BANKURA UNIVERSITY

(West Bengal Act XIX of 2013- Bankura University Act, 2013)

Main Campus, Bankura Block-II, P.O.: Purandarpur, Dist.: Bankura, Pin- 722155, West Bengal

Office of the Secretary, Faculty Council for Undergraduate Studies

BKU/FCUG/166/2022 Date: 26/08/2022

NOTIFICATION

As directed, the undersigned is pleased to inform you that Bankura University has initiated the process to revise the existing CBCS syllabus of Undergraduate programme in Physiology (Hons.) & Physiology (Programme) and as an important corollary to the process, the workshop through online mode will be organized on the date mentioned herewith to get the feedback from the stakeholders. Present Students, Alumni, Guardians, Academicians and other stakeholders related to the specific programme are requested for their kind participation in the workshop and to present their views/ observations etc. The stakeholders may go through the draft syllabus attached herewith and convey their observations to the office of the undersigned on ugsecretaryoffice@bankurauniv.ac.in within seven days from the date of publication of notice.

Date: 30.08.2022

Time: 11:00 AM (IST)

Link to join: **https://meet.google.com/ict-uxxm-pdn**

Sd/-
Secretary
Faculty Council for Undergraduate Studies

CBCS SYLLABUS

FOR

THREE YEARS UNDER-GRADUATE COURSE

IN

PHYSIOLOGY (HONOURS)

(*w.e.f. 2022*)

BANKURA UNIVERSITY

BANKURA

WEST BENGAL

PIN 722155

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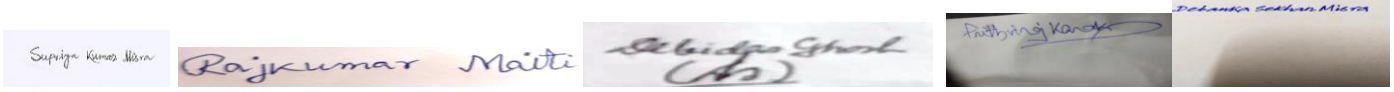
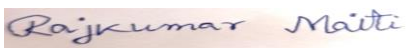


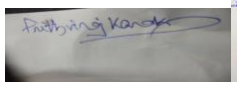
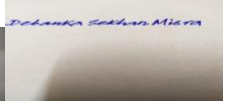
1. Introduction

The syllabus for Physiology at undergraduate level using the Choice Based Credit system has been framed in compliance with UGC CBCS Guidelines. The purpose of the course is to standardize physiology teaching at undergraduate level throughout the state.

The main objective of framing this new syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Physiology.

The course content also lists new practical exercises, so that the students get a hands-on experience of the latest techniques that are in current usage both in the advanced research laboratories and in Industry. The syllabus will equip all undergraduate students with knowledge on basic physiological mechanisms with references to their implications in pathogenesis of disease and the physiological basis of their management.

2. Scheme for CBCS Curriculum

2.1 Credit Distribution across Courses

		Credits
Course Type	**Total Papers**	**Theory + Practical**
Core Courses	14	14*4 =56 14*2 =28
Discipline Specific Electives	4	4*4=16 4*2=8
Generic Electives	4	4*4=16 4*2=8
Ability Enhancement Language Courses	2	1*2=2 (ENG / MIL) 1*4=4 (ENVS)
Skill Enhancement Courses	2	2*2=4
Totals	**26**	**142**

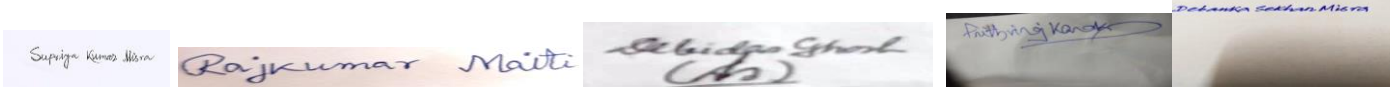
*Tutorials of 1 Credit will be conducted in case there is no practical component

2.1.1 Question Pattern Across Courses

Question Pattern							
Examination	Course type (Honours)	Credits (Theory+ Practical)	Type of questions	Marks/ question	No of questions to be attempted	Total	No of options (Out of)
	Total Marks (Theoretical)					25	
	CC (H), DSE (H), GE (H),	4	Objective	1	5	5	8
			Short	5	2	10	4
			Broad	10	1	10	2
	Total Marks (Theoretical)					40	
	SEC (H)	2	Very short	2	5	10	8
			Short	5	4	20	6
			Broad	10	1	10	2
	Total Marks (Practical)					15	
	CC (H), DSE (H), GE (H),	2	Practical work	10	Answer all the question	10	NA
			Laboratory Note Book	3		3	NA
			Viva Voce	2		2	NA
	Total Marks (Practical)					40	
	SEC (H)	2	Practical work	10	3	30	3
			Laboratory Note Book	5	NA	5	NA
			Viva Voce	5	NA	5	NA

Duration of Examinations

Subject and Type of Papers	Full Marks	Duration
Honours (Theoretical)	25	1 Hour 15 Minutes
Honours (Theoretical)	40	2 Hours
Honours (Practical)	15	2 Hours
Honours (Practical)	40	4 Hours



2.2 Scheme for CBCS Curriculum in Physiology (Honours)

SEMESTER –I

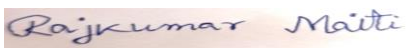
Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UG/PHYH /101/C-1	CT-1: Cellular Basis of Physiology CP-1: Cellular Basis of Physiology Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH /102/C-2	CT-2: Biological Physics and Enzymes CP-2: Biological Physics and Enzymes Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH /103/GE-1	Any one of the following GET-1: Cellular Components, Biophysical and Biochemical Concepts GPT-1: Cellular Components, Biophysical and Biochemical Concepts Lab	4 2	10	25 15	50	4	NA	4
UG/104/ AECC-1	Environmental Studies	4	10	40	50	2	NA	NA
Total in Semester - I		22	40	160	200	14		12

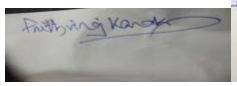
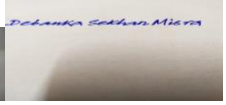
N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER –II

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UG/PHYH/ 201/C-3	**CT-3: Physiology of Nerve and Muscle Cells** **CP-3: Physiology of Nerve and Muscle Cells Lab**	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 202/C-4	**CT-4: Chemistry of Biomolecules** **CP-4: Chemistry of Biomolecules Lab**	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 203/GE-2	**Any one of the following** **GET-2: Blood, Cardio-respiratory and Neuromuscular Systems** **GEP-2: Blood, Cardio-respiratory and Neuromuscular Systems Lab**	4 2	10	25 15	50	4	NA	4
UG/204/ AECC-2	English/Hind/MIL	2	10	40	50	2	NA	NA
Total in Semester - II		**20**	**40**	**160**	**200**	**14**		**12**

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

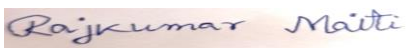



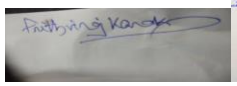
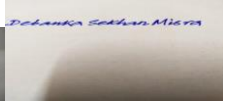



SEMESTER –III

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UG/PHYH/ 301/C-5	CT-5: Circulating Body Fluids CP-5: Circulating Body Fluids Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 302/ C-6	CT-6: Circulation CP-6: Circulation Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 303/C-7	CT-7: Functions of the Nervous System CP-7: Functions of the Nervous System Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 304/GE-3	Any one of the following GET-3: Digestion, Metabolism, Nutrition and Excretion GEP-3: Digestion, Metabolism, Nutrition and Excretion Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 305/SEC-1	Any one of the following SECP-1: Detection of Food Adulteration Lab Or SECP-1: Hematological Techniques Lab	2	10	40	50	NA	NA	4
Total in Semester - III		26	50	200	250	16		20

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

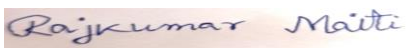



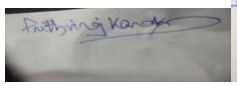
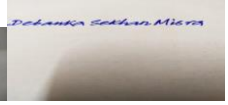



SEMESTER –IV

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UG/PHYH/ 401/C-8	**CT-8: Energy Balance, Metabolism, and Nutrition** **CP-8: Energy Balance, Metabolism, and Nutrition Lab**	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 402/C-9	**CT-9: Gastrointestinal Physiology** **CP-9: Gastrointestinal Physiology Lab**	4 2	10	25 15	50	4		4
UG/PHYH/ 403/C-10	**CT-10: Respiratory Physiology** **CP-10: Respiratory Physiology Lab**	4 2	10	25 15	50	4	NA	4
UG/ PHYH/ 404/GE-4	**Any one of the following** **GET-4: Neurosensory, Endocrine and Reproductive Systems** **GEP-4: Neurosensory, Endocrine and Reproductive Systems Lab**	4 2	10	25 15	50	4	NA	4
UG/ PHYH/ 405/SEC-2	**Any one of the following** **SECT-1: Clinical Biochemistry** **Or** **SECT-1: Pathological Microbiology and Bio-Medical Technology**	2	10	40	50	2	NA	NA
Total in Semester - IV		**26**	**50**	**200**	**250**	**18**		**16**

N.B. Theory: 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

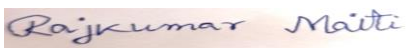



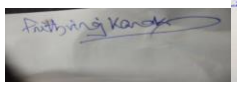
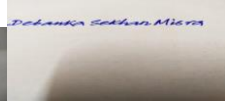



SEMESTER – V

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UG/ PHYH/ 501/C-11	CT-11: Special Senses CP-11: Special Senses Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 502/C-12	CT-12: Endocrinology CP-12: Endocrinology Lab	4 2	10	25 15	50	4	NA	4
UG/ PHYH/ 503/DSE-1	Any one of the following DSET-1: Biological Statistics and Computer Application DSEP-1: Biological Statistics and Computer Application Lab Or DSET-1: Human Nutrition and Dietetics DSEP-1: Human Nutrition and Dietetics Lab	4 2	10	25 15	50	4	NA	4
UG/ PHYH/ 504/DSE-2	Any one of the following DSET-2: Microbiology and Immunology DSEP-2: Microbiology and Immunology Lab Or DSET-2: Genetics and Molecular Biology DSEP-2: Genetics and Molecular Biology Lab	4 2	10	25 15	50	4	NA	4
Total in Semester – V		24	40	160	200	16		16

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

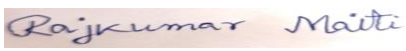



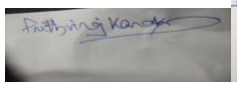
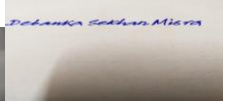



SEMESTER – VI

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UG/PHYH/ 601/C-13	CT13: Reproduction CP13: Reproduction Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 602/C-14	CP14: Excretion, Skin and Body Temperature Regulation CP14: Excretion, Skin and Body Temperature Regulation Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 603/DSE-3	Any one of the following DSET-3: Ergonomics and Occupational Physiology DSEP-3 : Ergonomics and Occupational Physiology Lab Or DSET-3: Environmental Physiology and Toxicology DSEP-3: Environmental Physiology Toxicology Lab	4 2	10	25 15	50	4	NA	4
UG/PHYH/ 604/DSE-4	Any one of the following DSET-4: Sports and Exercise Physiology DSEP-4: Sports and Exercise Physiology Lab Or DSET-4: Nanobiotechnology and Bioinformatics [* In case of DSET-4 (Or) Lecture hour = 18]	4 2 6	10 10	25 15 40	50 50	4 6	NA NA	4 NA
Total in Semester – VI		**24**	**40**	**160**	**200**	**16***		**16**

SC = Subject Code, C= Core Course, AECC= Ability Enhancement Compulsory Course, SEC= Skill Enhancement Course, GE= Generic Elective, DSE= Discipline Specific Elective IA= Internal Assessment, ESE= End-Semester Examination, Lec.=Lecture, Tu.= Tutorial, and Prc.=Practical

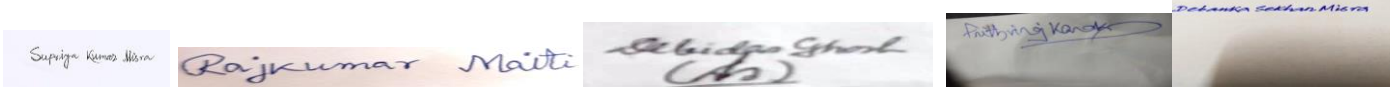



2.3 Choices for Discipline Specific Electives

Discipline Specific Elective – 1	Discipline Specific Elective – 2	Discipline Specific Elective – 3	Discipline Specific Elective – 4
DSET-1: Biological Statistics and Computer Application **DSEP-1: Biological Statistics and Computer Application Lab** **Or** **DSET-1: Human Nutrition and Dietetics** **DSEP-1:Human Nutrition and Dietetics Lab**	**DSET-2: Microbiology and Immunology** **DSEP-2: Microbiology and Immunology Lab** **Or** **DSET-2: Genetics and Molecular Biology** **DSEP-2: Genetics and Molecular Biology Lab**	**DSET-3: Ergonomics and Occupational Physiology** **DSEP-3 : Ergonomics and Occupational Physiology Lab** **Or** **DSET-3: Environmental Physiology and Toxicology** **DSEP-3: Environmental Physiology and Toxicology Lab**	**DSET-4: Sports and Exercise Physiology** **DSEP-4: Sports and Exercise Physiology Lab** **Or** **DSET-4: Nanobiotechnology and Bioinformatics**

2.4 Choices of Skill Enhancement Courses

Skill Enhancement Course-1	Skill Enhancement Course-2
SECP-1: Detection of Food Adulteration Lab **Or** **SECP-1: Hematological Techniques Lab**	**SECT-1: Clinical Biochemistry** **Or** **SECT-1: Pathological Microbiology and Bio-Medical Technology**



Program Outcomes

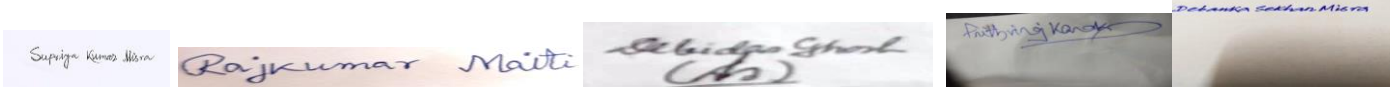
P.O.1: Students will be enriched about the knowledge covering the functional activities of different physiological systems operating in co-ordinated fashion from molecular and cellular levels to the system levels.

P.O.2: Participants of this course will be empowered by perceiving information about the impact of environmental biotic and abiotic factors for the maintenance of homeostasis of human body.

P.O3: Learners will be skilled and expertised themselves for doing biophysical and biochemical analysis of human body samples for assessment of health status and dissemination of public health awareness package to the community.

P.O4: Student will be oriented for cognitive power upgradation and problem-solving activity in different biological deviated conditions in connection with acclimatization to real life situation.

P.O5: Undergraduate students will capable to achieved integrated and interdependent knowledge among human body activities in collaborative manners with plant and animal kingdom in a holistic fashion.



Program Specific Outcomes

Course Objectives

Physiology provides a broad scientific education, which allows our graduates to pursue a career in research work or in related subjects and in areas such as Universities, Research Institute, and the Pharmaceutical Industry, scientific publishing or public health. As a graduate, the students will have a number of direct avenues -

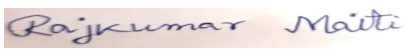
P.S.O1: Will orient the students and attract them for pursuing higher studies in this line and for carrier building in the field of health sector, formal education sector, pharma industries, biotechnological corporates etc.

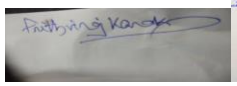
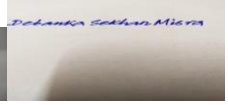
P.S.O2: Will facilitate the student for fundamental knowledge perception which will drive them to conduct further study in research in the field of allied health sciences, medical sciences, veterinary sciences and others.

