin E, vitamin C and selenium.

3. Microbiology

Microbial physiology – structure and function; capsules, slime layer, holdfast, pilli, 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

MSPY 103

(THEORY CORE)

Homeostasis of Internal Environment in Human, Stress Physiology, Alimentation, and Excretion

Full marks: 50 (40+10) **Total Credits: 4**

1. **Homeostasis of Internal Environment in Human (Cardiovascular, respiratory, blood ad 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 ischaemia; 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; haemorrhage 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, behavioural, neural and endocrine mechanisms; responses to hot and cold climates – heat acclimatization.

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

3. **Alimentation:**
   Modern concept of the mechanism of HCl secretion and its regulation – physiological and pharmacological. Modern concept of bile formation and secretion; pathophysiology of jaundice and Gall stone. Nature of exo- and endopeptidases and their mechanism of action in protein digestion; modern concept of the transport of end products of digestion of carbohydrates, lipids, proteins and nucleic acids and also minerals, vitamins and water across enterocytes.
   Control of movements of alimentary canal; constipation and diarrhoea. Role of intestinal microbial flora in health and disease; immunological tolerance of G.I. tract.

4. **Excretion:**
   Concept of development of kidney in the human embryo. E.M. structure of glomerular filtering membrane and the mechanism of the retention of macromolecules by it. Methods of study of renal tubular function. Types of tubular transport mechanisms and the transport of water and solutes, especially glucose, Na^+, K^+, H^+, Phosphate, PAH and urea; transtubular potential. Mechanism of formation of hypertonic urine; diuresis and diuretics. Cystometry, micturition and its higher control. Role of kidney in the maintenance of blood pH. Kidney as an endocrine organ, assessment of functional integrity of kidney.

MSPY 104

(THEORY CORE)
(Biophysics, Nutrition and Histochemistry)

Full marks: 50 (40+10) **Total Credits: 4**

1. **Biophysics and Electrophysiology**
   Fundamental concepts of important mechanical properties of cell materials; Viscosity of protoplasm, Dynamic behavior of materials; Viscoelastic behavior of living materials. Application of G-forces to living materials; Living body as a thermodynamic system; Flow of viscous fluids in biological systems – Newtonian and Non-Newtonian fluid.
   Electrophysiology of excitable tissues: Membrane theory of Bioelectric phenomena, origin of various forms of biopotentials and their measurements, physiological significance of voltage and Patch clamp technique in the study of membrane physiology; transducers and electrodes of different types and uses. Goldman-Hodgekin – Katz equation for propagation of nerve impulse.

2. **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.
   Excitation-contraction coupling in muscles – in Skeletal muscle. Excitation – contraction coupling in smooth muscle. Smooth muscle cell relaxation and activation mechanisms. Uterine, Detrusor Ureter Airway Vascular and Gastrointestinal smooth muscle cell. Muscle mechanics – Mechanical components in different types of muscle. Muscle length, tension and velocity relationships – length-tension curve, force-velocity curve, length-velocity curve, force-length-velocity diagram, mechanical transients.
   In vitro cell management techniques.
   Special cells – Astrocytes, oligodendrocytes, microglia ependymal cells in brain ventricles and Schwann Cells,

3. **Nutrition and Dietetics**
   Calorimetry – direct and indirect, energy cost of different types of activities. Importance of carbohydrates, lipids and proteins in nutrition. Evaluation of the quality of protein in food. Amino acids imbalance. Improvement of the nutritive value of a dietary plant protein. Biochemical and nutritional role and interrelationship of vitamins and minerals. Toxicity of microminerals. Protein calorie malnutrition – its prevention. Undernutrition and obesity. Nutrition during infancy, childhood, pregnancy, lactation and for older people.
   Principles of diet survey – special nutrition during pregnancy, lactation, infancy and early childhood.

4. **Histochemistry**
   Chemistry of fixation of tissue and chemistry of dyes, Chemistry of dye-tissue interaction and chemistry of staining, Histochemistry of macromolecules, Histochemistry of enzymes. Immunohistochemistry

MSPY 105

(PRACTICAL CORE)

Clinical Enzymology and Cytogenetics

Full marks: 50 (40+10) **Total Credits: 4**

l Biochemistry Practical

1. Estimation of protein, carbohydrate and lipid:
 (a) Serum protein by the Biuret method (colorimetric).
 (b) Blood glucose by
 Nelson-Somogyi method (colorimetric)
(c) Blood cholesterol by Liebermann – Burchard method (colorimetric).

(d) Estimation of NPN
 Blood urea, uric acid, creatine and creatinine.
(e) Estimation of Vitamins
 Ascorbic acid content of plasma by 2,6-dichlorophenol indophenol method.

Estimation of Minerals, Enzymes

2. Determination of Enzyme Activity
 (a) Serum amylase activity.
 (b) Alkaline phosphatase activity in plasma in Bodansky units.
 (c) Serum lipase activity.
 (d) SGOT and SGPT values as liver function tests.
 (e) Serum calcium by the method of Kramer and Tisdall (titrimetric)
 (f) Serum/ blood inorganic phosphate by the method of Fiske and Subbarow (colorimetric)

3. Cytogenetics:
 (a) Isolation of cellular organelles (nuclei, mitochondria, lysosomes) from rat liver by differential centrifugation.
 (b) Estimation of total protein from different subcellular fractions of liver.
 (c) Estimation of DNA and RNA from rat liver by means of diphenylamine and orcinol reaction, respectively.
 (d) Separation of proteins by electrophoresis on S.D.S. – polyacrylamide gel.
 (e) Histochemical technique for identification of nucleic acid.
 (f) Karyotyping in blood cells, bone-marrow and other cells

MSPY 106

(PRACTICAL CORE)

Histology, Histochemistry, Microbiology and Immunology

Full marks: 50 (40+10) **Total Credits: 4**

1. Histology:

(a) Histological techniques for the preparation of a paraffin section –fixation of tissue by different fixatives, dehydration, clearing, paraffin embedding, preparation of paraffin blocks and cutting of sections with rocking and rotary microtomes.
(b) Preparation of freezing sections with rocking and rotary microtomes.
(c) Staining of sections with haematoxylin – progressive and regressive methods, and counter-staining with eosin; staining with iron-haematoxylin and Azan's stain; special staining of nervous tissue; bulk staining; staining of elastic fibres by orcein; silver impregnation technique.
(d) Identification of stained sections of different tissues and organs and measurement of average diameter of tissue cells with micrometer.
(e) Supravital staining of reticulocytes and intravital staining of R.E. cells.
(f) Use of metachromatic stain (Toludene blue, methylene blue, Azure A) to demonstrate proteoglycans in mast cells.

2. Histochemistry:

(a) Histochemical methods for staining of lipid, iron (Prussian blue reaction),
(b) Lead, glycogen (Best's Cermine / PAS Stain),
(c) Alkaline phosphatase, DNA (Feulgeon reaction)
(d) Ascorbic acid, acid phosphatase (Gomori's technique) and
(e) Peroxidase (DAB technique).

3. 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.

M.Sc. Semester II Syllabus

MSPY 201

(THEORY CORE)

Cell Membrane Dynamics

Full marks: 50 (40+10) **Total Credits: 4**

Cell Membrane Dynamics

1. The plasma membrane – molecular structure – membrane lipids and proteins; principles of membrane organization – lateral mobility in membrane protein and lipid; cytoskeletal interaction. The erythrocyte membrane, Cell junction – tight junction, desmosome, adhesion plaque, gap junction – general concept of cellular signal mechanism, neuronal plasma membrane – structure and functional significance.

2. Transport across cell membranes – Passive and active transport across the cell membrane. Co-transport – symport and antiport. Active transport of Na^+ and K^+ ions – physiological and chemical properties of sodium pump, electrogenic pump, Ca^{2+} pump, proton pump, Na^+ complex exchange devices, Na^+ - Ca^{2+} exchange, Na^+ - H^+ exchange, Cl^- HCO_3^- exchange. The internalisation of macromolecules and particles.

3. 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.

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.

5. Electrical activities in post synaptic membrane – End plate potential – properties, channel activity, gating kinetics. MEPP – quantal transmitter release, botulism and tetanus. EPSP and IPSP – ionic basis, general properties. IS spike and SD spike. Electrical activities in smooth muscle and cardiac muscle.

6. 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, $Ca2^+$ 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.

MSPY 202

(THEORY CORE)

Central Nervous System and Sensory Physiology

Full marks: 50 (40+10) **Total Credits: 4**

Central Nervous System:

1. Evolutionary development of central nervous system, with special reference to cerebrum and cerebellum; Experimental methods in the study of CNS function; basic components of neural control system – input, integration and output.

2. Motor control system – sensory engram – role of cerebrum, basal ganglia , reticular formation and cerebellum; principal types of neurones, the basic neuronal circuits of cerebellum and their significance; Parkinson's disease. Primary language areas of human cerebral cortex; speech and its disorders. Concept of motor cortical columns and internal feedback system in their spinal cord – role of segmental and intersegmental sensory input in motor control.

3. Posture and equilibrium control system – role of vestibular apparatus, cerebellum and R.F.; muscle tone and decerebrate rigidity. The Spinal Cord Circuitry and Muscle Stretch Reflexes.

4. Behaviour control system – physiological basis of conditioning and learning, intelligence, memory, emotion, feeding and -role of hypothalamus and limbic system, Learning, molecular basis of memory; long term potentiation of memory; memory and neuropeptides – dementia and neurotransmitter system. Laterialization of function in human cerebral hemisphere. Interpretative and higher intellectual function of cerebral cortex – the thinking brain. Sleep, wakefulness; Temporal aspects of signaling and Brain rhythm. Modulation of neuronal activity.

5. Central control of autonomic nervous system – autonomic transmitters; receptors and pharmacology.

Sensory Physiology:

1. Sensory receptors – thermo-, mechano-, photo- and chemo-(including gustatory and olfactory) receptors – their E.M. structure; modern concept of sensory transduction and receptor potential; role of G-proteins and other proteins. Mechanism of perception of somesthetic sensations and their discrimination in the CNS; control system of pain sensation; opioid peptides; acupuncture, referred pain.
2. Mechanism of perception of olfaction and taste – their electrophysiology; sensory processing in the olfactory bulb and the brain. After taste.
3. Theories and mechanism of pitch perception; perception of loudness and localization of sound. Role of various cochlear potentials in the genesis of auditory action potentials. Central auditory cascade in the control of sensory input, clinical audiometry for assessment of hearing loss.
4. E.M. structure of the organisation of retina. Photoreception, Differential electrical responses of on-centre and off-centre of retinal, LGB and visual cortical neurone cells; modern concept of colour vision – colour coding and colour blobs. Photochemical basis of vision; visual acuity, critical fusion frequency. Binocular vision and its significance. Positive and negative after images, light and dark adaptation.

MSPY 203

(THEORY CORE)

Sports and Exercise Physiology

Full marks: 50 (40+10) **Total Credits: 4**

1. Introduction to Exercise Physiology, kinesiology, sports medicine.

2. Nutrition and human performance, optional nutrition for exercise and sports; importance of carbohydrate feeding before, during and in recovery from exercise; glycemic index, electrolyte and water intake; ORS.

3. Fuels for exercise, metabolism and bioenergetics during aerobic and anaerobic type of exercise, rest and recovery; blood lactate levels – O_2 debt, its concept, capacity, measurement and significance; metabolic aspect of steady state; steady rate and non-steady rate exercise; anaerobic threshold, aerobic capacity and VO_{2max} – factors influencing; methods of measurement and significance.

4. Energy, work, power and ergometry; measurements of the gross and net energy cost of different types of exercise and sports; computation of efficiency and concept of MET and its significance; body size and other factors and energy cost. Selection of fuel for exercise and sports and estimation of fuel utilization during exercise.

5. Cardio-respiratory changes and regulation in exercise; cardiac metabolism and efficiency; pulmonary and alveolar ventilation, concept of OBLA.

6. Physical training methods; principles and adaptation and physiology of training; application of training methods to various sports; exercise and training for health and fitness for general population and special population, e.g., hypertensives, asthmatics, diabetics, obese and elderly and for athletes.

7. Exercise and sports events at altitude, humid and hot environment and cold environment.

8. Skeletal muscle fibre types and exercise, training effects and modern concept of neuromuscular fatigue in exercise.

9. Ergogenic aids and sports – merits and demerits.

MSPY 204

(THEORY CORE)

Ergonomics and Chronobiology

Full marks: 50 (40+10) **Total Credits: 4**

Ergonomics:

1. A brief history of ergonomics; basic ergonomic methods and techniques; modern ergonomics – human-machine system; task and human-machine interaction; anthropometric principles in work space and equipment design; work space design for standing and seated workers; assessment and design of the physical work place-visual environment, thermal environment, auditory environment and noise assessment, human responses to vibration, computer aided ergonomic and work space design.

2. Physiology, work load and work capacity; ergonomical analysis of work activities and evaluation of work system. Industrial applications of physiology – physiological cost of work; applied physiology in the work place – night work and shift work, working hours and eating habits, daily and weekly working time, rest pauses in manual and industrial work, nutrition of work, fitness for work.

3. Heat, cold and the design of the physical environment thermoregulatory mechanisms, work in hot and cold climates, protection against climatic extremes, effects of climate on performance; effects of heat stress on performance in hot and cold industries; physiological limitations of human performance in hypo- and hyper-baric environments. Ergonomic principles of illumination, day light, colours and music for a pleasant work environment.
4. Basic methods for analysis of different components of system work study, time and motion study etc. Elements of Biomechanics and Motor Control, human performance. Human information processing, skill and performance. Basic elements of human behavior analysis. Accident & Safety, protection device etc. Concept of occupational health & disease.
5. Application of Ergonomics in Agriculture and Industry – one or two examples with case studies.

Chronobiology

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1. 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-I functions 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.

2. 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.

MSPY 205

(PRACTICAL CORE)

Amphibian Experimental Physiology and Educational field tour report

Full marks: 50 (40+10) **Total Credits: 4**

1. Amphibian Physiology Experiments

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

(b) Effect of K^+ free and Ca^{++} 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.

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

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

2. Educational Field Tour Report:

Consult standard Guideline.

Students are to attend COMPULSORY EDUCATIONAL FIELD TOUR 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.