P.S.O3: Will support the students for self-dependent learning and understanding to conduct experiments, knowledge bank enrichment and spreading the health awareness information through information-communication-technology.

P.S.O4: This course will provide a sound basis in human physiology to support further study in health and medical sciences or related fields.

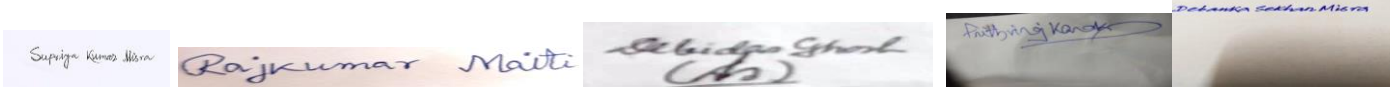
P.S.O5: On working in different designing industry as an Ergonomist.

Knowledge and Understanding

1. Will facilitate disease prevention, early recovery from diseases and health promotion by improving DALY through developing health friendly attitude and practices by adopting healthy food style, life style, hygiene and sanitation.
2. Will help for understanding the different physiological events operating in our body from the view points of biochemical and biophysical dimensions.
3. Will favour to achieve knowledge for explaining the physiological process at cellular level from the dimension of genomics, proteomics and metabolomics.
4. Will drive the students for experience gathering about data collection from societal events covering community health followed by data analysis and statistical testing to find out the cause and effect relationship establishment in favour of community programs and plane design.
5. Will induce the student for obtaining knowledge upgradation about impact of environment on human health considering environment-gene interaction, nutrient-gene interaction, pharma-gene interaction.
6. Will tune the students to expertise themselves about different molecular techniques for unfolding the molecular level of action that give confidents for research conduction in future for benefit of human society.



3. Core Courses

Semester – I

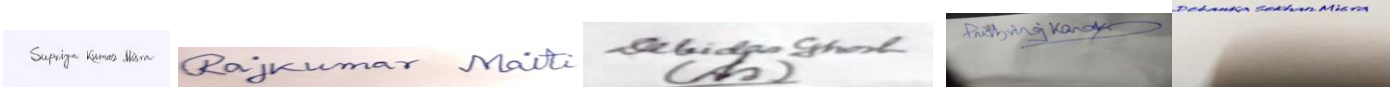
Course Outcome (CO)

COT-1: Cellular Basis of Physiology Paper consists of two units. Unit-I deals with the knowledge of cellular function. Unit-II deals with the cell division, cell cycle and body's homeostatic mechanism.

COT-2: Biological Physics and Enzymes Recognize and define a variety of terms specific to the bio-physics and enzymes.

COP-1: Cellular Basis of Physiology Lab Students will learn and able to identify stained sections of different mammalian Tissues and Organs.

COP-2 : Biological Physics and Enzymes Lab Students will learn to measure Blood Pressure by non-invasive methods and measure enzyme activity.



3.1 Core T1 – Cellular Basis of Physiology

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25]

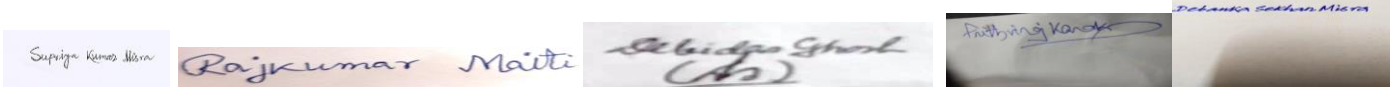
4 Credits

Unit 1

1. Introduction
2. Body Fluid Components – Blood, lymph, tissue fluid, CSF, synovial fluid (Source, composition and function).
3. Organ Systems and Tissues – General classification, special emphasis on connective tissue, areolar tissue, and cells - Ciliated epithelium and glandular cells.
4. Morphology and Function of Cell Organelle – Plasma membrane, nucleus, mitochondria, ribosome, lysosome, Golgi body, endoplasmic reticulum, peroxisomes, cytoskeletal elements, centrosomes.
5. Transport Across Cell Membranes - Active, passive, carrier mediated, antiport and symport.
6. Intercellular Communication in details – Gap junction, tight junction, intercalated disc, desmosomes and Cell adhesion molecules. Extracellular matrix components.

Unit 2

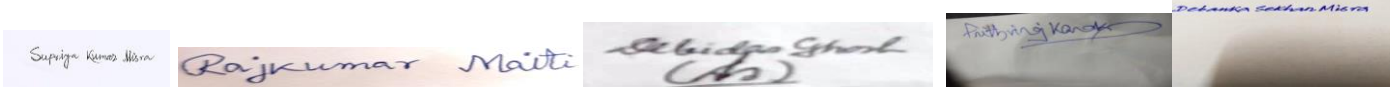
1. Cell Cycle – Definition, different phases of cell cycles, regulation, check points of cell cycle.
2. Apoptosis and Necrosis - Basic concept and mechanism.
3. Cell division
   a. Mitosis – Phases and significance.
   b. Meiosis – Phases and significance.
   c. Special emphasis on homologous, heterologous, chiasma, crossing over, recombination,
   disjunction of chromosome.
3. Homeostasis – General concept, feedback and feedforward regulatory mechanism of Homeostasis.
4. Aging – Etiology, theories of aging, metabolic changes and management.



3.2 Core P1 – Cellular Basis of Physiology Lab
[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15]

2 Credits

1. Introduction on: Principle, use and function of different components of microscope.
2. Introduction on permanent slides - Applied value.
3. Study and identification of stained sections of different mammalian tissues and organs:
   bone, cartilage, trachea, lungs, spleen, lymph gland, esophagus, stomach, duodenum, ileum, jejunum, large intestine, liver, kidney, ureter, salivary glands, pancreas, adrenal gland, thyroid gland, testes, ovary, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, smooth muscle, artery, vein, tongue, uterus.
4. Examination and staining of fresh tissues squamous, ciliated and columnar epithelium by methylene blue stain.
5. Staining of adipose tissue using Sudan III or IV.



3.3 Core T2 – Biological Physics and Enzymes

[Theory: Credits 4 (4 Lectures /Week)/ Marks 25]

Unit 1

1. Study of Units for Measuring Concentration of Solutes: Normality, moles, equivalents, osmoles.
2. Principles of dilution.
3. Acids and Bases; acidosis and alkalosis, tolerance level of acidosis and alkalosis and normal homeostasis,
4. pH and Buffer - Henderson Hasselback equation (quantitative problems). Definition of pH, Determination of pH. Buffer, operating principle of buffer (Brief idea).

Unit 2

1. Bonds and forces in biomolecules.
2. Colloids - Definition, types, properties, importance, protective colloid and gold number.
3. Osmosis and Diffusion – Definition, process in brief and physiological importance.
4. Surface tension, Specific Gravity – Definition, process in brief and physiological importance.
5. Viscosity and Resistance – Definition and physiological importance.
6. Flow and Pressure – Biophysical aspect and physiological importance
   a. Laminar and Streamline flow
   b. Poiseuille-Hagen Formula
   c. Laws of Laplace
7. Dialysis and Ultracentrifugation – Definition, principle, mechanism in brief and application.
8. Chromatography - Definition, principle, applied value of major types (Paper Chromatography and TLC), HPLC (in brief)

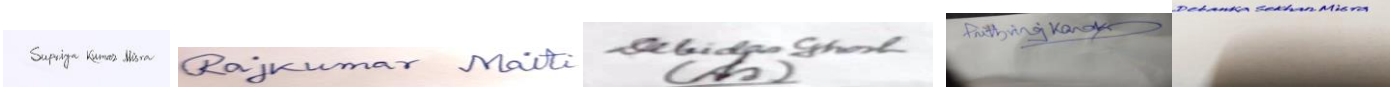
Unit 3

1. Electrophoresis – Gel, SDS-Page - Definition, principle and applied value.
2. Autoradiography - Definition, principle and applied value.
3. Cell Fractionation and Tracer Techniques – Process and applied value.
4. Nanoparticles and its application in Physiology.
5. Thermodynamics -1st Law, 2nd Law, entropy, enthalpy, Gibbs free energy - General concept and application in human body. Endergonic and Exergonic reactions, reversible and irreversible processes, equilibrium constant. Physiological steady state and Living body as a thermodynamic system.

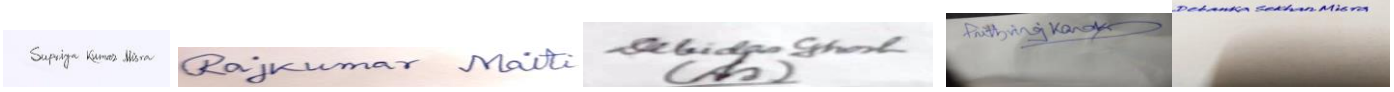
Unit 4

1. A study of Enzymes:

a. Definition, apo-enzyme, holoenzyme, co-enzyme, properties and classification; isoenzymes, ribozymes and abzymes.



b. Mechanism of enzyme action.
c. Factors regulating enzyme activities.
d. Kinetics – Hyperbolic and sigmoid kinetics; Michaelis constant.
e. Enzyme inhibition-Competitive, non-competitive and uncompetitive.
f. Allosteric modulation of enzymes activities.
g. Concept of rate limiting enzymes – Definition and features.



3.4 Core P2 – Biological Physics and Enzymes Lab
[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15]

2 Credits

1. Determination of systolic, diastolic, pulse and mean blood pressure by non-invasive method (Auscultatory Method).
2. Determination of enzyme activities (e.g., SOD, CAT, amylase, transaminase).
3. Preparation of buffer solution (Phosphate buffer, bi-carbonate buffer) and pH measurement.
4. Determination of viscosity of glycerol and sugar solution in respect to water.
5. Demonstration of oncotic pressure of colloidal solutions.

Suggested Readings

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2. Das, D. (2008). Biochemistry. Academic Publishers.
3. Das, D. (2004). Biophysics and Biophysical Chemistry. Fifth Edition. Academic Publishers
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9. Eroschenko, V.P. (2012). Difiore's Atlas of Histology: With Functional Correlations. Twelfth Edition. Lippincott Williams Wilkins Company.
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14. Khurana, I. (2015).Medical Physiology. 2nd Edition. Elsevier India.
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16. Chaudhuri, S.K.(2008). Concise Medical Physiology. Sixth Edition. NCBA.
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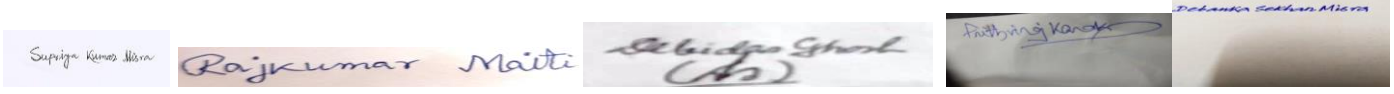
19. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.



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Pvt. Ltd
21. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.
22. Debnath J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata
23. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
24. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
25. Byabaharik Sharir Bignan. Debnath J. Shreedhar Prokashani, Kolkata.
26. Pal, G.K. Pal, P. (2013).Textbook of Practical Physiology. Third Edition. Universities.
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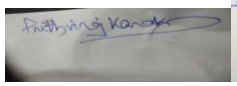
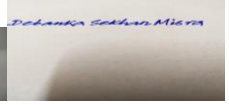



Semester – II

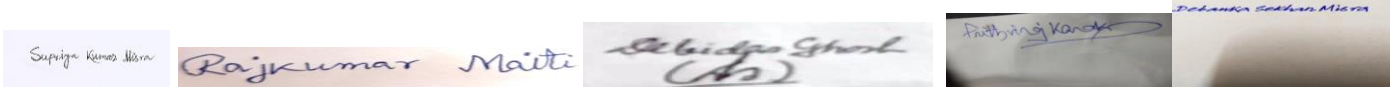
Course Outcome (CO)

COT-3: Physiology of Nerve and Muscle Cells - Students will study the anatomy of muscle, nerve, synapse and neuromuscular junction. In this paper they will learn the properties of muscle and nerve and mechanism of muscle contraction.

COT-4: Chemistry of Biomolecules - In this paper student will learn the structure and function of bio-molecules at a chemical level within a biological context.

COP-3: Physiology of Nerves and Muscle Cells Lab - Students will practically learn the different properties of muscle in response to electrical stimulus.

COP-4: Chemistry of Biomolecules Lab - Students will learn to identify different physiologically import biomolecules by qualitative experiments.



3.5 Core T3 – Physiology of Nerve and Muscle Cells

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] 4 Credits

Excitable Tissue: Nerve

1. Introduction
2. Nerve Cells – Types, structure and function of neuron.
3. Properties of nerve cell and myelinogenesis.
4. Action potential, phases and ionic basis of action potential.
5. Conduction of nerve impulse in myelinated and nonmyelinated nerve fibre.
6. Nerve Fiber - Types and function, degeneration and regeneration of nerve fibre.
7. Neurotrophins – Definition, chemical nature and function.

Excitable Tissue: Muscle

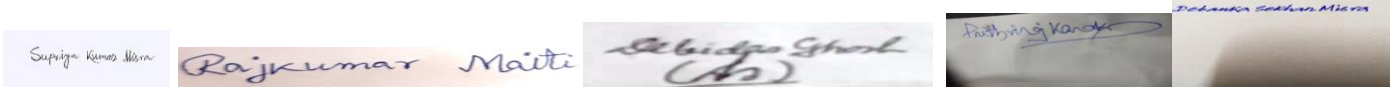
1. Introduction – Etiology of specific type of muscle, classification and general function.
2. Skeletal Muscle
    a. Morphology – Structure and function.
    b. Properties of muscle in the intact organism.
    c. Mechanism of contraction.
    d. Electrical phenomena and ionic fluxes.
    e. Energy sources and metabolism.

3. Cardiac Muscle
    a. Morphology – Structure and function.
    b. Properties of cardiac muscle.
    c. Metabolism

4. Smooth Muscle
    a. Morphology – Structure, properties and function.
    b. Single unit and multi unit smooth muscle.
    c. Mechanism of contraction.

Synaptic and Junctional Transmission

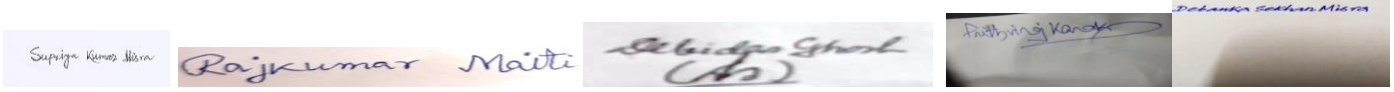
1. Introduction
2. EM structure of central and peripheral synapse.
3. Properties of synapse.
4. Synaptic transmission.
    a. Electrical events at synapses.
    b. Chemical transmission of synaptic activity.
    c. Synaptic plasticity and learning – in brief.
    d. Neurotransmitter – Types; mode of action of cholinergic and adrenergic substance.
5. Neuromuscular Transmission.



a. Neuromuscular junction – Anatomy, mechanism of signal transduction and function.
b. Applied aspects – Myasthenia Gravis and Lambert-Eaton syndrome.
b. Denervation hypersensitivity in brief.

Receptor

1. Introduction
2. Receptors – Definition, biotransducers, classification and functions, receptor potential.
3. Electrical and ionic events in Pacinian corpuscle.



3.6 Core P3 – Physiology of Nerves and Muscle Cells Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Study of kymograph, induction coil, key and other instruments used to study mechanical
   responses of skeletal muscle.
2. Isolation and staining of nerve fibers with node(s) of Ranvier ($AgNO_3$) and muscle fibers (Methylene blue).
3. Preparation of gastrocnemius-sciatic nerve and muscle of toad.
4. Kymographic recording of simple muscle curve of toad.
5. Kymographic recording of hot and cold saline on isolated nerve muscle preparation of toad.
6. Calculation of Latent period, contraction period, relaxation period, maximum height of contraction from the kymographic recording of simple muscle curve of toad and interpret your result.

3.7 Core T4 – Chemistry of Biomolecules

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

A. Introduction on biomolecules, importance on human system.

B. Carbohydrates

1. Classification of carbohydrates.
2. Structure of carbohydrates.
3. Properties of carbohydrates.
4. Functions of carbohydrates.

C. Proteins

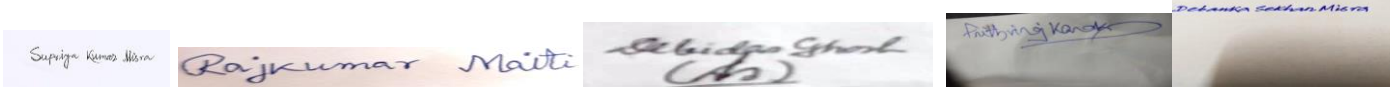
1. Classification of proteins.
2. Structure of proteins.
3. Properties of proteins.
4. Functions of proteins.
5. Amino acid - Classification and properties.

D. Lipids

1. Classification of lipids.
2. Structure of lipids.
3. Properties of lipids.
4. Functions of lipids.

E. Nucleic acids

1. Purine and pyrimidine: Structure, nomenclature and tautomerism.
2. Nucleic acids: Nucleosides and nucleotides - Structure. Polynucleotides.
3. Structure, types and function of DNA.
4. Structure, types and function of RNA.
5. DNA replication, transcription and translation.



3.8 Core P4 – Chemistry of Biomolecules Lab
[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15]

1. Introduction of qualitative assessment of physiologically important biomolecules.
2. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic acid, uric acid, glucose, galactose, fructose, sucrose, lactose, albumin, gelatin, peptone, starch, dextrin, urea, glycerol, bile salts - Systematic analysis and confirmatory test.

Suggested Readings

1. Mahapatra, A.B.S. (2011). Essentials of Medical Physiology Practical. First Edition. Current Books International'.
2. Ghai, C.L. A Text Book of Practical Physiology. 8th Edition. Jaypee.
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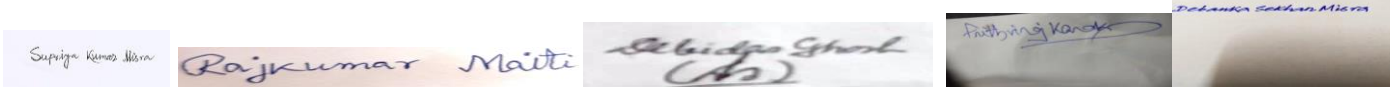


Semester – III

Course Outcome (CO)

COT-5: Circulating Body Fluids-This paper introduces the composition, structure and functions different body fluids.

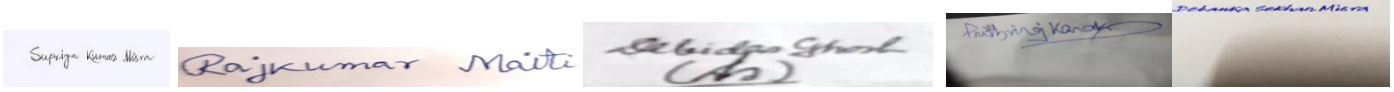
COT-6: **Circulation** - In this paper student should have acquired a basic understanding of the electrical and mechanical activity of the heart and also about the circulation through special organs of the body.

COT-7: **Functions of the Nervous System** - Students will acquire basic knowledge about the structure of the nervous system and functions and also understand how the central and peripheral nervous system is organized.

COP-5: **Circulating Body Fluids Lab** - Students will learn to prepare and staining of blood film and identify different blood cells.

COP-6: **Circulation Lab** - Students will learn about the effects of drugs and ions on perfused frog's heart. In this paper students will learn different applied aspects of ECG.

COP-7: Functions of the Nervous System Lab - Students will learn different reflex response and handgrip strength and also know different types of memory tests.



3.9 Core T5 - Circulating Body Fluids

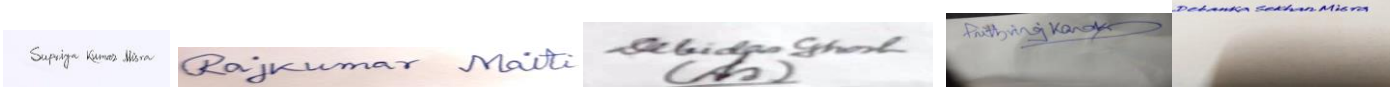
[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] 4 Credits

1. Introduction
2. Blood – Components and general function.
3. Plasma - Composition and function.
4. Plasma proteins - Origin, synthesis, classification and function
3. Blood volume and determination of blood volume.
4. Bone Marrow – Red and yellow.
5. Red Blood Cells – Erythropoiesis; hemoglobin-types, synthesis and fate.
6. White Blood Cells – Morphology, classification, life cycles, functions, Human leucocyte antigen (HLA). Leucopoiesis, Arneth index.
7. Platelets - Formation and fate.
8. Hemostasis – Definition, factors, modern concept and abnormalities in hemostasis. Anti-coagulants used in different purposes.
9. Blood Types – Group and Rh typing. Cross matching (major and minor cross matching), Blood transfusion and transfusion related hazards
10. Lymph – Formation, circulation and function.
11. Clinical implication of different components of blood.
12. Separation of different components of blood in blood bank and their clinical importance.

3.10 Core P5 – Circulating Body Fluids Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Preparation and staining of blood film with Leishman's stain and identification of blood Cells.
2. Differential count of WBC.
4. Total count of RBC and WBC.
5. Bleeding time and clotting time.
6. Hemoglobin estimation by Sahli's method
7. Preparation of haemin crystal.
8. Preparation and staining of bone marrow and different stages of erythropoiesis.
    a. Measurement of diameter of megakaryocyte.
9. Reticulocyte staining.
10. Blood group determination and Rh typing.



3.11 Core T6 – Circulation

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Origin of the Heart Beat and the Electrical Activity of the heart

1. Introduction
2. Special junctional tissues – Location, structure and function.
2. Origin and spread of cardiac impulse and pacemaker potential.
3. The Electrocardiogram – Leads, Einthoven Law, Einthoven triangle, electrical axis of heart, different normal waves and their significances.
4. Electrocardiographic findings in other cardiac and systemic diseases (Myocardial ischemia,
   heart block, atrial and ventricular fibrillation) and Cardiac arrhythmias.
5. Diagnosis of cardiac diseases by analysis of blood sensors : Troponin C.

The Heart as a Pump

1. Introduction
2. Mechanical events of the cardiac cycle, heart sound, volume and pressure change.
3. Cardiac Output - Definition, types, factors affecting, regulation and measurement.

Dynamics of Blood and Lymph Flow

1. Introduction
2. Anatomic and biophysical considerations of
   a. Arterial and arteriolar circulation.
   b. Capillary circulation.
   c. Lymphatic circulation and interstitial fluid volume.
   d. Venous circulation.
3. Blood Pressure – Definition, types, measurement and regulation.

Cardiovascular Regulatory Mechanisms

1. Introduction
2. Local regulatory mechanisms.
3. Substances secreted by the endothelium.
4. Systemic regulation by hormones and nervous system.

Circulation Through Special Regions

1. Introduction
2. Cerebral circulation

a. Anatomic considerations
b. Peculiarities
c. Cerebral blood flow measurement and regulation
d. Circulation of CSF
e. Brain metabolism and oxygen requirements.
f. The Blood-Brain Barrier.

3. Anatomy, regulation and peculiarities of
   a. Coronary circulation.
   b. Splanchnic circulation.
   c. Circulation of the skin.
   d. Placental and fetal circulation.

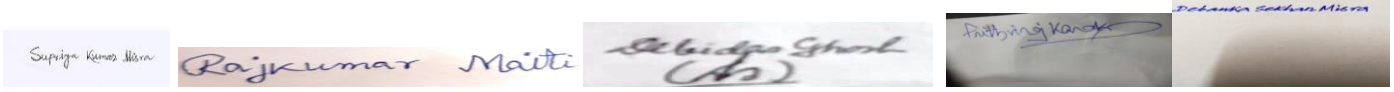
Cardiovascular Homeostasis in Health & Disease

1. Introduction
2. Compensation for gravitational effects.
3. Exercise.
4. Inflammation and wound healing (in brief).
5. Atherosclerosis.
6. Shock (in brief).
6. Hypertension (in brief).
7. Heart Failure and Stroke (in brief).

3.12 Core P6 – Circulation Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Introduction and preparation of Amphibian Ringer solution.
2. Kymographic recording of the normal heart beat of toad.
3. Effect of adrenaline and acetyl choline on perfused heart of toad.
4. Computation of HR, PQ interval, QRS complex, PR interval from supplied ECG recording graph.



3.13 Core T7 - Functions of the Nervous System

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Elementary Idea on Brain and Spinal Cord

1. Structural organization of different parts of brain and spinal cord.

Reflexes

1. Introduction of Reflex - Conditioned, unconditioned, mono synaptic, disynaptic and poly synaptic. Reflex arch - Component.
2. Monosynaptic reflexes: The stretch reflex.
3. Polysynaptic Reflexes: The withdrawal reflex.
4. General properties of reflexes.

Cutaneous, Deep & Visceral Sensory and Motor Pathways.

1. Ascending and descending tracts: Origin, courses, termination and functions.
2. Functions of the spinal cord with special reference to functional changes- Following hemisection and complete section of spinal cord.
3. Pain production, perception, regulation, pain pathway and Gate control theory. Referred pain.

Structure and Functions of Different Parts of the Brain

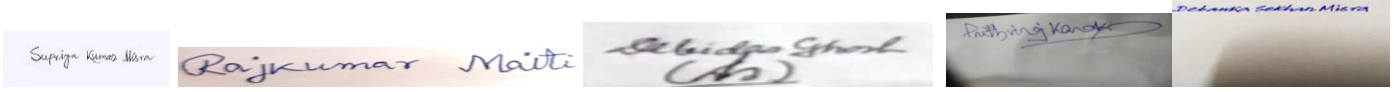
1. Introduction
2. The reticular formation and the reticular activating system.
3. Cerebral Cortex – Structure, important areas and their function.
4. Evoked cortical potentials.
5. The Electroencephalogram.
6. Physiological basis of the EEG, consciousness, and sleep.
7. Interpretation of abnormal EEG pattern.
8. Thalamus- Structure, neural connection, function and abnormalities.

Control of Posture and Movement

1. Introduction
2. Role of cerebellum, basal ganglia and vestibular apparatus (In brief).
3. Movement disorders.

The Autonomic Nervous System

1. Introduction
2. Anatomic organization of autonomic outflow.
3. Chemical transmission at autonomic junctions.
4. Responses of effector organs to autonomic nerve impulses.
5. Cholinergic and adrenergic discharge.



Central Regulation of Visceral Function

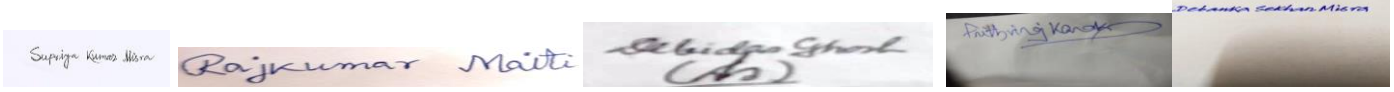
1. Introduction
2. Medulla oblongata.
3. Hypothalamus
   a. Anatomic considerations.
   b. Nuclear organization, connection and function

Neural Basis of Instinctual Behaviour and Emotions

1. Introduction
2. Anatomic consideration of limbic system.
3. Limbic system in sexual behavior, fear and rage phenomenon.

Higher Functions of the Nervous System

1. Introduction
2. Learning – General concept; Memory – Short term and long term
4. Functions of the neocortex.
5. Disorders relating learning and memory.



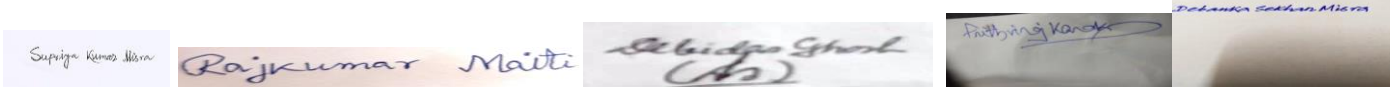
3.14 Core P7 – Functions of the Nervous System Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Experiments on superficial (Plantar) and deep (Knee Jerk) reflex.
2. Measurement of hand grip strength.
3. Reaction time by stick drop test.
4. Short term memory test (Shape and picture word).
5. Two point discrimination test.

Suggested Readings:

1. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Hall J.E. (2016).Guyton & Hall Textbook of Medical Physiology. Second South Asia Edition.
3. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
4. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
5. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
6. Chatterjee, C.C. (2016). Human Physiology Volume 2. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
7. Core Text Book of Neuro-Anatomy, by M.B. Carpenter: the Williams and Wilkins Company.
8. Berg, J.M. Tymoczko, J.L. Stryer, L. (2006). Biochemistry: International Edition
9. Charles Nobach. The Human Nervous System. Mc Graw Hill Book Co.
10. Berne , R.M. and Levy M.N. Physiology. C.V. Mosby Co.
11. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
12. Barrett, K. E. Barman, S.M., Boitano, S. Brooks, H.L. (2012). Ganong's Review of Medical Physiology. 24th Edition. Lange Medical Book. Prentice-Hall International.
13. Pal, G.K. Pal, P. (2013).Textbook of Practical Physiology. Third Edition. Universities.
14. Shepherd. G.M. Neurobiology. Oxford University Press.
15. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
16. Byabaharik Sharir Bignan. Debnath J. Shreedhar Prokashani, Kolkata.



Semester – IV

Course Outcome (CO)

COT-8: Energy Balance, Metabolism, and Nutrition - This paper consists of different biomolecules metabolic pathway and also focus on understanding the essential components of our diet and discuss the changes in nutrition and energy balance that the human body.

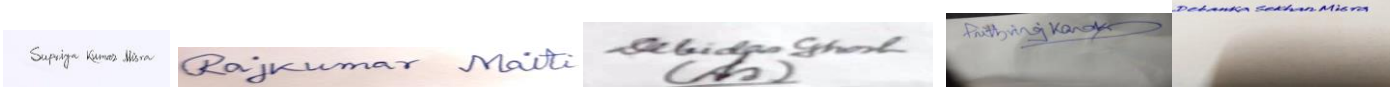
COT-9: Gastrointestinal Physiology - In this paper student will learn about the different digestive organs and their functions.

COT-10: Respiratory Physiology - Students will acquire basic knowledge of the respiratory organs and different gaseous exchange process.

COP-8: Energy Balance, Metabolism, and Nutrition Lab - Students will learn the quantitative estimation of different biomolecules.

COP-9: Gastrointestinal Physiology Lab - In this practical paper student will perform the intestinal motility and effects of different drugs on intestinal movements.

COP-10: Respiratory Physiology Lab - Students will learn lung volume and capacity by Spirometric analysis



3.15 Core T8 - Energy Balance, Metabolism, and Nutrition

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] 4 Credits

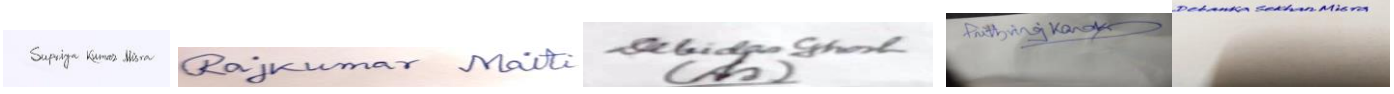
1. Introduction
2. Energy metabolism
3. Redox potential. Mitochondrial electron transport chain. Oxidative phosphorylation- Inhibitors and uncouplers.
4. Carbohydrate metabolism – Glycolysis, Krebs Cycle, glycogenesis, glycogenolysis, neoglucogenesis, HMP Shunt and Cori cycle and their regulations.
5. Protein metabolism – Deamination, Transamination Ornithine cycle, Protein synthesis.
6. Fat and cholesterol metabolism – Beta-oxidation omega-oxidation, ketogenesis, fatty acid synthesis and cholesterol synthesis.
7. Integration of carbohydrate, fat and protein metabolism.
8. Purines and Pyrimidines– Biosynthesis: de novo and salvage pathways. Catabolism.
9. Nutrition – BMR, RQ, RDA, SDA, NPU, Biological value of proteins, vitamins and minerals – Brief idea.