MSPY 206

(PRACTICAL CORE)

Mammalian Physiology Experiments and Human Physiology Experiments

Full marks: 50 (40+10) **Total Credits: 4**

1. Mammalian Physiology Experiments:

(a) Action of adrenaline and acetylcholine on the smooth muscles of small intestine of rat or guineapig in a Dale's bath.
(b) Action of oxytocin on the contraction of smooth muscle of uterus of rat or guineapig.
(c) Demonstration of (i) effect of drug on the perfused mammalian heart, (ii) effect of drug on the contraction of rat diaphragm, (iii) studies of reflexes in spinal and decerebrate preparations.

2. Human Physiology Experiments

(a) Experiments on pulse rate:-
(b) Diurnal variations, In different postures at rest, On breath holding, With variation of static workload, Maximum rate with variation of dynamic exercise
(c) Experiments on blood pressure:
(d) In different postures at rest, with variation of static workload, Following dynamic exercise
(e) Experiments on respiration: Effect of breath holding and hyperventilation-pneumographic record
(f) Determination of respiration rate (i) diurnal variations, (ii) in different postures at rest.
(g) Effect of a standard exercise on the vital capacity.
(h) 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
(i) Anthropometric and other experiments: Anthropometric measurements of the body dimensions. Determination of body fat and lean body mass. Determination of muscle power with dynamometer.
(j) Audiometry

M.Sc. Semester III Syllabus

MSPY 301

(THEORY CORE)

Endocrinology and Bioinstrumentation

Full marks: 50 (40+10) **Total Credits: 4**

Endocrinology

1. Pituitary and Hypothalamic Hormones:

2. Biosynthesis and secretion; control of secretion; Receptors and binding proteins, physiological pharmacological functions and disorders of anterior, posterior and hypothalamic hormones

3. Thyroid Hormones:

   Biosynthesis and secretion; control of secretion; Receptors and binding proteins, physiological pharmacological functions and disorders of thyroid hormones, Iodine metabolism, anti-thyroid agents and Goitrogens

4. Adrenal Gland
   Biosynthesis and secretion; control of secretion; Receptors and binding proteins, physiological pharmacological functions and disorders of Adrenal cortical and medullary hormones

5. Endocrine Pancreas
   Biosynthesis and secretion; control of secretion; Receptors and binding proteins, physiological pharmacological functions and disorders of pancreatic hormones

Bioinstrumentation

1) Principle of instrumentation and use of: Phase contrast, ultra-, polarising – and electron microscope. Different types of electrophoresis apparatus. Assembly for gas and gel chromatography, high pressure liquid chromatography (HPLC) and thin layer chromatography (TLC). Echocardiograph, and cathode ray oscilloscope (CRO). Scintillation counter and principles of imaging technique magnetic resonance imaging (MRI).

2) DNA and protein Sequencer. Spectroscopy: Atomic absorption spectroscopy, Infrared spectroscopy, X-ray diffraction.

3) Spirometry and lung function tests. Work of heart, Pressure volume relations of heart; significance of echocardiography and ECG in the assessment of cardiac function,

4) Hemodynamics Principles including Blood Pressure. Study of Polygraph for measuring biopotentials, different type of transducers, EEG, EMG.

MSPY 302

(THEORY CORE)

Biostatistics and Computer Application

Full marks: 50 (40+10) **Total Credits: 4**

Application of Computer: in Physiology

Classification of computer: Importance of computer application in Physiology and bio-medical sciences, brief history of development of computer, computer generations, classification of computer – analogue, digital, hybrid, micro, mini, mainframe and super computers. Computer hardware: basic components of computer – CPU, peripheral devices, computer memory, and computer buses. Software – Types of software- monitor program and operating system, utility program, application program, language processor, computer languages- machine language, assembly language, high-level languages. File management – usage of peripheral data storage devices such as tapes, discs and floppies, methodology of programming using flow charts; sample programmes for statistical methods, email, internet. Basic concept of email, Internet-components of Internet, www, searching biological information from Internet, library-searching technique, LAN. Word processor- basic operation and its application in biological sciences; Ms excel – basic operation and it application in biological sciences; Ms. PowerPoint – steps of PowerPoint presentation, slide preparation for biological items.

Biostatistics in Physiology

Concept of bioinformatics- field of application, common biological databases

Null hypothesis for testing, levels of significance, errors of inference, student's t-test for significance of difference between sample means; other tests of significance. Correlation, correlation coefficient, regression, method of least square; correlation involving qualitative variables; Chi-square test. Principles of design of an experiment; analysis of variance – models and assumptions; computation of one-way ANOVA.

MSPY 303

(PRACTICAL CORE)

Biostatistics and Computer application

Full marks: 50 (40+10) **Total Credits: 4**

A. Biostatistics

1) Computation of Frequency distribution of continuous measurement variable, Mean, median, mode, S.D. and S.E. for grouped data of a sample,

2) 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,

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

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

B. Computer application in Physiology

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

MSPY 304

GE (GENERIC ELECTIVE)

(THEORY)

Environmental Physiology and Occupational Health

Full marks: 25 (20+5) **Total Credits: 2**

1. Environment-Biology correlation with special reference to performance, productivity and its relevance.
2. Role of Ergonomics in ensuring occupational health and productivity.
3. Role of NIOSH, OSHA and other relevant agencies in protecting Human Resources.
4. Environmental and occupational diseases: Air, water and soil borne diseases. Vector borne diseases, disease induced by human. Nicotin-induced disease. Health consequences of industrial and agricultural occupation –pneumoconiosis, occupational cancer. Accident in industry. Occupational health in India.
5. Ergonomics and environment : Relation between human environment and ergonomics ; Man- machine and environment interactions; Occupational health and hygiene; Occupational diseases.
6. Environmental toxicology: Toxic chemical in the environment and definition of toxicology; Molecular mechanism of toxicants action; Xenobiotic induced oxidative stress, cell injury, signaling and gene regulation, cytotoxicity. Genetic toxicity—chromosomal aberration, sister chromosomal exchanges, DNA damage and repair. Factors affecting toxicity, dose and duration, biological activity, health status, effects and response, synergism and antagonism, acute and chronic effects. Carcinogens, mutagens, teratogens and reproductive toxicity, impacts of toxic chemicals on enzymes. Toxic effects of Cd, Pb, Hg, cyanide and carbon monoxide. Food additives, pesticides, --insecticides, herbicides, fungicides, dioxine, PCB, furan and PAH.
7. Principles and concepts of Ergonomics; Ergonomics in Indian scenario: simple case studies; Man- Machine Environment System interface-study and analysis; Concept of optimal zone, comfort and health; Psychophysiology of work: performance in different environment; Occupational health hazards; Exercise, health and disease. Home & work place Ergonomics. Musculoskeletal disorder – types, cause, preventing measures

MSPY 305

(DISCIPLINE-CENTRIC ELECTIVE- THEORY)

(DE 1/2/3/4/5)

Full marks: 50 (40+10) **Total Credits: 4**

MSPY 305 –DE 1 NUTRITION AND DIETETICS

1. Food Science & food technology: Food guide pyramid, food group, food faddism, Adulteration of food and food contaminants, infective agents in food; natural good toxins. Food poisoning – chemical and microbial. Food allergy and hypersensitivity.

2. Food processing, factors effecting nutritive value in processed food; enrichment of foods; major chemical reactions in the food components. Effect of processing on nutrients – chemical and radiation hazards. Food additives, food colour and preservatives.

3. Energy needs and energy balance: Components of energy expenditure – BMR, physical activity, SDA of food etc. daily energy need. Regulation of energy intake – hunger and satiety – role of hypothalamus and limbic system. Positive and negative energy balance. Laws of thermodynamics and their application to nutrition. Weight control programmes – dietary management, modification of physical activity and behaviour.
4. Nutrition through Different Stages of Life:
   Nutritional needs in infancy, childhood, adolescence and adulthood
   Nutrition during pregnancy and lactation
   Geriatric Nutrition. Aging and senescence.

5. Clinical Nutrition: Nutrition and diet in the management of metabolic diseases (diabetes mellitus, gout), systemic diseases (hypertension, coronary heart disease, gastrointestinal diseases, renal disease), iodine deficiency disorder, dental diseases, disorders of pancreas, liver and biliary tract, diseases of the blood, inherited metabolic diseases (phenyl ketonuria, homocystinuria, glycogen, storage disease, galactosaemia, etc.) and post-operative patients.
6. Advanced Therapeutic nutrition: Nutrition in Stress (fever burn survey), Cancer, HIV, Osteoporosis and neurodegenerative diseases

MSPY 305 –DE 2 ENDOCRINOLOGY AND REPRODUCTION

1. Gonadal steroid genesis: Autocrine, paracrine and endocrine regulation of gonadal steroid genesis; Regulation of expression of gene encoding steroidgenic enzymes.
   Infertility in males and females:
2. Immunological, structural, functional and hormonal aspect; Artificial insemination, sexually transmitted diseases and their impact on fertility; Sperm maturation, motility and capacitation; Hypogonadism and hypergonadism in male.

3. Hormonal basis of hypertension :
   Hypertension and its classification. Hormones involved in hypertension. Hypertension in relation with endocrine disorder.
4. Hormones in stress:
   Sympathoadrenal system and stress condition
5. Hormone receptor :

Models of hormone receptor- fixed and mobile model and their location. Molecular structure of receptor; signal transduction mechanism. Hormone signalling: cell surface hormone receptors, binding properties of cell surface receptors, coupling of cell surface receptors to intracellular signalling, ligands that act through nuclear receptors ,nuclear receptor signalling mechanisms. Regulation of gene expression by different pathways. Second messenger (cAMP, cGMP, Calcium and IP 3) and their mechanism.

6. Genetic regulation of steroid hormone action. Growth factors and its receptors in relation to hormone action.
7. Measurement of hormones: Biossay, RIA, hormone assay protocol; ELISA- different type, basic steps, assay protocol, advantages.

Neuroendocrinology: Hypothalamus as neuroendocrine organ. Releasing hormones – chemistry, synthesis, physiological roles and control. Hypothalamo – hypophyseal axis -- its functional significance and role in homeostasis. Pineal gland and endocrine rhythms. Circumventricular organs The Hypothalamic melanocortin system.

MSPY 305-DE 3 ERGONOMICS AND OCCUPATIONAL HEALTH

1. Principles and concepts of Ergonomics; Ergonomics in Indian scenario: simple case studies; Man- Machine Environment System interface-study and analysis; Concept of optimal zone, comfort and health; Psychophysiology of work: performance in different environment; Occupational health hazards; Exercise, health and disease. Home & work place Ergonomics. Musculoskeletal disorder – types, cause, preventing measures
2. **Bioengineering**: Biophysical and biomechanical aspects of movements – angular movements – goniometry, power movements of the hands and feet and control. Precision grips and control. Precision, accuracy and speed of motor-sensory coordination. Motion stereotypes. The mechanics of different postures – lying, sitting, standing, walking, running, jumping, swimming, etc; analysis of posture and movements – postural sway, angular velocity and acceleration; maintenance of postural equilibrium. Kinesiological analysis of force and equilibrium; centre of gravity stability of the human body; equilibrium in water. Leverage – anatomical examples of different types of levers. Biomechanical aspects of exercise – cartilage and joint limitations on exercise.
3. **Nutrition and Exercise**: Nutritional requirements of sports of different types – Diet for an athlete. Pre-game meal, post-game meal and spacing of meals. Utility of fluid and electrolyte replacement in maintaining exercise performance; glycogen loading for trained endurance athletes.
4. **Exercise and Metabolism**: Physical exercise, glucose transporter and glucose transport. Glucose–fatty acid cycle in muscle at rest and exercise; pyruvate dehydrogenase activity during various types of exercise. Effects of endurance training and relation of glucose–fatty acid cycle

in fatigue, involving 5 HT in brain. Muscle metabolism and performance during sprinting and repeated intense exercise. AMP deaminase, ammonia metabolism; branched chain amino acid metabolism and exercise. Free radicals, antioxidants and exercise.

5. **Psychophysiology of Exercise**: Mental load and its measurement; motivation and attitudes – factors governing these. Aptitude development. Role of special senses, especially vision and hearing in performance. Human sensitivity to heat, light and sound. Perceptual leads; role of colors, glare and discomfort, flicker phenomenon, spontaneous blinking, oculography. Signal detection and target recognition – factors affecting attention. Noise and music. Fatigue – types, symptoms, causes, probable seat of fatigue, factors contributing to inefficiency and fatigue in industry; monotony and boredom, prevention of nervous breakdown. Elementary idea of psychotherapy for goal directed behavior.
6. **Women and Exercise:** Exercise related physiological profiles of the males and females. Biomechanical adaptations and limitations of the females. Exercise related adaptive changes of the menstrual cycle. Skeletal demineralization in the amenorrheic athletes. The psychological effects of exercise in women. Exercise and menstruation. Contraception and pregnancy.

MSPY 305-DE 4 ENVIRONMENTAL PHYSIOLOGY

1. Biogeochemical cycles: Natural cycles of the environment, utility of recycling of matter – Hydrological cycle, Carbon cycle, Oxygen cycle, Nitrogen cycle, Phosphorus cycle and Sulphur cycle.
2. Ergonomics and environment: Relation between human environment and ergonomics; Man-machine and environment interactions; Occupational health and hygiene; Occupational diseases.
3. Natural processes: Evolution and extinction; Weather and climate change; Cyclone; Monsoon; Floods and Droughts—their impact on environment. Principle of biomagnification, bioaccumulation and biodegradation; Earth quake and volcanic action.
4. Concept of pollution; Exploitation of natural resources; Ecological crisis; Concept of natural threshold.
5. Atmospheric pollution: Introduction; Categories (carbon monoxide, hydrocarbons, ozone, particularities, sulpher dioxide, nitrous oxides) and their interaction. Air pollution – point and nonpoint sources; Primary and secondary pollution—Phenomena of photochemical smog, inversion, heat- island formation, acid rain, ozone depletion greenhouse effect and El Nino; Standards/ units; Indoor pollution; Control of air pollution – anthropogenic and legal.
   Soil pollution: Classification; Sources: hazardous waste dumping. Interaction of toxic chemicals with physical, chemical and biological systems of soil. Effects of soil pollution on human health. Biodegradability of waste products. Control of soil pollution.
   Water pollution: Introduction; Surface and ground water pollution; Oceanic pollution; Eutrophication; Concept of safe drinking water; Types of water pollution –biological, chemical (Hg, Pb, As, Mo), nuclear, thermal and pesticides; Industrial waste and sewage pollution; Concept of DO, BOD, COD; Impact of water pollution – its control and management.
   Sound pollution: Concept of acoustic noise, Sources of noise pollution; Effects of noise pollution on human health; Measurement of noise and noise indices; Noise control –general and personal; Ultra sound and infra sound.
   Radioactive pollution: Radioactive pollution from natural and man –made sources; Negative side of nuclear energy; Dumping; Nuclear test; Medical use of X-ray; Impact of radiation on human health ; Control and measurement.