3.16 Core P8 - Energy Balance, Metabolism, and Nutrition Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

Biochemical Estimation

1. Introduction on colorimetric study.
2. Quantitative estimation of glucose and sucrose by Benedict's method - Percentage and total Quantity.
3. Quantitative estimation of amino nitrogen (Sorensen's Formol titration method)- Percentage and total quantity
4. Estimation of percentage quantity of lactose in milk by Benedict's method.



3.17 Core T9 - Gastrointestinal Physiology

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] 4 Credits

Gastrointestinal structure

1. Introduction
2. Anatomy and histology of alimentary canal.
   a. Gastrointestinal hormones.
   b. Mouth and esophagus and stomach.
   c. Exocrine portion of the pancreas.
   d. Liver and biliary system.
   e. Small intestine.
   f. Colon.
   g. Gastrointestinal motility and function.

Digestion and Absorption

1. Introduction
2. Carbohydrates.
3. Proteins and nucleic acids.
4. Lipids.
5. Absorption of water and electrolytes.
6. Absorption of vitamins and minerals.

Normal microbial flora

1. General introduction of intestinal microbiota.
2. Brief ideas about prebiotics and probiotics and their clinical importance.

3.18 Core P9 – Gastrointestinal Physiology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Introduction on Dale's Apparatus and Preparation of Dale's Fluid.
2. Kymographic recording of normal movements of rat's intestine in Dale's Apparatus.
3. Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements.

3.19 Core T10 – Respiratory Physiology

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Pulmonary Function

1. Introduction
2. Properties of gases.
3. Anatomy of the lungs.
4. Mechanics of breathing – Mechanism, resistances of breathing, surfactant, compliance.
5. Gas Exchange in the lungs.
6. Pulmonary circulation.
7. Other Functions of the respiratory system – Excretory, body defense function of lungs, pulmonary buffers.

Gas Transport Between the Lungs and the Tissues

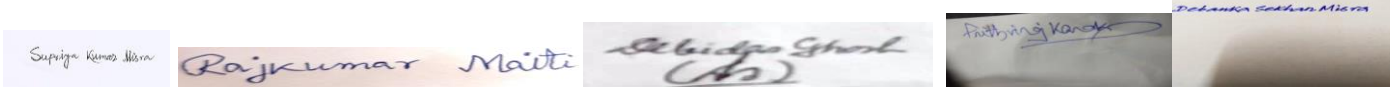
1. Introduction
2. Oxygen transport – Mechanism, dissociation curve and factor regulating it.
3. Carbon Dioxide Transport –Mechanism, dissociation curve and factor regulating it.
4. Respiratory acidosis and alkalosis

Regulation of breathing

1. Introduction
2. Neural control of breathing – Respiratory center and respiratory reflexes.
3. Chemical control of breathing.
4. Non-chemical Influences on breathing – in brief

Breathing Adjustments in Health and Disease

1. Introduction
2. Effects of exercise.
3. Types of hypoxia.
4. Oxygen therapy.
5. Hypercapnia and hypocapnia.
6. Other respiratory abnormalities (Mountain sickness, apnoea, dyspnea, dysbarism, Chyne Stroke Breathing and HAPO.
7. Effects of increased barometric pressure – Caisson disease etc.
8. Artificial breathing – Methods in brief and significance.



3.20 Core P10 – Respiratory Physiology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

List of Practical

1. Measurement of peak expiratory flow rate.
2. Measurement of tidal volume and vital capacity.
3. Pneumographic recording of chest movement; effect of swallowing, hyperventilation, coughing, reading and laughing and breath holding.
4. Measurement of oxygen saturation by pulse oxymeter before and after exercise.
5. Measurement of forced expiratory volume (FEV) in first second and first 10 second.
6. Demonstration on digital spirometer for lung function test (PFT).

Suggested Readings:

1. Srilakshmi, B. (2016). Nutrition Science. Fifth Edition. New Age International Publishers.
2. Srilakshmi, B. (2014). Dietetics. Seventh Edition. New Age International Publishers.
3. Das S. Textbook of Normal and Therapeutic Nutrition. Academic Publishers.
4. Das S. (2016).Textbook of Community Nutrition. 2nd Edition. Academic Publishers.
5. Basu, P. Nutritional Biochemistry. Academic Publishers.
6. Srilakshmi, B. (2015). Food Science. Sixth Edition. Age International Publishers.
7. Swaminathan, M. (2012). Handbook of Food and Nutrition. Jain Book Agency.
8. Swaminathan, M. (2015). Essentials of Food and Nutrition. Vol. I AND Vol. II. The Bangalore Printing and Publishing Co., Ltd.
9. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
10. Hall J.E. (2016). Guyton & Hall Textbook of Medical Physiology. Second South Asia Edition.
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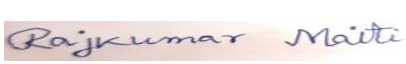

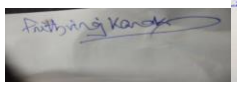
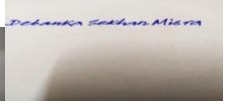

18. Shepherd.G.M. Neurobiology. Oxford University Press.
19. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
20. Byabaharik Sharir Bignan. Debnath J. Shreedhar Prokashani, Kolkata.
21. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
22. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
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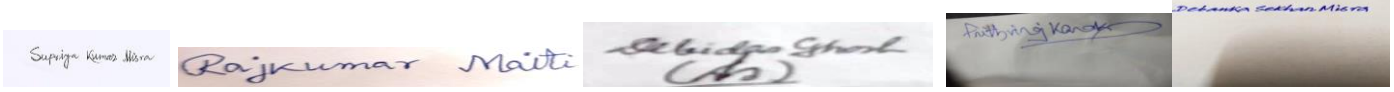


Semester – V

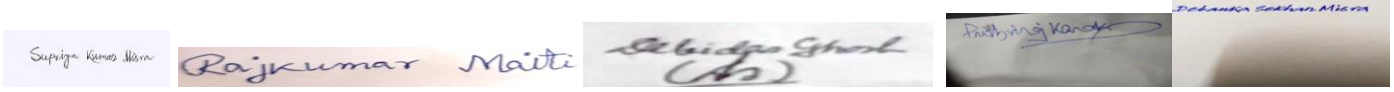
Course Outcome (CO)

COT-11: Special Senses - Students will learn about all the sensory organs and their functions.

COT-12: Endocrinology - Students will know about the structure, functions and applied aspects of endocrine organs.

COP-11: Special Senses Lab - Students will learn about the different sensory function tests and fixation process.

COP-12: Endocrinology Lab - In this practical students will learn hormones activity on reproductive and digestive organs.



3.21 Core T11 - Special Senses

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Vision

1. Introduction
2. Anatomic considerations of eye.
3. Histological structure of retina
4. The Image forming mechanism (accommodation and visual acuity), light adaptation and dark adaptation
5. The photoreceptor mechanism: Genesis of electrical responses, photopic and scotopic vision
6. Visual pathways and effects of lesions of these pathways.
7. Color vision.
8. Other aspects of visual function – Monocular and binocular.
9. Eye Movements – Lateral and rotational.
10. Errors in visual process**.**

Hearing and Equilibrium

1. Introduction
2. Anatomic considerations of ear.
3. Hair cells.
4. Auditory pathway.
5. Mechanism of hearing.
6. Vestibular function.
7. Loss of hearing – Audiometry, test for conductive deafness, neural deafness and central deafness. Role of ear on equilibrium and posture- Role of reflexes.

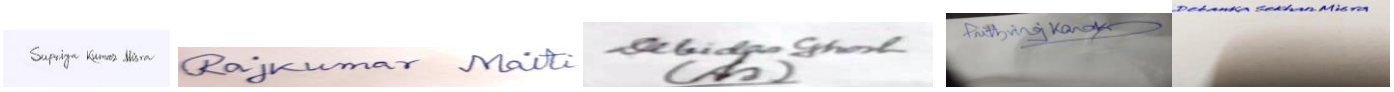
Smell and Taste

1. Introduction
2. Smell
3. Receptors and pathways.
4. Physiology of olfaction and classification of olfaction.
5. Physiology Taste – Taste bud, basic modalities of taste.
    a. Receptor and pathways
    b. Physiology of taste, taste adaptation and masking effect.

3.22 Core P11 – Special Senses Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Principles of fixation and staining,
2. Staining and identification of fixed nervous tissue.
3. Determination of visual acuity by Snellen's chart / Landolt's C chart.
4. Determination of colour blindness by Ishihara chart.
5. Perimetry.
6. Determination of deafness by tuning fork test.
7. Silver nitrate preparation of corneal cell space.
8. Demonstration on hearing threshold by audio meter.



3.23 Core T12 – Endocrinology

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Unit 1

General concept on Endocrinology

1. Introduction to endocrinology. Anatomy of endocrine system.
2. Hormones – Classification, hormone receptor- Fixed model and mobile model receptor. Genomic and non-genomic concept of regulation of hormone actions (c-AMP and tyrosine kinase). Positive and negative feedback mechanism.
3. Elementary idea of hormone action.
4. Hypothalamus: Basic concept of neurohormone. Hypothalamo-hypophyseal endocrine axis and portal system.

The Pituitary Gland

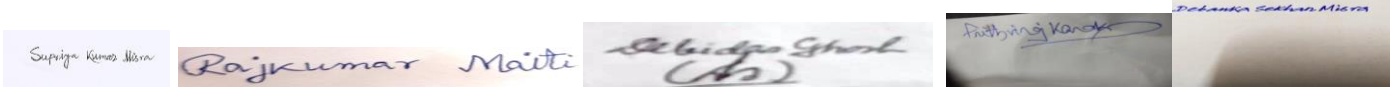
1. Introduction
2. Histology of pituitary gland.
3. Anterior pituitary and Posterior pituitary hormones.
4. Growth Hormone - Mechanism and function of GH and applied aspects.
5. Pituitary hyperfunction and hypofunction in humans.

Thyroid Gland

1. Introduction
2. Anatomic considerations.
3. Formation and secretion of thyroid hormones.
4. Transport of thyroid hormones.
5. Effects of thyroid hormones.
6. Regulation of thyroid secretion.
7. Primary and secondary hyper and hypo-thyrodism, LATS, Hashimoto thyroiditis, goiter, Thyroid storm and Grave's disease.

Endocrine Functions of the Pancreas and the Regulation of Carbohydrate Metabolism

1. Introduction
2. Histology of pancreas.
3. Structure, biosynthesis, and secretion of insulin.
4. Function of insulin.
5. Mechanism of action.
6. Insulin excess.
7. Regulation of insulin secretion.
8. Glucagon - Biosynthesis and function.
9. Blood sugar homeostasis.
10. Other Islet cell hormones.
11. Hypoglycemia and Diabetes mellitus in humans.



The Adrenal Cortex and Medulla

1 Introduction
2. Adrenal morphology.
3. Adrenal Cortex- Structure, biosynthesis and functions of adrenocortical hormones
4. Adrenal Medulla- Structure, biosynthesis and Function of Medullary Hormones
b. Regulation of Adrenal Medullary Secretion.
5. Cushing syndrome, Addison's disease, adaptive syndrome, Cuhn's disease and Pheochromocytoma.

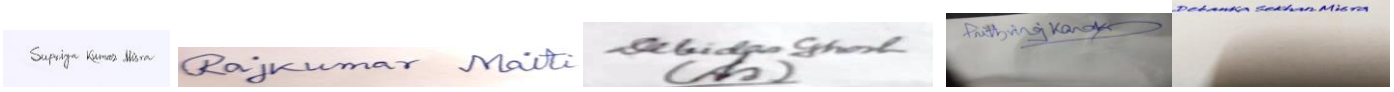
Unit 2

Hormonal Control of Calcium Metabolism and the Physiology of Bone

1. Introduction
2. structure and histology of parathyroid gland
3. Parathyroid hormones
4. Calcium and phosphate metabolism
5. Bone physiology.
6. Vitamin D and its biotransformation; role of vitamin D on calcium metabolism and bone health.
7. Vitamin D as a hormone.

Endocrine Functions of the Kidneys, Heart, and Pineal Gland

1. Introduction
2. The renin-angiotensin system.
3. Erythropoietin.
4. The Endocrine Function of the Heart: Atrial natriuretic peptide.
5. Pineal Gland-Neuroendocrine gland and function of melatonin.
6. Human Chronobiology, biological rhythms; basic concepts and implications.



3.24 Core P12 – Endocrinology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Study of the effects of oxytocin on uterine contraction of albino rats.
2. Study of the effects of adrenaline on intestinal and uterine movements of albino rats
3. Growth chart and interpretation.
4. Quantification of serum calcium by colorimetric method using calcon indicator.
5. Case study on the basis of endocrine pathophysiology using photograph provided through lottery.
6. Thyroid status assessment using secondary data on thyroid profile.

Suggested Readings:

1. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
2. Kronenberg, H.M. Melmed, S. Polonsky, K.S. Larsen, P.R. (2009). Williams Textbook of Endocrinology. Eleventh Edition. Saunders.
3. Ganong, W.F. Review of Medical Physiology. Lange Medical Book. Prentice-Hall International.
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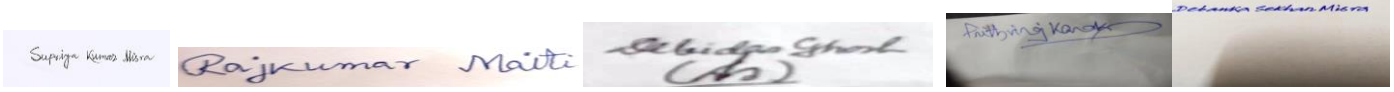


Semester – VI

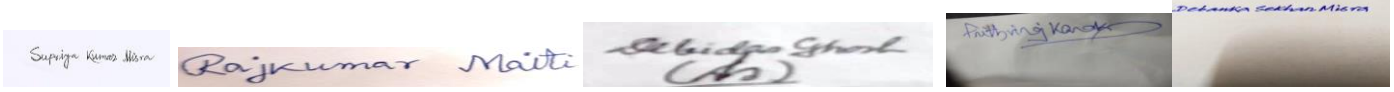
Course Outcome (CO)

COT-13: Reproduction - Students will learn details of about male and female reproductive system.

COT-14: Excretion, Skin and Body Temperature Regulation - Students will learn details of mechanism of urine formation and renal function.

COP-13: Reproduction Lab - In this practical paper student will learn pregnancy test and histoarchitecture of male and female reproductive organs

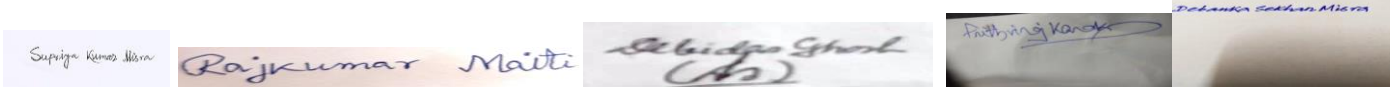
COP-14: Excretion, Skin and Body Temperature Regulation Lab- Students will able to identify different normal and abnormal constituents of urine.