Marine pollution: Natural and anthropogenic sources; Effect on marine biota; Control and management.
Arsenic pollution: Introduction, discovery, production; Sources of arsenic in soil –form of arsenic in soil, arsenic-soil –plant relationship, critical concentration of arsenic in soil; Sources of arsenic in the environment-natural and anthropogenic; Use of arsenic-historical and modern; Arsenic concentration in ground water drinking water standard; Arsenic cycle; Effect of arsenic on human health – target organ, mode of action, diagnosis and treatment.

MSPY 305-DE 5 SPORTS AND EXERCISE PHYSIOLOGY

1. **Sports and exercise physiology:** Historical development of sports sciences

2. **Muscular systems in sports and exercise Physiology**

   The Neuromuscular system and exercise: Striated muscle, Contraction mechanics, Muscular strength, Muscular fatigue, Neuromuscular Integration, motor unit, motor unit recruitment, motor learning, skill learning, and muscle involvement in different actions

3. **Sports and exercise in different**

   a. **Physiological aspects**

      Applied physiological aspects of some specific sports. Physiological demand of sprints, middle and long distance running, amateur boxing, Rowing, cycling, badminton, field hockey, football (soccer)

   b. **Environmental condition**

      Effect of biological rhythm, Jet lag on sports performance. Sports and Exercise at Altitude, thermal extremes-Hot and Cold environment and sports performance, Factors influencing physical activity: Season, Altitude, Temperature, Humidity, Food habits, Drugs.
      Altitude training and sports performance, diving physiology.

   c. **In children, women, otherwise-abled people**

      Children- Pediatric exercise physiology.-Function vs. body size during growth, anaerobic performance, Aerobic performance
      Women –exercise in different phases of menstrual cycle, pregnancy adapted physical activity- Sports and Exercise for otherwise-abled people,

4. **Principles of training with modern techniques in sports and exercise physiology**

   Assessment of Body profiles .The Physiological principles of training, training methods, training cycles – effect of training on body systems, Training equipment. Warm up, cooling down, stretching exercise. Methods in sports training and assessment of sports performance Physiology of training: effect on VO2 max, aerobic and anaerobic threshold level and performance

5. **Sports and Exercise at the molecular level**

   a) Endocrinology in Sports and Exercise
   b) Immune function in Sports and Exercise

6. **Sports and exercise psychology**

   a) Psychology of expert performance - Optimal performance states, visual cues, decision making and situation awareness anxiety, arousal and performance - Conceptual, models, new dimensions to the anxiety response, measurement issues and practical implications. Sequential and deterministic approaches to establishing a performance model; Motivation
   b) Applied Sport Psychology - Ethical issues and professional training, models of assessment and professional practice, specific interventions (goal setting, imagery, and relaxation, self-talk)

MSPY 306

(DISCIPLINE-CENTRIC ELECTIVE- PRACTICAL)

(DE 1/2/3/4/5)

Full marks: 50 (40+10) **Total Credits: 4**

MSPY 306- DE 1 NUTRITION AND DIETETICS

1. Nutrition and molecular biology: Chromatography – a. Paper, b. thin layer, c. gas liquid chromatography (demonstration) d. High performance liquid chromatography (demonstration). Genomic DNA isolation from blood and tissue
2. Adulteration of food:
   (i) Metanil yellow in sweets, ice-cream and beverages. (ii) Aluminium foil in sweet. (iii) Margarin in Ghee. (iv)Water in milk. (v) Chalk Powder in sugar. (vi) Khesari flower in Besan
3. Blood Constituents:

Serum constituents: a. protein (Folin Ciacalteau method/ Biuret method), b. glucose, c. cholesterol, d. A/G ratio, e. total lipid (gravimetric method)

1. Nutritional assessment and Diet survey

MSPY 306 –DE 2 ENDOCRINOLOGY AND REPRODUCTION

1. Bioassay:
   i. Oxytocin on rat's uterine contraction
   ii. Acetylcholine on intestinal motility
   iii. Adrenalin on intestinal motility / blood pressure

2. Experimental surgery on the following and histological studies:
   i. Gonadectomy
   ii Adrenalectomy
   iii Thyroidectomy
   iv. Vasectomy
3. Study of estrous cycle in female rats under normal and experimental conditions.
4. Study of immunological methods for pregnancy detection.

MSPY 306- DE- 3 ERGONOMICS AND OCCUPATIONAL HEALTH

1. Introduction to practical experiments on human subjects.
2. Study of cardio-respiratory systems following exposure to different workload by ergometers (bicycle, tread mill, step test, etc.).
3. Study of recovery cardiac cost following exposure to tread mill running at different speeds and inclinations.
4. Determination of V_{O2max} with Queen's College Step Test.
5. Determination of V_{O2max} with Astrand Nomogram by bicycle ergometry.
6. Determination of V_{O2max} with Margaria Nomogram by Step Test.
7. Determination of distance of 12 minute run (Cooper's test).
8. Determination of distance of 6 minute runs with maximum speed.
9. Determination of lung volumes by spirometry.
10. Determination of static and dynamic lung function.
11. Determination of oral temperature, heart rate and blood pressure in different conditions
12. Determination of circadian rhythm of different physiological parameters
13. Determination of physical fitness index by Astride Jump Test (AJT) and Treadmill test
14. Determination of hot and cold spots in human subjects
15. Effects of exposure to hot and cold environment in human subjects
16. Determination of thermal stress of the environment: WBGT & Oxford index
17. Anthropometry: determination of body composition and somatotyping
18. Mapping of visual field, clinical assessment of color vision and blind spot in the field of vision
19. Determination of electrical axis of heart
20. Determination of choice of reaction time in human subjects

MSPY 306 –DE -4. ENVIRONMENTAL PHYSIOLOGY

1. Water quality measurement:

Physical parameters: movement, color, temperature and transparency, Chemical parameters: pH, BOD, COD, DO, oil, grease and other pollutants (chloride, fluoride, calcium and potassium). Microorganism.

2. Sound quality measurement: Sound intensity, pitch, hearing loss.

3. Measurement of body temperature (oral and skin), blood pressure, heart rate, lung functions in test conditions—during exercise, hot and cold environment, noisy environment, high altitude.

4. Biochemical identification of food additives (water in milk, water in honey, additives in tea, margarine & vanaspati in ghee & butter, metanil yellow, rhodamine-B & chalk powder in sweet sugar, turmeric powder & chili powder).

MSPY 306 –DE -5 SPORTS AND EXERCISE PHYSIOLOGY

1. Introduction to practical experiments on human subjects and Standardization of different techniques for recording different parameters on human subjects
2. Study of structural anthropometry on human subjects.
3. Study of body composition, i.e. Lean Body Mass (LBM), FM, target weight, somatotype etc.
4. Study of cardiorespiratory systems following exposure to different work load by ergometers (bicycle, treadmill, step test, etc.).
5. Study of recovery cardiac cost following exposure to treadmill running at different speed and inclination.
6. Determination of Physical Fitness Index with step test.
7. Determination of Physical Fitness Index with Astride Jump Test.
8. Determinations of VO2 max with Queen College Step Test.
9. Determination of VO_2 max with Astrand Nomogram by Bicycle ergometer
10. Determinations of VO_2 max with Margaria Nomogram by Step Test.
11. Determination of Cardio-respiratory fitness with Point slope Method by Step Test.
12. Determination of distance of 12 min run (Cooper test).

MSPY 307

CE (Community Health Assessment)

Full marks: 25 (20+5) **Total Credits: 2**

Broad Community Engagement Programmes/ activities (UGC Prescribed)

1. Appreciation of Rural Society
2. Understanding Rural Society
3. Rural Institutions
4. Rural Development Programmes, etc.

(For details see National Curriculum Framework and Guidelines, UGC, January 2020, page 11) **

M.Sc. Semester IV Syllabus

MSPY 401

(THEORY CORE)

Developmental Biology and Population Science

Full marks: 50 (40+10) **Total Credits: 4**

1) Developmental Biology

i) Developmental Biology Basic concept of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages, stem cell-types, genesis and differentiation, Planar cell polarity (PCP), molecular biology of stem cell and its regulatory molecules, emerging trend and clinical applications; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. Gametogenesis, fertilization and early development

ii) Morphogenesis and organogenesis in animals – cell aggregation and differentiation, limb development and regeneration, differentiation of neurons, environmental regulation of normal development, sex determination.

1. Population Science

i) Concept of population. Population situation – international, national, state and regional level; birth-rate, death-rate, infant mortality rate, fertility rate. Reasons for rapid population growth in the country and its impact on the society. Population growth and problem in family life situation – stress and strain in family, social group and country situation, physiological, chemical, mechanical and immunological method of controlling fertility; family planning and population growth.

ii) Sex education – Fertility, behaviour, sexually transmitted diseases, effects of early marriage, family life education – types of family, age at marriage, concept of happy family, spacing of child and survival measures.

iii) National population policy / programme – education, women, children, youth, environment, housing, food, drinking water policy.

iv) Major child killer diseases immunisation and preventive measures, immunisation schedule and when to immunise.

v) Prevention of communicable diseases and drug abuse and addiction, drug metabolism and detoxification.

MSPY 402

(THEORY CORE)

Reproductive biology, Environmental Physiology and Ecology

Full marks: 50 (40+10) **Total Credits: 4**

Reproductive Physiology

1. Physiological role of male and female gonads and reproductive organs; gametogenesis and evaluation – its control system. Endocrine function of gonads and its control system.

2. Sperm and Oocyte maturation. mechanism and control of fertilisation. Acrosome reaction, Sperm-induced oocyte activation and Completion of meiosis at fertilization. Mechanism and control of fertilisation.

3. Physiology of pregnancy, stress and maternal physiology, formation of placenta – its endocrine and other functions in foetal life; control of pregnancy, mechanism of implantation and parturition.

4. In vitro fertilization, embryo transfer and amniocentesis – its significance and utility. Cardiovascular and respiratory physiology of foetus, their changes in neonate.

5. Hormonal control of mammary glands during pregnancy and after parturition; significance of breast feeding.

Environmental Physiology and Ecology

1. A brief idea about environment and atmosphere – troposphere, stratosphere, mesosphere, thermosphere, exosphere, standard atmospheres; environmental segments – lithosphere; hydrosphere; biosphere.

2. Man and biosphere; environmental awareness and safety measures; earth as the only suitable habitat for human being; basic concepts on changes in the environment caused by man and his style of living.

3. Man and ecosystem: Concept and dynamics of ecosystem – its components; interactions between environment and biota; concept of habitat and ecological niches; limiting factors; sun as a primary source of energy; energy flow, food chain, food web and trophic levels; ecological pyramids and recycling; biotic community- concept, structure, dominance, fluctuation and succession; biogeo-chemical cycles – N.P.C. and S cycles in nature.

4. Ecosystems and nature's balance – quality of environment and resources management; stability and complexity of eco-systems. Principles of conservation, conversation strategies; sustainable development.

5. Ecology of populations and effects of population growth on the environment – World's and India's population situation and its remedial measures; psycho-social consequences of crowding – its different models and effects.

6. Ecology and the future of men – O_2 supply and air quality, water supplies; space on earth; distributional inequality, violence and war; adaptive capability of man; Greenhouse effect and global temperature; risks to ozone layer; acid rain; loss of tropical forests, photochemical smog; suspended particulate matter; soil erosion; New approaches to environment and development.

MSPY 403

(THEORY CORE)

Toxicology, Xenobiotics and human health; Evolutionary Biology

Full marks: 50 (40+10) **Total Credits: 4**

Toxicology, Xenobiotics and human health

Nature of toxic effects; nature and dose response relation-ship; Conventional Dose-Response Curves, Non monotonic Dose-Response Curves, Pharmacokinetics versus toxicokinetics, Alterations in ADME.,

Types of Therapeutic Drug Toxicity. Acute lethal toxicity; factors influencing toxicity; biochemical basis of toxicity; bio-handling of toxic elements – absorption, bio-distribution, bio-transformation, excretion.

Xenobiotic and endogenous substances – metabolism and toxic – kinetics of xenobiotics; The phases of drug metabolism: Sites of drug metabolism, Phase 1 reactions, CYPs: The Cytochrome P450 Superfamily, Flavin-Containing Monooxygenases, Hydrolytic Enzymes Phase 2 reactions: conjugating enzymes, Glucuronidation, Sulfation Glutathione Conjugation, *N*-Acetylation, Methylation, role of xenobiotic metabolism in safe and effective use of drugs.

Carcinogens, pulmonary and hepato-toxicity; teratogenicity, mutagenicity; carcinogenicity and genotoxic carcinogens. Toxicity of pesticides; food and food additives; radiation; toxic effects

of industrial chemicals, Carcinogens and Heavy Metals Drug Toxicity and Poisoning, membrane toxicity, CO and antifreeze – ethylene glycol.

Evolutionary Biology:

Emergence of evolutionary thoughts Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis.

Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism.

Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence.

Population genetics – Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

MSPY 404

(DISCIPLINE-CENTRIC ELECTIVE- THEORY)

(DE 1/2/3/4/5)

Full marks: 50 (40+10) **Total Credits: 4**

MSPY 404 –DE -1 NUTRITION AND DIETETICS

1. Nutrition, Growth and National Nutrition Policy: Nutritional survey and assessment, Nutritional counselling, epidemiology, National and international bodies of research organization, Community nutrition, midday meal, ICDS, Nutritional policies and laws. Interaction of national and international organisations (FAO, WHO, UNESCO, ICMR, etc.) and their role in determining dietary goals and guidelines.

2. Dietary and Nutritional Imbalances

   (a) Malnutrition: Prenatal, postnatal malnutrition and their impact on the growth and development of the child. Protein-energy malnutrition – Kwashiorkor, Marasmus; classification and management. Anaemia.

   (b) Under nutrition: (i) Starvation as a model of undernutrition; (ii) Behavioural disorders affecting food intake – Anorexia nervosa and Bulimia nervosa.

   (c) Obesity – Definition of Obesity, Physiology of Energy Balance, Energy Expenditure, pathogenesis of obesity: Genes and environment, metabolically normal obesity, adverse consequences of obesity. Obesity management by very low-calorie diet, timing of meals, anorectic drug treatment, exercise, etc.