3.25 Core T13 – Reproduction

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

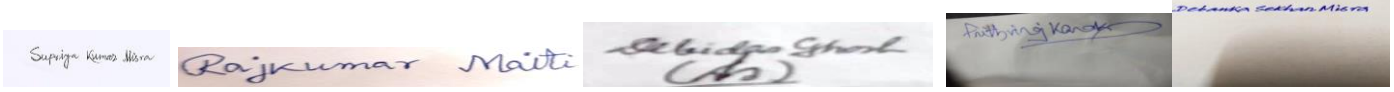
1. Introduction on reproductive system.
2. Sex differentiation and development:
    a. Chromosomal sex.
    b. Embryology of the human reproductive system.
    c. Aberrant sexual differentiation.
    d. Puberty and its hormonal control.
    e. Precocious and delayed puberty.
    f. Menopause.
3. Pituitary Gonadotropins and Prolactin.
4. The male reproductive System:
    a. Primary and secondary sex organs and their functions
    b. Structure of sperm, motility, capacitation and viability of sperm.
    b. Gametogenesis, spermiation and ejaculation.
    c. Endocrine function of the testes.
    d. Control of testicular function.
    e. Abnormalities of testicular function.
5. The female reproductive system
    a. Primary and secondary sex organs and their functions.
    b. Oogenesis and ovulation.
    c. Menstrual cycle and its hormonal control.
    d. Endocrine Function of ovary.
    e. Control of ovarian function.
    f. Abnormalities of ovarian function.
6. Fertilization
7. Implantation
8. Male and female infertility.
9. Placenta – Structure, hormones and function.
10. Pregnancy – Physiology of pregnancy, hormonal regulation and pregnancy test.
11. Parturition.
12. Development of mammary gland, lactation and regulation of milk secretion.
13. Population Control- Family planning and contraceptive measurement.



3.26 Core P13 – Reproduction Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Study of estrous cycle.
2. HE staining and identification of testis, ovary and uterus of paraffin embedded tissue section.
3. Pregnancy test from human urine sample by immunological method.
4. Semen Analysis: Sperm count, sperm motility and sperm viability by eosin and nigrosine staining.



3.27 Core T14 – Excretion, Skin and Body Temperature Regulation

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Excretion

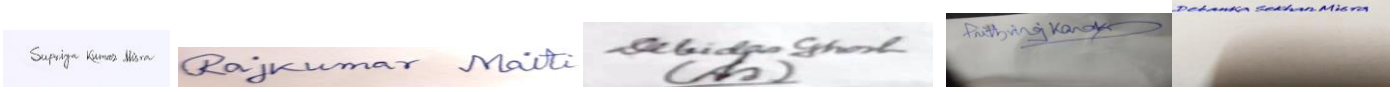
1. Introduction of renal system and its structure.
2. Function of malpighian corpuscles and renal tubule.
3. Urine formation – Glomerular ultrafiltration, tubular reabsorption and tubular secretion.
5. Physical properties and composition of urine (normal and abnormal)
6. Role of renal buffers on acid base regulation of urine.
7. Regulation of Na^+ and H_2O balance by renal system.
8. Counter current system.
9. Renal Circulation and its peculiarities.
9. Diuretics, diuresis
10. Disorders of renal functions- renal failure (Dialysis), renal stone, glomerulonephritis, nephrotic syndrome.
11. Urinary Bladder: Structure, filling and emptying of urinary bladder (micturition)
12. Renal function test: Inulin and Urea Clearance Test, renal threshold values,
13. Non-excretory Function of Kidney, structure and function of JG apparatus.

Skin

1. Structure of skin and its functions
2. Sweat Glands - Types, structure and composition of sweat, mechanism of sweat formation, secretion and its regulation.
3. Sebaceous glands - Structure and functions.
4. Insensible perspiration in brief.

Body Temperature

1. Physical and physiological processes of thermoregulation, routes of thermogenesis and thermolysis, concept of thermokinetics, homeotherm, poikilotherm, hibernation and aestivation.
2. Regulation of body temperature in homeotherms – Role of endocrine and nervous system.
3. Pyrexia, hyperthermia and hypothermia.



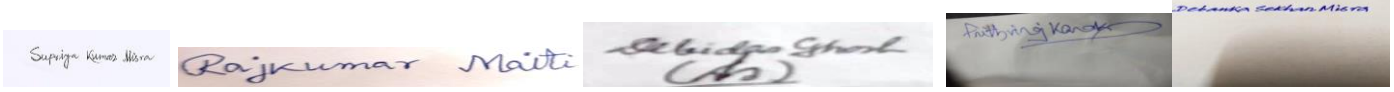
3.28 Core P14 - Excretion, Skin and Body Temperature Regulation Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Testing of normal constituents of urine (Biochemical Test)
2. Identification of abnormal constituent of urine (Biochemical Test)
3. Microscopic observation of RBC, pus cell and cast in urine.
4. Measurement of body temperature and heart rate in graded exercise

Suggested Readings

1. Chatterjee, C.C. (2016). Human Physiology Volume 2. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
3. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
4. Khurana, I. (2015).Medical Physiology. 2nd Edition. Elsevier India.
5. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
6. Ganong, W.F. Review of Medical Physiology. Lange Medical Book. Prentice-Hall International.
7. Schatten, H. Human Reproduction. Willey.
8. Constantinescu, G.M. Animal Model and Human Reproduction. Willey.
9. Chaudhuri, S.K.(2008). Concise Medical Physiology. Sixth Edition. NCBA.
10. Pal, G.K. Pal, P. (2013).Textbook of Practical Physiology. Third Edition. Universities.
11. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
12. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
13. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
14. Godkar , P.B. Godkar. O.D.(2014). Textbook of Medical Laboratory Technology. 14th Edition.
15. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.



4. Discipline Specific Elective Courses

CO-DSET1: Biological Statistics and Computer Application – From this DSE course student will learn about graphical representation and statistical analysis of data; history of computer, different generation computer, binary number, languages of computer, computer viruses and application of computer in Physiology.

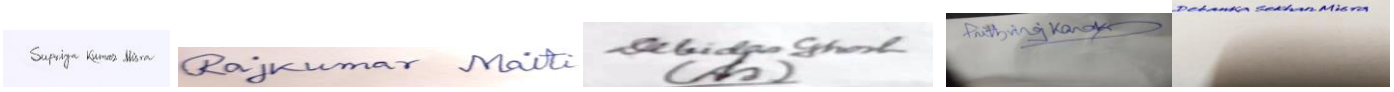
CO-DSET1: Human Nutrition and Dietetics: This paper will help the students for the knowledge of nutritional assessment and calorific values of different foods, importance of dietary fibre, requirement of vitamin and minerals for the maintenance of healthy life style.

CO-DSET2: Microbiology and Immunology: From this paper students will learn about different type of microbes and their culture media, growth and genetics. Basic ideas about human immune system, different types of immunity, vaccination and immunization process.

CO-DSET2: Genetics and Molecular Biology – Student will learn about basic principles of Mendelian genetics, crossing over, linkage, central dogma of protein, gene mapping and Human Cytogenetics.

CO-DSET3: Ergonomics and Occupational Physiology - From this paper student will develop their knowledge about man-machine-environment relationship. Side by side they will gather knowledge about Ergonomical designs of different working station and also ergogenic aids.

CO-DSET3: Environmental Physiology and Toxicology – Student will acquire the knowledge about environmental components and pollutants. They also learn about different adverse effect of air, water, noise and pesticide pollution on human health.



They also acquire the knowledge about dose response curve, effective, lethal dose and toxin.

CO-DSET4: Sports and Exercise Physiology – This discipline specific course will help the students to know about bioenergetics, effect of training, physical exercise, nutritional requirement in sports, sports injury, aerobic and anaerobic power and doping.

CO-DSET4: Nanobiotechnology and Bioinformatics – This paper will help our students to grow up their knowledge about nano particles, nano-designing and their application in medical science.

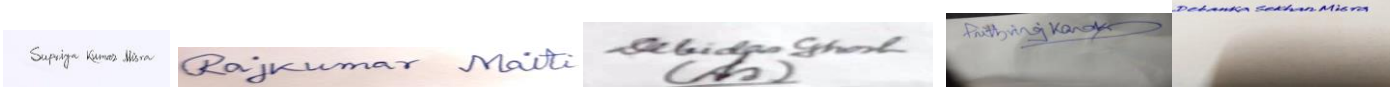
CO-DSEP1: Biological Statistics and Computer Application Lab – This practical paper will help the students to increase their ability for data collection, statistical analysis, graphical presentation and finally preparation of a field study report scientifically.

CO-DSEP1: Human Nutrition and Dietetics Lab: This discipline specific elective practical paper enhances the ability of our students to know about basic principle of diet survey, community health survey with the help of anthropometric and physiological parameters, epidemiological study and perform community nutrition management.

CO-DSEP2: Microbiology and Immunology Lab: In this practical paper student will learn about their own blood group determination, Gram staining and spore staining of bacteria along with idea about acid fast staining.

CO-DSEP2: Genetics and Molecular Biology Lab: This practical paper will help to increase the knowledge of students about gel electrophoresis, quantification of DNA, RNA, protein and isolation of genomic and plasmid DNA.

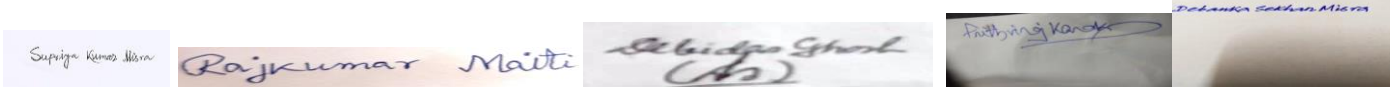
CO-DSEP3: Ergonomics and Occupational Physiology Lab: Student will learn from this DSE practical paper to determine the effect of static and dynamic exercise



on heart rate and blood pressure along with different anthropometric measurements. They will also learn about the measurement of noise and humidity of working places.

CO-DSEP3: Environmental Physiology and Toxicology Lab: This practical paper will help to grow up the knowledge of our students about the entire environment by increasing their ability to measure relative humidity, sound intensity level, light intensity level and amount of dissolved oxygen in water.

CO-DSEP4: Sports and Exercise Physiology Lab: Student will learn from this practical paper about the determination of physical fitness, effect of exercise on heart rate and blood of pressure, determination of VO_2 max and walking test.



4.1 DSE T1 – Biological Statistics and Computer Application

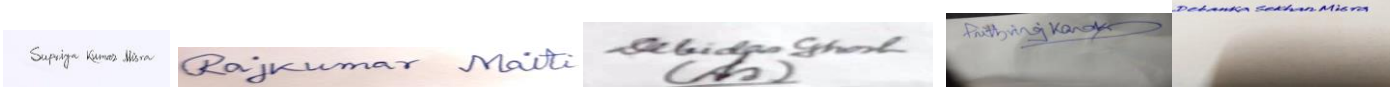
[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Concepts in Biological Statistics

1. Scope of statistics – Principles of statistical analysis of biological data.
2. Basic concepts – Variable, parameter, statistics and sampling.
3. Classification of statistics (Brief idea of statistics of location, statistics of dispersion, statistics of co-relation and statistics of regression). Brief idea of parametric and non-parametric statistics.
4. Presentation of data - Frequency distribution, frequency polygon, histogram, bar diagram and pie diagram.
5. Measurement of central tendency- mean, median, mode in grouped and ungrouped data.
6. Computation of dispersion- Mean deviation, standard deviation, standard error of mean and variance.
7. Standard score.
8. Probability- General concept.
9. Normal distribution-Properties and assumption, skewness and kurtosis.
10. Student's t-distribution- properties and assumption.
11. Testing of hypothesis - Null hypothesis, alternative hypothesis, errors of inference (Type-I and type-II), degrees of freedom, levels of significance, students' t-test (Single group paired observation study, individual matched grouped study) and z-score for significance of difference.
12. Non-Parametric - Chi-square test (Assumption-test for independence).

Concepts in Computer Application

1. History of computer, basic components of computer and their importance.
2. Binary number, decimal number, addition, subtraction, multiplication and division using binary number.
3. Basic concept of software and computer language.
4. Concept of MS word, Excel and Power point.
5. Concept of networking and website.
6. Application of computer in Physiology.



4.2 DSE P1 – Biological Statistics and Computer Application Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

Field Study Report

A report (hand-written) on the basis of field survey from one of the followings topics by using basic statistical tools

1. Physiological parameters (at least three parameters to be measured): Heart rate, blood pressure, respiratory rate, PFI, blood hemoglobin content, differential count of WBC and visual acuity.

2. Anthropometric Measurements (at least three parameters).

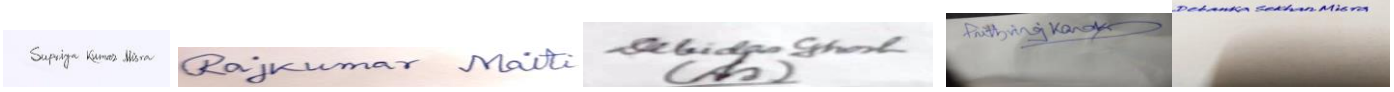
3. Epidemiological studies - Cross sectional and vertical.

OR

4.1 DSE T1 – Human Nutrition and Dietetics

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

1. Introduction- Basic concept of nutrition and dietetics, concept of undernutrition and overnutrition (Obesity).
2. Constituents of food - Macro and micro-nutrients and their significance.
3. Basal metabolic rate -Factors, determination by Benedict-Roth apparatus and significance.
4. Respiratory quotient and its significance.
5. Specific dynamic action- Definition, normal values of different food stuffs and its
6. importance.
7. Calorific value of macronutrients.
8. Body calorie requirements – In different types of work, Adult consumption unit.
9. Dietary requirements of carbohydrate, protein, lipid and other nutrients at different phases of human life cycle RDA as per ICMR.
10. Balanced diet and principles of formulation of balanced diets for growing child, adult man and woman, pregnant woman and lactating woman.
11. Nitrogen balance, essential amino acids, biological value of proteins, NPU, DC and PER.
12. Supplementary value of protein.
13. Dietary fibres – Source, types, composition and importance.
14. Resistance starch and its importance.
15. Vitamins and Minerals (Fe, Na, K, Ca, P, I, Zn and selenium) – Sources, daily requirement, physiological role and deficiency symptoms.
16. Nutraceutical - Concepts and their importance.
17. Principle of diet survey.
18. Composition and nutritional value of common food stuffs.
19. Physiology of starvation and obesity.
20. Space nutrition in brief.

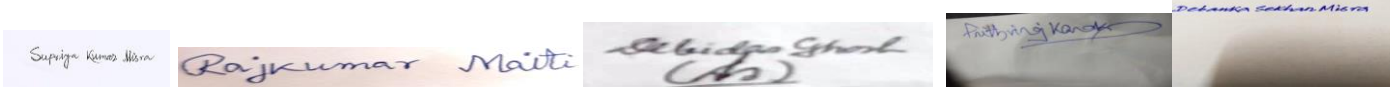


4.2 DSE P1 – Human Nutrition and Dietetics Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

Diet Survey /Field Study Record

1. Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report on his/her locality/ costal area/ hilly area/ coal mines area.
2. A report (hand-written) on the basis of field survey from One of the followings:
   a. Physiological parameters of human (at least three parameters).
   b. Anthropometric measurements on human (at least three parameters).
   c. Epidemiological studies on complete and partial immunization programme / Vitamin A prophylaxis programme / Nutrition status assessment of pre school children.



4.3 DSE T2 – Microbiology and Immunology

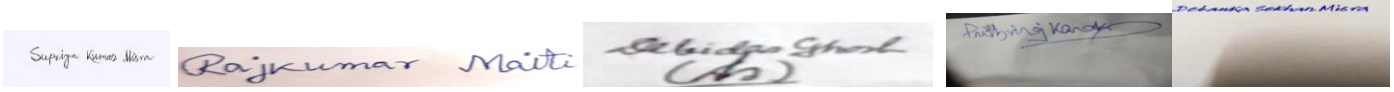
[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Microbes

1. Brief introduction about microbes, structure and morphological classification of different microbes and bacterial spore.
2. Bacterial nutrition, bacterial culture media and bacterial growth curve.
3. Bacterial genetics – Conjugation, transformation and transduction.
4. Bacterial metabolism – Fermentation (Ethanol and lactic acid) and Entner-Dudroff pathway and their importance.
5. .Elementary idea of bacteriostatic, bactericidal agents and antibiotics.
6. Gram positive, Gram negative, pathogenic and nonpathogenic bacteria. Sterilization, pasteurization.
7. Brief idea on acid fast bacteria.
8. Viruses - Structure and types, Lytic and lysogenic cycle, effect of RNA virus on human body system. Prions – Basic ideas and prion diseases.
9. Basic concept of COVID-19.

Overview of Immune System

1. Introduction about immune system and immune organs (primary and secondary).
2. Classification of immunity- Innate and acquired immunity, humoral and cell mediated immunity, Natural and artificial immunity and herd immunity.
3. Immuno-competent Cells- B-lymphocytes and T-lymphocytes (T_H, T_S, T_{NK}, T_C & T_{DTH}), APC.
4. Major Histocompatibility Complex (MHC)-Type-I&II and interferon.
5. Immunoglobulin - classification, basic structure and function.
6. Antigen-antibody interaction- different types (Precipitation, coagulation, agglutination, neutralization and flocculation).
7. Cytokines, Lymphokines, inflammation and hypersensitivity and its types.
8. Activation of complement system-pathways (brief concept of classical and alternative pathway). Brief idea on MAC complex.
9. Vaccination – Principles, Universal protocol on Immunization-brief idea, primary and secondary reaction of vaccination, health reaction due to vaccination, memory cell formation due to vaccination and importance of immunization and concept on booster dose.
10. Basic principles of immunological techniques and their application - RIA and ELISA.
11. Immunopathology - Basic principles of autoimmune disease (Hashimoto disease, SLE, Myasthenia gravis and Graves' disease).
12. AIDS- Causative virus, mode of transmission, effects on human body, preventive measures.



4.4 DSE P2 – Microbiology and Immunology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Gram staining of bacteria and identification of Gram positive and Gram-negative bacteria.
2. Blood grouping and Rh typing
3. Bacterial spore Staining
4. Preparation of bacteria culture media.
5. Demonstration: Radial immuno-diffusion and Acid-fast staining of bacteria.

OR

4.3 DSE T2 – Genetics and Molecular Biology

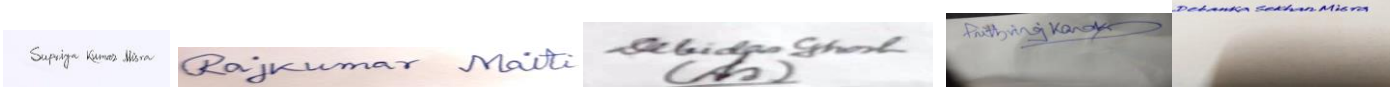
[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] 4 Credits

Genetics

1. Basic principles of Mendelian genetics - monohybrid and dihybrid.
2. Test and back crosses.
3. Bacterial genetics-transformation, transduction, conjugation (mention of F+ /F-, Hfr strain, function of pilus).
4. Extension of Mendelism - Epistasis and its different types present in plants and animals. Penetrance, expressivity, pleiotropism.
5. Numerical and Structural variations in chromosome - Basic concepts of aneuploids and polyploids.
6. Crossing over and Linkage
7. Gene Mapping and SNP analysis.
8. Human Cytogenetics - Human Karyotype, banding technique, use of human cytogenetics in medical science, inborn errors of metabolism, aneuploidy in humans. Sex determination and sex linkage.

Molecular Biology

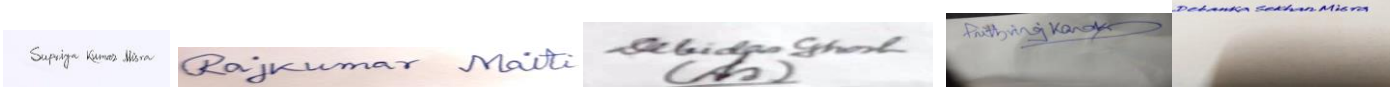
1. Basic concept of molecular biology.
2. DNA replication-Meselson and Stahl Experiment, DNA Polymerases, Ligases and other regulatory proteins.
3. Genetic Code - Properties and wobble hypothesis.
4. Transcription - RNA Polymerase and other regulatory mechanism in prokaryotes.
5. Translation – Codon-anticodon interaction and mechanism in prokaryotes.
6. Regulation of gene expression: Operon Concept – Lac Operon in brief.
7. Gene Mutation – Agents and types.
8. DNA Repairing Processes.
9. Concept of oncogenes and properties of cancer cells.
10. Recombinant DNA technology in brief and its applications – Gene therapy, transgenic animal.
11. Polymerase chain reaction (PCR), RTPCR.



4.4 DSE P2 – Genetics and Molecular Biology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Retrieval of amino acid sequence from mRNA.
2. Retrieval of codogen in DNA from codon sequence of mRNA.
3. Extraction of DNA from supplied sample, extraction of RNA from supplied sample.
4. Quantification of Protein by Bradford Reagent
5. Demonstration-DNA gel electrophoresis (Agarose Gel).



4.5 DSE T3 – Ergonomics and Occupational Physiology

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

1. Genesis and concept of ergonomics – Man-machine-environment interaction.
2. Importance of ergonomics in occupational health and well-being.
3. Classification of Physiological work load. Concept of work rest cycle and its significance.
4. Physical work environment: (a) Thermal environment, its' effect, Heat stress indices, (b) Noise and vibration, its' effect on workers. Occupational deafness, (c) Illumination level and its' effect on visual performances, (d) Ergonomic principles of control of Physical hazards.
5. Static anthropometry, application of anthropometric data in design. Somatotyping
6. User interface and control display compatibility.
7. Prevention of accidents, concept of Industrial safety.
8. Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.

4.6 DSE P3 – Ergonomics and Occupational Physiology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] **2 Credits**

1. Measurement of working heart rate by ten beats methods.
2. Measurement of blood pressure before and after different grades of exercise.
3. Measurement of some common anthropometric parameters (Sitting and standing posture). Calculation of BSA and BMI from anthropometric data.
4. Measurement of WBGT indices.
5. Measurement of noise level by noise level meter.
6. Demonstration of determination of cardiac cost of specific work.

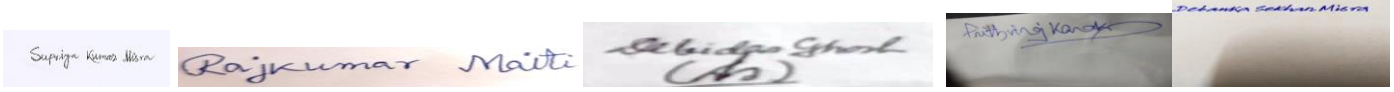
OR

4.5 DSE T3 – Environmental Physiology and Toxicology

[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

Unit 1
Environmental Pollutions and Health Hazards

1. Air Pollution: definition, sources, air pollutants, effects of air pollution on human health, concept of ozone hole, green house effects and global warming, acid rain, photochemical smog.
2. Water Pollution: definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, arsenic pollution, concept of safe drinking water standards.
3. Soil Pollution: causes, health hazards, soil pH and soil moisture level study, solid waste managements – Bioremediation and phytoremediation.
4. Sound Pollution: Definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (Noise standards).



5. Radionuclide Pollution: Ionizing radiations, effects of ionizing radiation on human health, permissible doses.
6. Concept of hygiene and sanitization and their impact on public health.
7. Air, Water, Food Borne Diseases – Influenza, cholera, typhoid and hepatitis A, their causes, symptoms and control.
8. Food additives and adulterants: Definition, examples and human health hazards.
9. Vector Borne Epidemic Diseases: Malaria and Plague-etiology and control.

Environmental management

1. Environmental ethics
2. Conservation of topsoil, ground water and wild lives; rain water harvesting; sanctuary, national park, biosphere reserve, wildlife (conservation) Act, 1992 and EPA act and importance.

Unit 2

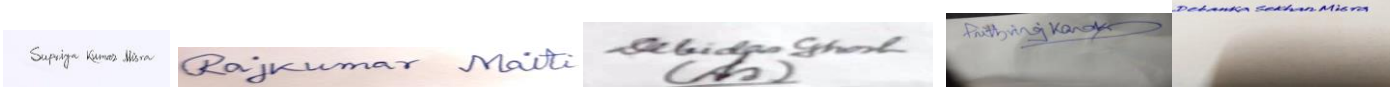
Toxicology

1. General concept on Toxicology.
2. Factors affecting toxicity.
3. LD50, LOD50, ED50, NOEL, LOEL.
4. Concept of acute and chronic effects of toxins.
5. Birth defects and teratogens in brief.
6. Concepts of biomagnification and bioconcentration.
7. Brief idea on Prevention of Food Adulteration Act, 1954.
8. Other Food Toxicants: BPA, BPS, pesticides, PAH, Dioxin, PCB, heavy metals: Pb, Hg, Cd, As etc.

4.6 DSE P3 – Environmental Physiology and Toxicology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] 2 Credits

1. Measurement of dissolved oxygen by Wrinkler's method.
2. Relative humidity measurement by dry bulb and wet bulb thermometer.
3. Suspended particulate matter of specific air sample.
4. LD_{50} measurement from provided graph.
5. Noise intensity measurement by sound level meter.
6. Light intensity measurement by Lux meter.
7. pH measurement of soil and water in different climatic areas.



4.7 DSE T4 – Sports and Exercise Physiology

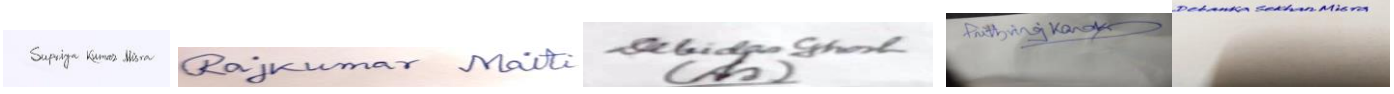
[Theory: Credits 4 (4 Lectures/Week)/ Marks 25] **4 Credits**

1. Introduction on exercise and sports.
2. Physiological work- isotonic, isometric, isokinetic, positive and negative. Brief idea on muscular power, strength and endurance.
3. Importance of regular exercise in health and wellbeing.
4. Basic concept of Bioenergetics, energy sources during exercise (Phosphagen, anaerobic system and aerobic system).
5. Muscles: Types and fiber classification and their role in sports.
6. Cardio-respiratory responses during different grades of exercise.
7. Concept of excess post-exercise oxygen consumption (EPOC), physiological fatigue and recovery.
8. Anaerobic and aerobic work. Aerobic work capacity - Measurement, physiological factors and applications.
9. Training: Principles of physical training, training to improve aerobic and anaerobic power. Effects of overtraining and detraining.
10. Pre-game, intra-game and post-game meals and their nature and importance.
11. Nutritional supplements in exercise and sports, ergogenic aids – Brief concept. Sports drink. Glycogen loading on sports performances.
12. Sports injury and it's management.
13. Basic idea on sports rehabilitation and sports medicine.

4.8 DSE P4 – Sports and Exercise Physiology Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 15] **2 Credits**

1. Measurement of blood pressure before and after different grades of exercise.
2. Recording of recovery heart-rate after standard exercise.
3. Determination of Physical Fitness Index by Harvard Step Test (Modified).
4. Measurement of body fat percentage.
5. Determination of endurance time by hand grip dynamometer.
6. Determination of VO_2 max by Queen College Step Test.
7. Six-minute walk test.



OR

4.7 DSE T4 – Nanobiotechnology and Bioinformatics

[Theory: Credits 6 (6 Lectures/Week)/ Marks 40] **6 Credits**

1. Introduction to nanoscience and nano-biotechnology.
2. Definition of a nano-particles, features and their application on human health maintenance.
3. Types of Nanostructures; Types of nanocrystals - One dimensional (1D)-Two dimensional (2D) -Three dimensional (3D) nanostructured materials - Quantum dots - Quantum wire; Core/Shell structures, micelle and nano-capsule.
4. Synthesis of nanomaterials in brief.
5. Loading and unloading of desired substances to and from the nano-particle, factors affecting and its measurement.
6. Characterization techniques for Nanomaterials: X-ray diffraction; Scanning Electron Microscope (SEM); Transmission Electron Microscopy (TEM).
7. Properties of Nanomaterials: Size dependent properties - Mechanical, Physical and Chemical properties. Types of Nanomaterials: Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO_2, CeO_2, ZnO) – Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites. Applications of Nanomaterials in Biology: Biochemical sensors; Imaging; Cancer treatment etc.
8. Toxicity of nanomaterials in the environment – Health threats.

Suggested Readings

1. Pelczar, M.J. (2001) Microbiology. 5th edition, Tata McGraw-Hill Co, New Delhi.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology. Pearson Benjamin Cummings, USA. 8th edition.
4. Saha, I. Paul. B. (2016). Essential of Biostatistics. 2nd Edition. Academic Publishers.
5. Giri, P.K. Banerjee, J. Statistical Stools and Techniques. Academic Publishers.
6. Das, D. Handbook of Practical Microbiology, Cell Biology Genetics and Biometry. Academic Publishers.
7. Srilakshmi, B. (2016). Nutrition Science. Fifth Edition. New Age International Publishers.
8. Srilakshmi, B. (2014). Dietetics. Seventh Edition. New Age International Publishers.
9. Das S. Textbook of Normal and Therapeutic Nutrition. Academic Publishers.
10. Das S. (2016).Textbook of Community Nutrition. 2nd Edition. Academic Publishers.
11. Basu, P. Nutritional Biochemistry. Academic Publishers.
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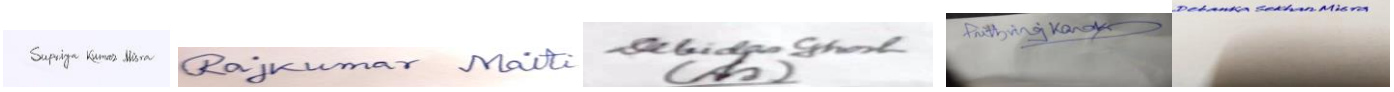

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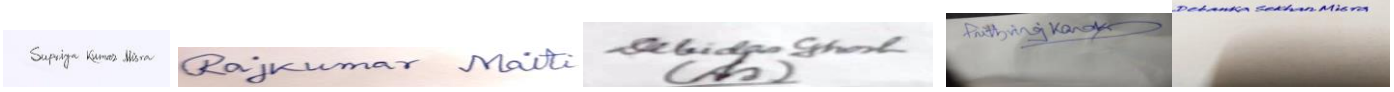

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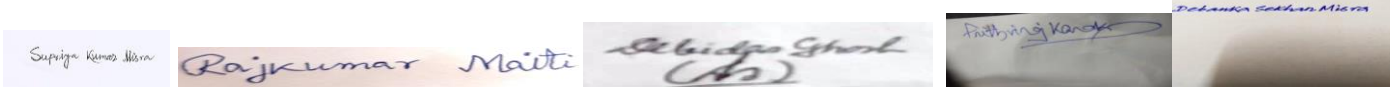


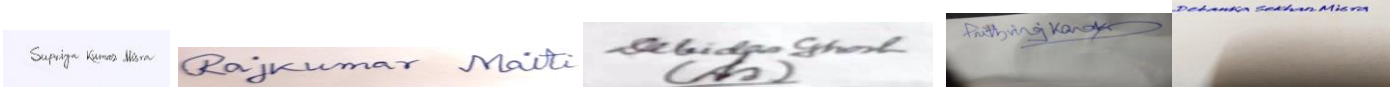
5. Skill Enhancement Courses

CO-SEC P1: Detection of Food Adulteration Lab – From these SEC paper students will learn about different type food adulteration, heavy metals and their toxic effects on food as well as human health.