3. Nutrition & Exercise: Nutrition in relation to work, sports, exercise and other environmental, stresses (e.g., space travel etc.). Adequate fluid and electrolyte replacement in maintaining exercise performance; carbohydrate loading for well-trained endurance athlete. Importance of glycogen loading in the athlete.

4. Interactive Nutrition: Nutrients & nutrients interaction, drug & nutrient interaction, hormone & nutrient interaction, nutrient & genetic problem, nutrition & immunity, nutrition & addiction.

5. Future nutrition: Genetically engineered food, nutraceuticals, preventive nutrition & genetic counselling, nutrition & detoxification, phytochemicals and nutrition, nanotechnology & food.

MSPY 404-DE—2 ENDOCRINOLOGY & REPRODUCTION

1) Endocrinology and Aging:
   The Endocrinology of Aging. General aspect of aging. Different theories of aging. Aging and its effects on endocrine and reproductive system. Endocrinology of Alzheimer's disease and late life depression. Vitamin D and Alzheimer's disease.

2) Hormone and metabolism :

   Hormonal involvement in metabolism of carbohydrate and protein. Hormonal regulation of Ca^{2+} homoeostasis. Vitamin D cell signalling in health and disease.

   Overview of Hyperlipidemia and Dyslipidemia, Cholesterol and lipoprotein synthesis and role of hormones, atherosclerosis.

   Control of food intake and body weight, Ghrelin–Leptin tango in body-weight regulation, major neuropeptides involved in appetite regulation, Insulin Secretion, insulin action and glucose homeostasis, insulin resistance and the risk of type 2 diabetes mellitus, insulin resistance increases fatty acid oxidation causing mitochondrial overproduction of ROS , Physiology of defense against hypoglycemia, Control of glucose homeostasis by the brain,

3) Immune endocrine system: Inter action of immune and endocrine system. Neuroimmuno modulation and hormones. Adipose tissue as an endocrine and immune organ.

4) Gut hormones

5) Prostate as endocrine gland: Location and structure of prostate. Different bioactive molecules of prostate having endocrine function and their physiological role.

6) Thymus as endocrine gland :
7) General history of thymus. Bioactive molecules of thymus and their role

MSPY 404-DE-3 ERGONOMICS & OCCUPATIONAL HEALTH

Introduction – History, development and scope of the subject; Human-machine models, error and reliability, error codes, Information theory.

Human capabilities of Human-Machine interface – Multiple signal detection: hearing, visual olfaction, touch and pressure; motor skills; psychomotor skills; system design and evolution- PERT, MERT etc.

1. Man –machine interaction: Controls – types, principle of design of controls, coding of controls, displays: auditory, visual, olfactory, tactile, etc.; feed-back controls, compatibility, motion stereotype.
2. Work Space design: Engineering anthropometry, work envelop, principle of work station design, layout of equipment, design applications.

   Biomechanics: Kinesiological analysis of body movements, center of gravity – methods and significance, back and shoulder compression.
3. Occupational Health, Management, Safety and Hygiene – Occupational health, safety, safety principles, factories act, occupational hazards, accidents – causes, analysis, preventive measures, ISO certification. Information processing – theories, decision making and analysis, emerging trends in the field of cognitive ergonomics.
4. Work measurement and evaluation – Bioenergetics, manual material handling: efficiency of load carriage, sex difference in performance, motivation, work force evaluation in different conditions and in different occupations, work-rest cycle, exercise (as work) in health and disease.
5. Circadian Rhythms, Shift work, principles of shift work, night shift, attitude; social and personal.

   Current trends in the subject, post globalization scenario, problems of technology transfer etc.
6. Environmental Stress and Performance: Micro and macro environment – their evaluation, climatic factors – heat and cold stress, clothing, noise, vibration, illumination; health hazards and work performance in different environmental conditions, management of environmental stress in work places.

MSPY 404—DE- 4 ENVIRONMENTAL PHYSIOLOGY

1. Energy: Sun as a primary source of energy; Conventional, non-conventional, renewable and non- renewable energy resources. Energy demand.

a) Non-renewable resources: Coal, Oil, Natural fossil fuel, Gas, Uranium—world reserves and conservation. Thermal power generation.

b) Renewable resources- solar energy, solar cooker, smokeless chullah , solar electricity , biomass as fuel-forest and agricultural residues . Limitation of biomass as a renewable resource. Mention of alcohol fuels-methanol, ethanol; Electric power generation: hydal, tidal, wave-power, wind and geo-thermal power generation.

2. Environmental toxicology: Toxic chemical in the environment and definition of toxicology; Molecular mechanism of toxicants action; Xenobiotic induced oxidative stress, cell injury, signaling and gene regulation, cytotoxicity. Genetic toxicity—chromosomal aberration, sister chromosomal exchanges, DNA damage and repair. Factors affecting toxicity, dose and duration, biological activity, health status, effects and response, synergism and antagonism, acute and chronic effects. Carcinogens, mutagens, teratogens and reproductive toxicity, impacts of toxic chemicals on enzymes. Toxic effects of Cd, Pb, Hg, cyanide and carbon monoxide. Food additives, pesticides, -- insecticides, herbicides, fungicides, dioxine, PCB, furan and PAH.
3. Environmental impact assessment (EIA): Nature of environmental impact assessment; EIA system effectiveness and its evaluation.
4. Environmental management : Concept of management ; Environmental management in industries ; Solid and hazardous waste management ; Recycling waste materials , waste minimization , fly ash use and disposal . Resource planning and management; water resource management; Wildlife conservation and biosphere reserves.
5. Disasters management: Definition, nature, types of disaster. Natural disaster –flood, drought, landslides, tsunami, earthquake, volcanism. Man-made disasters – industrial, mine, war and fire . Principle of disaster management. Role of Remote sensing, information system, science and technology in disaster management.
6. Environmental biotechnology:
   Bioremediation: definition, phyto and microbial remediation; Microbial destruction of environmental pollutants –degradation of different pesticides and pollutants.
   Vermiculture technology. Biofertilizer technology.
7. Environmental and occupational diseases :
7. Air, water and soil borne diseases. Vector borne diseases, disease induced by human. Nicotin-induced disease.
8. Health consequences of industrial and agricultural occupation –pneumoconiosis,
9. Occupational cancer. Accident in industry. Occupational health in India.

MSPY 404—DE- 5 BIOMECHANICS, KINESIOLOGY IN SPORTS AND EXERCISE

Concept of Biomechanics and kinesiology

Movements at Specific joints, force. kinematics, kinetics, work, power, energy, motion, Body mechanics and kinesiological problems: Understanding the scientific basis of human movement. Kinematics, Mechanics of human movement, modern techniques of biomechanical analysis, qualitative analysis of human movements and lever system, Stability and Equilibrium, Center of Gravity, Static Balance and Dynamic Equilibrium. Pattern recognition and usage, Skill analysis, skill error analysis and correction.

Ergonomics and injury, etiology and patho-mechanics of injury, equipment design and injury - sports engineering mechanical support to the body - taping, splinting, braces, orthotics. Protective equipment - body padding mouth guards, helmets, headgear. Shoe-surface interaction - footwear design, surface characteristics, traction, Sport-specific problems - skiing, cycling, tennis, mountain sports.