CO-SEC P1: Hematological Techniques Lab – In this paper student will get expertise on different hematological techniques for blood sample analysis.

CO-SEC T1: Clinical Biochemistry – From this paper student will gather knowledge about principle and application of colorimeter and spectrophotometer. They will also learn about pathophysiological significance of different physiologically important biomolecules and enzymes.

CO-SEC T1: Pathological Microbiology and Bio-Medical Technology – This paper will helps our students to enhance their knowledge about modern biomedical instrumentation and techniques. They will also learn about how to handle sample of infectious disease.



5.1 SEC P1 – Detection of Food Adulteration Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 40] 2 Credits

Qualitative tests for Food Adulteration

Qualitative tests for identifying food adulterants in some food samples:

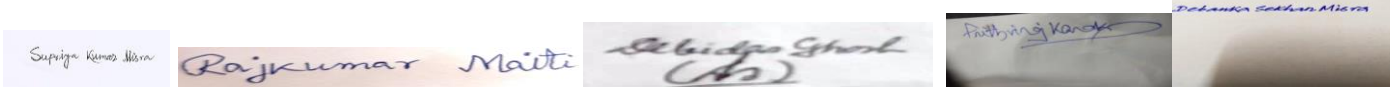
Metanil yellow, rhodamin B, saccharin, monosodium glutamate, aluminium foil, chicory, bisphenol A and bisphenol S, chocolate brown HT, margarine, Pb, Hg, As, PCB, Dioxin etc. in turmeric powder, besan, laddoo, noodles, chocolate and amriti.

OR

5.1 SEC P1 – Hematological Techniques Lab

[Practical: Credits 2/ (4 Practical Classes/Week) /Marks 40] 2 Credits

1. Preparation of blood smear and identification of blood cells.
2. ESR measurement by Wintrobe's or Western green method.
3. Total count of RBC and WBC.
4. Determination of haematocrit, MCV, MCH, MCHC, bleeding time, clotting time.
5. Measurement of hemoglobin (Cyanmethemoglobin method) in blood.
6. Preparation of serum.
7. Estimation of serum urea and creatinine by using kit.
8. Blood sugar estimation By Nelson-Somogyi method.
9. Osmotic fragility test.
10. Quantification of serum total protein by Biuret method.



5.2 SEC T1 – Clinical Biochemistry

Theory: Credits 2 (2 Lectures/Week)/ Marks 40] **2 Credits**

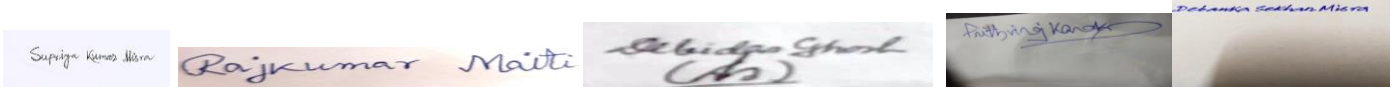
1. Principle and application of colorimeter and spectrophotometer.
2. Pathophysiological significance of blood parameters – Glucose, serum protein, albumin, urea, creatinine, uric acid, bilirubin and ketone bodies.
3. Alteration of lipid and thyroid profile in health and disease.
4. Strength of solution: Normality and molarity with calculation.
5. Pathological significance of some enzymes and proteins: Lactate dehydrogenase, glucose-6-phosphate dehydrogenase, creatin kinase, amylase, ACP, ALP, Beta-glucuronidase, ALT, AST, Lipase, Gamma-glutamyl transpeptidase, cardiac troponins and CRP.

OR

5.2 SEC T1 – Pathological Microbiology and Bio-Medical Technology

Theory: Credits 2 (4 Lectures/Week)/ Marks 40] **2 Credits**

1. Introduction on Pathological Microbiology and Bio-Medical Technology.
2. Classification of bacteria. Cell wall structure of Gram-positive and Gram-negative bacteria.
3. Basic precautionary measures taken against bacterial and viral infection –
   a. During sample collection.
   b. At the time of handling in the laboratory.
4. Identification of tubercular bacteria in sputum (Demonstration: with utmost precautionary measures).
5. Bacterial growth curve and generation time.
6. Different types of culture and media.
7. Different types of vectors – Plasmid, Cosmid.
8. Biomedical techniques – ECG, EEG, EMG, ERG, PCR, RT-PCR (Principle, procedure, normal wave and clinical application)
9. Principle and application of – CO_2 incubator, Doctor's Centrifuge, Colorimeter, Spectrophotometer, Laminar air flow.



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9. Pelczar, M.J. (2001) Microbiology. 5th edition, Tata McGraw-Hill Co, New Delhi.
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14. Chattopadhyay P. (2011). Practical Physiology. 1st Edition. New Central Book Agency.
15. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
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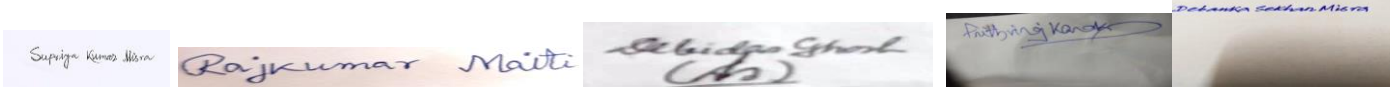


6. General Elective Course

Course Outcome (CO)

COT-1: Cellular Components, Biophysical and Biochemical Concepts – From this paper student will learn about cellular function, enzymes, a variety of terms specific to the bio-physics and biomolecules.

COT-2: Blood, Cardio-respiratory and Neuromuscular Systems – From this paper student will learn about components of blood and their function along with synthesis of hemoglobin. They also learn about nerve muscle physiology and cardiorespiratory functions.

COT-3: Digestion, Metabolism, Nutrition and Excretion – This paper will help to gather knowledge about digestion and absorption of food, different anabolic and catabolic reaction, basic components of food with their nutritional values and excretion of metabolic waste materials.

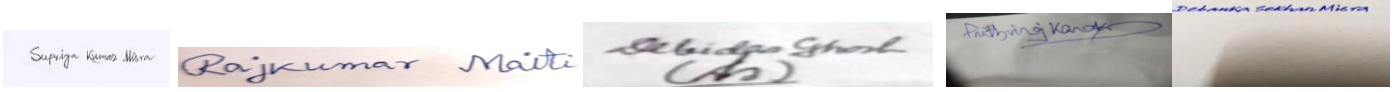
COT-4: Neurosensory, Endocrine and Reproductive Systems – From this paper Student will learn about physical and chemical coordination of human body system along with the male and female reproductive system.

COP-1: Cellular Components, Biophysical and Biochemical Concepts Lab - Students will gather knowledge about different parts and use of compound microscope along with histological structure of different organs and glands.

COP-2: Blood, Cardio-respiratory and Neuromuscular Systems Lab – From this practical paper student acquire the practical knowledge about lung function test, pneumographic recording of chest movement, blood film preparation, identification of different blood cells, bleeding time, and clotting time.

COP-3: Digestion, Metabolism, Nutrition and Excretion Lab – This practical paper will help to increase the ability of students in qualitative identification physiologically important biomolecules

COP-4: Neurosensory, Endocrine and Reproductive Systems Lab – This practical paper helps our students to know about basic idea on kymograph and its application on nerve muscle preparation of toad. They will be able to measure visual acuity, colour blindness and histology of male and female reproductive organs.



6.1 GE T1 – Cellular Components, Biophysical and Biochemical Concepts

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Units of Human System

1. Introduction to Human Physiology.
2. Structure and functions of plasma membrane, nucleus and different cell organelles - Endoplasmic reticulum, golgi bodies, mitochondria, ribosome, lysosome and peroxisome.
3. Structure, function and classification of epithelial, connective, muscular and nervous tissues.

Biophysical Principles

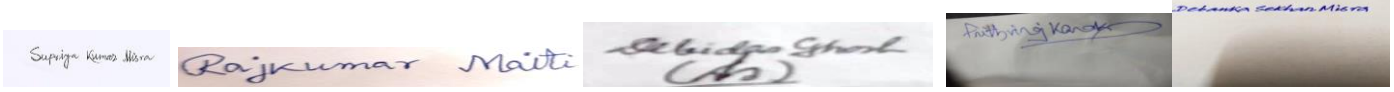
1. Physiological importance biophysical processes: Diffusion, osmosis, dialysis, ultra filtration, surface tension, absorption and adsorption.
2. pH and Buffers: Brief idea and significance in human body.
3. Colloids: Definition, classification, properties and physiological importance.

Enzyme

1. Definition, classification, factors affecting enzyme action.
2. Michelis Menten equation and hyperbolic kinetics of enzyme action in brief.
3. Regulation of enzyme action in brief.
4. Concept of coenzymes and isozymes.

Chemistry of Bio-molecules

1. Carbohydrates: Definition, classification with examples, sources, fundamental properties, and physiological importance.
2. Lipids: Definition, classification, properties and physiological importance.
3. Proteins: Definition, Classification, important properties and function. Essential and non-essential amino acid.
4. Nucleic acids: Structure of DNA and RNA.



6.2 GE P1: Cellular Components, Biophysical and Biochemical Concepts Lab

(Practical: Credits 2/ Marks 15) 2 Credits

Identification of permanent slides and Fresh tissue preparation

1. Elementary idea of compound microscope and its use.
2. Introductory discussion on preparation of permanent slide.
3. Lung, trachea, spleen, lymph gland, liver, salivary glands, pancreas, esophagus, stomach, small intestine, large intestine, ovary, adrenal gland, testis, thyroid gland, spinal cord, cerebellum, cerebral cortex, kidney, skin and tongue.

Experiment on fresh tissues

1. Preparation and staining of fresh tissue: Squamous and skeletal muscle fibre by methylene blue stain.

Suggested Readings

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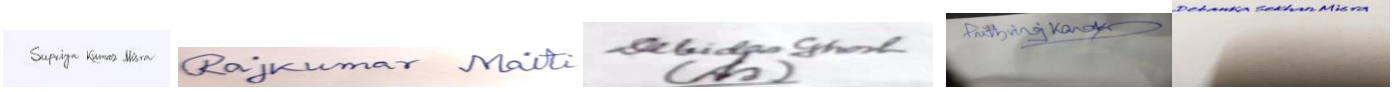

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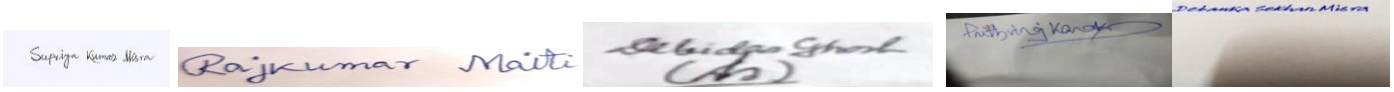


SEMESTER - II

GE T2 - Blood, Cardio-respiratory and Neuromuscular Systems

6.3 [Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Blood and Body Fluid

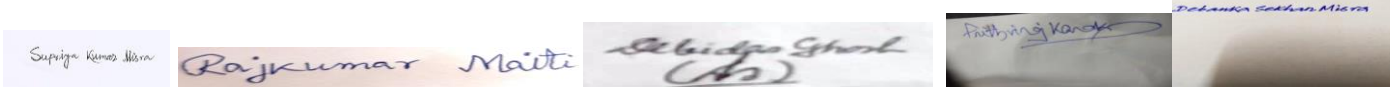
1. Blood: Composition, functions, plasma and serum.
2. Plasma proteins: Origin, classification and functions.
3. Blood cells: Morphology and functions.
4. Erythropoiesis: Different stages, factors affecting and fate of RBC.
5. Anaemia: types (Definition and causes).
6. Haemoglobin: Types, biosynthesis, functions and derivatives.
7. Coagulation of blood: Coagulation factors, mechanism of coagulation, procoagulants and anticoagulants.
8. Lymph and tissue fluids: Composition, formation, and functions.
9. Blood groups: ABO system and Rh typing. Blood transfusion and its hazards.

Cardiovascular Physiology

1. Anatomy of the heart.
2. Properties of cardiac muscle.
3. Origin and propagation of cardiac impulse.
4. Cardiac cycle: Events, heart sounds and heart rate.
5. Cardiac output: Determination by Fick principle, factors affecting.
6. Blood pressure and its regulation and factors controlling.
7. Methods of measurement of blood pressure.
8. Peculiarities of regional circulations: Coronary and cerebral.
9. Myocardial ischemia and heart block.

Respiratory Physiology

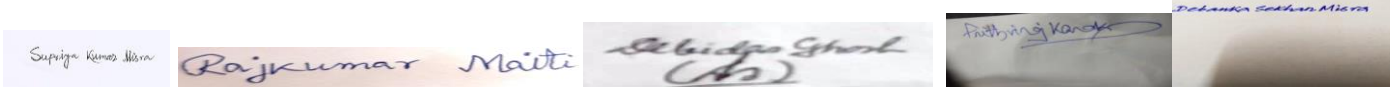
1. Functional anatomy of the respiratory system.



2. Mechanism of breathing. Significance of physiological and anatomical dead space. Lung volumes and capacities.
3. Transport of oxygen and carbon dioxide in blood and tissue.
4. Regulation of respiration: Neural and chemical.
5. Hypoxia, Caisson's disease, cyanosis, anoxia and acclimatization in brief.

Neuro-muscular System

1. Structure of neurons.
2. Origin and propagation of nerve impulse.
3. Properties of nerve fibers: Excitation, conduction, All or none law and refractory period.
4. Synapses: Types, EM structure, mechanism of synaptic transmission. Motor unit and motor point.
5. Myoneural junction - Structure, mechanism of impulse transmission. Degeneration and regeneration in nerve fibers.
6. Different types of muscle and their structure. Red and white muscle. Muscular contraction: Structural, mechanical and chemical changes in skeletal muscle during contraction and relaxation. Isotonic and isometric contractions.
7. Properties of muscle - All or none law, beneficial effect, summation, refractory period, rheobase and chronaxie, tetanus and fatigue.



6.4 GE P2: Blood, Cardio-respiratory and Neuromuscular Systems Lab

Haematological experiments

1. Preparation and staining of human blood film with Leishman's stain and identification
   of different types of blood corpuscles.
2. Determination of blood group: ABO system and Rh factor.
3. Preparation of haemin crystals.
4. Determination of clotting time and bleeding time.

Lung function tests

Measurement of TV and VC by spirometer.

Recording of chest movement by Pneumograph:

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

Suggested Readings

1. Mahapatra, A.B.S. (2011). Essentials of Medical Physiology Practical. First Edition. Current Books International'.
2. Ghai, C.L. A Text Book of Practical Physiology. 8th Edition. Jaypee.
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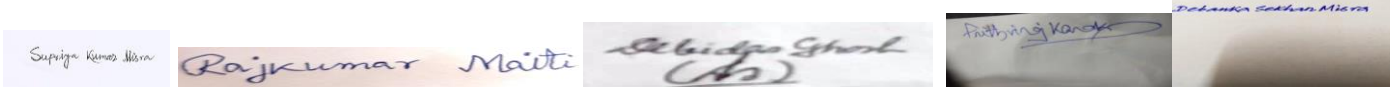


6.5 GE T3 - Digestion, Metabolism, Nutrition and Excretion

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Digestive system:

1. EM structure of alimentary canal and digestive glands.
2. Movements of the alimentary canal and significance. Mastication and deglutition.
3. Composition and functions of digestive juices and bile.
4. Mechanism of secretions HCl and bile.
5. Digestion and absorption of carbohydrate, protein and lipid.