Injuries: causes, prevention, rehabilitation in relation to sports and exercise

Injury rates, Injury types, Practice versus competition injuries, Body parts/regions injured, Injury mechanisms, Age, Gender differences in injuries Injuries in selected sports and physical activities, Diagnosis & Management of Musculoskeletal Injuries

Physiotherapy in injury management Prevention of sports injuries Rehabilitation issues. First Aid Emergency Care

Exercise for health and well being

Exercise Therapeutics: Exercise for special populations-senior citizens, diabetics, COPD patients, people suffering from hypertension and CAD.

Exercise prescription for health and wellbeing- Physiotherapy.

Management of sports and exercise performance

Planning, Organizing, Sports Exercise and Recreational Activities and Facilities. Selection of talented sportspersons, Principles of training for performance improvement, Train the trainer Programme, Management of Sports team, Motivation for performance Management of stress; Risk Management, Legal Issues in Sports National International Standards

Management of Sports Events.

MSPY 405

(DISCIPLINE-CENTRIC ELECTIVE- PRACTICAL)

(DE 1/2/3/4/5)

Full marks: 50 (40+10) **Total Credits: 4**

MSPY 405-DE-1 NUTRITION & DIETETICS

1. Abnormal constituents of urine**:** Urea, uric acid, creatinine

2. Estimation of Food contents:
3. Moisture and ash content,
4. total carbohydrate, protein and fat.
5. Iodine value of fat.
6. Mineral content: Ca, P, Fe, Cu.
7. Vitamins in Food and biological samples:
   Ascorbic acid, (ii) Vitamin A, (iii) Thiamine (iv) Tochopherol.

8. Food Microscopy**:** Carbohydrate, protein and fat food products**.**

9. Blood constituents: Studies on enzyme activity: SGOT, SGPT, LDH, Acid and
10. Alkaline phosphatase Minerals: Ca, Na, Fe, P Vitamins C and E

MSPY405 - DE-2 ENDOCRINOLOGY AND REPRODUCTION PRACTICAL

1. Biochemical estimation under experimental condition:
   i . Blood ascorbic acid.
   ii. Serum cholesterol
   iii. Serum lipoprotein cholesterol
   iv. Blood sugar
   v. Serum sodium and potassium
   vi. Serum alkaline phosphatase
   vii. Blood calcium
2. Study on sperm morphology.
3. Study of sperm motility.
4. Sperm count.

MSPY 405-DE-3 ERGONOMICS & OCCUPATIONAL HEALTH

1. Determination of Whole body CG.
2. Determination of spinal curvature in different work postures.
3. Determination of reaction time: eye - hand and eye - leg coordination.
4. Lung functions tests
5. Determination of thematic visual stress

6. Determination of VC – Demonstration
7. EMG studies in different positions and working conditions.
8. Recording of ECG in different working conditions; effect of postural changes, determination of electrical axis of heart
9. Determination of heat stress indices.
10. Determination of illumination level in different work stations. (xi) Time and motion study.
11. Determination of circadian rhythm of common physiological parameters and its computer analysis including Fourier analysis
12. Psychological testing through questionnaire technique.
13. Measurement of noise in different work stations, audiometry.
14. Biochemical testing for explorative markers of stress
15. Group project to visit of institutes of national importance and industries
16. Viva Voce (general) and on group project
17. Practical note book

MSPY 405-DE -4 ENVIRONMENTAL PHYSIOLOGY

1. Air quality measurement:
   Physical parameters: wind velocity, wind direction, atmospheric pressure, minimum and maxium temperature, relative humidity
   Chemical parameters: particulate matters and other pollutants.

2. Soil quality measurements:
   Physical parameters: bulk density, sp. gravity, moisture contents.
   Chemical parameters: pH and other pollutants.
   Microorganisms.

3. Experimental studies: Acute and chronic effects of Hg, Pb, As, nicotin, metanil yellow, malachite green on intestinal motility of rat and on perfused heart of toad. Change in blood parameters.

4. Histological studies regarding chronic effects of food additives, Hg, As, Pb on liver, kidney, lung, skin, intestine and brain tissue.

5. Educational field tour: Visit to sewage treatment plant; School of environmental studies; Solar project at Gosaba / Bankura.

MSPY 405-DE -5 BIOMECHANICS, KINESIOLOGY IN SPORTS AND EXERCISE

1. Determination of distance of 6 min run with maximum speed.
2. Determination of Hb concentration before and during graded exercise.
3. Electrocardiographic changes before and during graded exercise by

electrocardiograph.

4. Exercise-Tolerance test to determine cardiac efficiency.
5. a) Hand-muscle strength by Hand-grip-Dynamometer.
   b) Hand-muscle-strength during different postures.
   c) Blood pressure changes during hand-muscle-endurance study.
6. Determination of blood lactic acid concentration by photoelectric colorimeter.
7. Determination of lung volumes by expirograph.
8. Determination of static and dynamic lung functions.
9. Determination of steady state heart rate at different work load on a bicycle ergometer.
10. Determination of ventilation volume of lungs at steady state heart rate.
11. Study report of visiting institute of repute for exposure to modern techniques, etc.

MSPY 406 (DISSERTATION/REVIEW, PROJECTS)

BASED ON DISCIPLINE-CENTRIC ELECTIVE

Full marks: 50 (40+10) **Total Credits: 4**

Term paper based on special paper i.e. Major Elective subject chosen.

Project should be done based on major elective subject chosen. Marks will be

Project Report-- 40
Seminar and Viva -10
Total 50

Guidelines of Question Pattern:

In each course of 50 marks (4 credits/) the End-semester examination shall be of 40 marks (10 marks Mid-sem examination/Continuous Assessment based on class test, assignment, seminar etc modalities for which are to be decided by the concerned course-in-charge and to be notified to the students at the beginning of the semester). In End-semester, there shall be 8 questions of 10 marks each from which 4 questions are to be answered by the candidates (Time 2 hours).

2. In each course of 50 marks (4 credits) which has two groups within it the End-semester examination shall be of 40 marks. There shall be 4 questions of 10 marks from each group. Candidates are to answer 4 questions taking 2 from each group. (Time 2 hours).

Guidelines for Evaluation Pattern:

Notes on marks distribution:

 The performance of a candidate in a theoretical course (paper) will be assessed for a maximum of 50 marks as explained below (except the courses DEPT 307 and DEPT 406 which are discussed later):

 40 marks as end-semester examination
 10 marks as Continuous Assessment based on class test, assignment, seminar etc, modalities for which are to be decided by the concerned course-in-charge and notified to the students at the beginning of the semester

MSPY 406 (Project paper/Practical Paper):
Based on Survey Report, Assignment, Presentation and Viva-Voce.
Field survey and project Writing: 40 marks
Presentation and Viva-Voce (in the presence of external experts from other Universities/Institutions): 10 marks

** **MSPY 307 CE**: Community Engagement Activities
Students have to participate in the Community Engagement programmes/ activities of the department for the concerned year and follow it up with a written Report & Presentation and Viva-Voce. The main objectives are to develop an appreciation of rural culture, lifestyle and wisdoms among students, to learn about the states of various agricultural and rural development programmes, to understand causes for rural distress and poverty and explore solutions for the same and to apply class room knowledge of courses to field realities. Evaluation pattern would be as follows:
 Report writing: 20 marks

 Presentation and viva-voce: 5 marks (in the presence of external expert(s) from other Departments of the Home University)

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-Hall 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 Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & 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, Blackwell 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 Cell 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,Williams 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. Churchill 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.lntroducing 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.