Metabolism

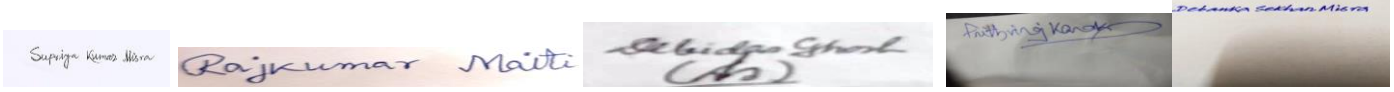
1. Metabolism of carbohydrate: Glycogenesis in brief, glycolysis, glycogenolysis, gluconeogenesis, pentose phosphate pathway, TCA cycle and Cori cycle – Their significances.
2. Metabolism of lipids: Fatty acid bio synthesis, lipolysis, Beta oxidation and omega oxidation of fatty acids. Brief ideas on fat storage and adipose tissue.
3. Formation and fate of ketone bodies. Lipoprotein – Classification and their importances.
4. Metabolism of proteins: Elementary idea of protein synthesis, transamination, oxidative and non-oxidative deamination. Formation of urea.
5. Integration of carbohydrate, lipids and protein metabolism in brief.

Nutrition

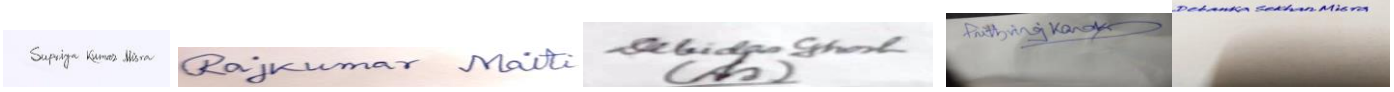
1. Basic constituents of food and their nutritional significance, dietary fiber and its importance.
2. Vitamins: Definition, sources, daily requirements, functions, deficiency symptoms and hypervitaminosis.
3. Mineral metabolism: Ca. P, Fe (Source, absorption and physiological function).
4. BMR: Definition, factors affecting and determination by Benedict-Roth apparatus. Respiratory quotient: Definition, factors affecting and significance.
5. Brief idea on: Nitrogen balance, biological value of proteins, digestibility coefficient, net protein utilization, protein efficiency ratio. Supplementary action of protein, specific dynamic action, protein sparing food.
6. RDA, Adult Consumption Unit and NPN.
7. Basic principle and methods for diet chart preparation.
8. Diet chart preparation - College student, pregnant and lactating mother.

Excretory system

1. Anatomical organization of urinary system. Gross structure of kidney.
2. Renal circulation: Anatomy and peculiarities.



3. Microanatomy (Including electron microscopy) of a nephron and structure differences between cortical and juxtamedullary nephrons. Juxtaglomerular apparatus.
4. Mechanism of formation of urine. Concept of ultrafiltration, glomerular filtration rate. Passive and active tubular transport.
5. Innervation of urinary bladder in brief, filling of bladder.
6. Micturition. Micturition reflexes, diuresis and role of ADH (In brief).
7. Normal and abnormal constituents of urine and their significance. Concept of renal threshold. Functions of kidney and renal function tests (inulin and urea clearance tests).
8. Non-excretory functions of kidney.



6.6 GE P3: Digestion, Metabolism, Nutrition and Excretion Lab

(Practical: Credits 2/ Marks 15) 2 Credits

Qualitative Experiments

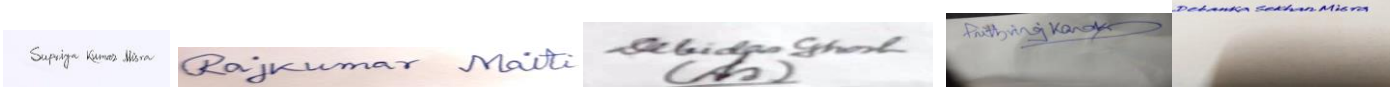
1. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic acid, glucose, fructose, lactose, sucrose, starch, albumin, peptone, urea, acetone, glycerol, bile salts - Systematic analysis and confirmatory test.

Quantitative Experiments

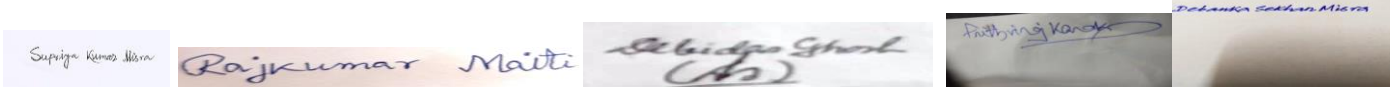
1. Quantitative estimation of glucose by Benedict's method - Percentage and total quantity.
2. Quantitative estimation of amino nitrogen (Sorensen's Formol titration method) - Percentage and total quantity.

Suggested Readings

1. Srilakshmi, B. (2016). Nutrition Science. Fifth Edition. New Age International Publishers.
2. Srilakshmi, B. (2014). Dietetics. Seventh Edition. New Age International Publishers.
3. Das S. Textbook of Normal and Therapeutic Nutrition. Academic Publishers.
4. Das S. (2016).Textbook of Community Nutrition. 2nd Edition. Academic Publishers.
5. Basu, P. Nutritional Biochemistry. Academic Publishers.
6. Srilakshmi, B. (2015). Food Science. Sixth Edition. Age International Publishers.
7. Swaminathan, M. (2012). Handbook of Food and Nutrition. Jain Book Agency.
8. Swaminathan, M. (2015). Essentials of Food and Nutrition. Vol. I AND Vol. II. The Bangalore Printing and Publishing Co., Ltd.
9. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
10. Hall J.E. (2016). Guyton & Hall Textbook of Medical Physiology. Second South Asia Edition.
11. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
12. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
13. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
14. Berne , R.M. and Levy M.N. Physiology. C.V.Mosby Co.
15. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
16. Barrett, K. E. Barman, S.M., Boitano, S. Brooks, H.L. (2012).Ganong's Review of Medical Physiology. 24th Edition. Lange Medical Book. Prentice-Hall International.
17. Pal, G.K. Pal, P. (2013).Textbook of Practical Physiology. Third Edition. Universities.
18. Shepherd.G.M. Neurobiology. Oxford University Press.
19. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.



20. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.
21. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol I. Santra Publication Pvt. Ltd
22. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.
23. Debnath, J. (1998). Sharir Bigyan. Vol. I & II. Shreedhar Prokashani, Kolkata.
24. Debnath, J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.



6.7 GE T4 - Neurosensory, Endocrine and Reproductive Systems
[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Nervous System

1. A brief outline on organization and basic functions of (Sensory, motor and association) the nervous system.
2. Histology of spinal cord.
3. Origin, course, termination and functions of – Gall and Burdach tract, spino-thalamic tract, cortico-spinal tact and pyramidal tract.
4. Reflex action - Definition, reflex arc, classification, properties and function.
5. A brief idea of the structure and functions of cerebellum.
6. Functions of thalamus and hypothalamus.
7. Cerebral cortex: Histological structure and functions.
8. CSF - Composition, formation and functions.
9. A brief description of the organization of the autonomic (Sympathetic and parasympathetic) nervous system. Functions of sympathetic and parasympathetic nervous system.

Sensory Physiology

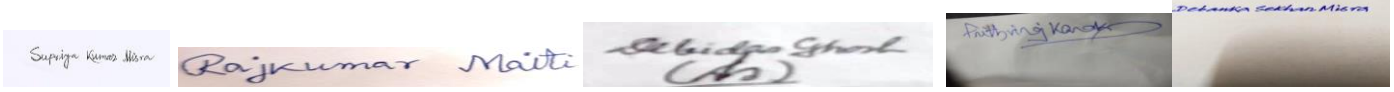
1. Audition: Structure of ear, auditory pathway, mechanism of hearing. Deafness in brief.
2. Vision: Structure of the eye. Histology of retina. Visual pathway. Light reflex. Chemical changes in retina on exposure to light. Accommodation - Mechanism. Errors of refraction. Light and dark adaptation.
3. Elementary idea of colour vision and colour blindness.
4. Olfaction and gustation: Structure and function of receptor organs, neural pathway. Olfactory and gustatory adaptation. After taste.

Endocrine System

1. Hypothalamus: Location, Hypothalamo-hypophyseal-endocrine axis and portal system. Releasing factors, in brief. Basic concept of neurohormone.
2. Pituitary: Histological structure, hormones and functions.
3. Thyroid: Histological structure, functions of thyroid hormones (T_4 and T_3). Thyrocalcitonin. Hypo and hyper-active states of thyroid.
4. Parathyroid: Histological structure, functions of parathyroid hormone.
5. Adrenal gland: Histological structure and function.
6. Pancreas: Histology of islets of Langerhans. Origin and functions of pancreatic hormones.
7. Brief idea of gastrointestinal hormone.
8. Cause of major pathophysiology of endocrine gland in brief (Gigantism, dwarfism, acromegaly, goiter, tetany, Cushing's syndrome and diabetes mellitus).

Reproductive Physiology

1. Primary and accessory sex organs. Secondary sex characters.
2. Puberty- Physiological changes.
3. Testis: Histology, spermatogenesis, hormonal control, testicular hormones and their functions.
4. Ovary: Histology, oogenesis, hormonal control. Ovarian hormones and their functions.
5. Menstrual cycle and its hormonal control.
6. Development of mammary gland and lactation - Role of hormones.
7. Fertilization and implantation.
8. Pregnancy: Physiology and hormonal control.



6.8 GE P4: Neurosensory, Endocrine and Reproductive Systems Lab

(Practical: Credits 2/ Marks 15) 2 Credits

1. Kymograph and its accessories.
2. Recording of simple muscle curve with sciatic-gastrocnemius muscle preparation of toad.
3. Determination of visual acuity by Snellen's chart / Landolt's C chart.
4. Determination of colour blindness by Ishihara chart. Exploration of conductive and perceptive deafness by tuning fork method.
5. HE staining and identification of testis and ovary of supplied paraffin embedded tissue section.
6. Sign, symptoms and reasons of pathophysiological state of the photograph provided within the syllabus on hyper and hypo active states of endocrine glands.

Suggested Readings:

1. Chatterjee, C.C. Human Physiology Vol. 1 & 2, Medical Allied Agency.
2. Debnath J. Sharirbigyan (Bengali) Vol. I & 2. Sridhar Prakashani.
3. Pramanik, D. Principles of Physiology. Academic Publishers, Kolkata.
4. Chaudhuri, S.K. Concise Medical Physiology. New Central Book Agency.
5. Bandopadhyay, A. Snatok Sharirbidya, , Calcutta Book House.
6. diFiore's Atlas of Histology, V.P. Eroschenko, Wolters-Kluwer
7. Shaver, L.G. Essentials of Exercise Physiology. Surjeet Publications.
8. Guyton, C. Text Book of Medical Physiology, W.B. Saunders Co.
9. Venkatesh, D. Sudhakar, H.H. Textbook of Medical Physiology, Wolters Kluwer
10. Khurana, I. Textbook of Medical Physiology, Elsevier
11. Mahapatra, A.B.S. Medical Physiology. Current Books International.
12. Sembulingam, K. Sembulingam, P. Essentials of Medical Physiology. Jaypee Brothers Medical Publishers Pvt. Ltd.
13. Manna, M.K. Practical Physiology. Sritara Prakashani, Kolkata.
14. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.
15. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.
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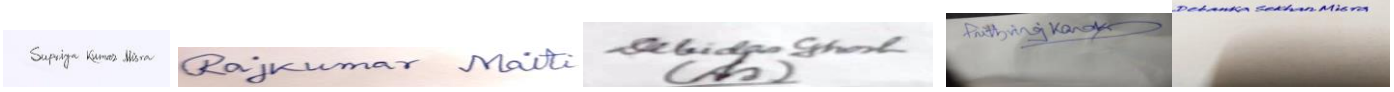
17. Debnath, J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.



CBCS SYLLABUS

FOR

THREE YEARS UNDER-GRADUATE COURSE

IN

PHYSIOLOGY (PROGRAMME)

(*w.e.f. 2022*)

BANKURA UNIVERSITY

BANKURA

WEST BENGAL

PIN 722155

CONTENTS

1. Scheme for CBCS Curriculum

1.1 Credit Distribution across Courses

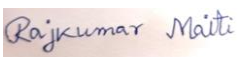
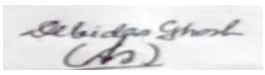
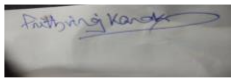
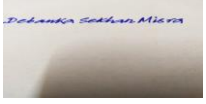
		Credits
Course Type	**Total Papers**	**Theory + Practical**
Core Courses	12	12*4 =48 12*2 =24
Discipline Specific Electives	6	6*4=24 6*2=12
Ability Enhancement Language Courses	2	1*2=2 (ENG / MIL) 1*4=4 (ENVS)
Skill Enhancement Courses	4	4*2=8
Totals	24	122

1.1.1 Question pattern across Courses

Question Pattern							
Examination	Course type (Programme)	Credits (Theory + Practical)	Type of questions	Marks/ question	No of questions to be attempted	Total	No of options (Out of)
	Total Marks (Theoretical)					25	
	CC, DSE	4	Objective	1	5	5	8
			Short	5	2	10	4
			Broad	10	1	10	2
	Total Marks (Theoretical)					40	
	SEC	2	Very short	2	5	10	8
			Short	5	4	20	6
			Broad	10	1	10	2
	Total Marks (Practical)					15	
	CC, DSE	2	Practical work	10	Answer all the question	10	NA
			Laboratory Note Book	3		3	NA
			Viva Voce	2		2	NA
	Total Marks (Practical)					40	
	SEC	2	Practical work	10	3	30	3
			Laboratory Note Book	5	NA	5	NA
			Viva Voce	5	NA	5	NA

Duration of Examinations

Subject and Type of Papers	Full Marks	Duration
Program (Theoretical)	25	1 Hour 15 Minutes
Program (Theoretical)	40	2 Hours
Program (Practical)	15	2 Hours
Program (Practical)	40	4 Hours

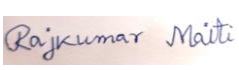
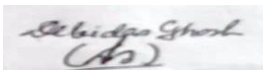
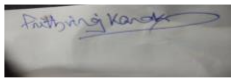
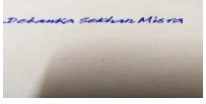






1.2 Scheme for CBCS Curriculum in Physiology (Programme)

SEMESTER –I

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec	Tu.	Pr.
UGP/PHYG/101/ C-1A	**CT-1: Cellular Basis of Physiology and Biophysical Principles** **CP-1: CT-1: Cellular Basis of Physiology and Biophysical Principles Lab**	4 2	10	25 15	50	4	NA	4
UGP/102/ C-2A	Discipline-2 From another discipline	6	10	40	50			
UGP/103/ C-3A	Discipline-3 From another discipline	6	10	40	50			
UG/ 104/ AECC-ENV	**Environmental Studies**	4	10	40	50	4	NA	NA
Total in Semester – I		**22**	**40**	**160**	**200**	**8**		**4**

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER –II

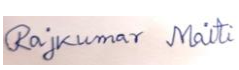
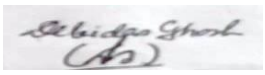
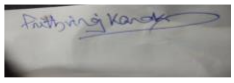
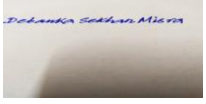
Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UGP/PHYG/ 201/C-1B	**CT-2: Cardiovascular, Respiratory and Neuromuscular Physiology** **CP2: Cardiovascular, Respiratory and Neuromuscular Physiology Lab**	4 2	10	25 15	50	4	NA	4
UGP/202/ C-2B	Discipline – 2 From another discipline	6	10	40	50			
UGP/ 203/C-3B	Discipline – 3 From another discipline	6	10	40	50			
UG/204/ AECC-E/MIL	English/MIL	2	10	40	50	4	NA	NA
Total in Semester – II		**20**	**40**	**160**	**200**	**8**		**4**

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER –III

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec	Tu.	Pr.
UGP/ PHYG/ 301/C-1C	**CT-3 Digestive System, Metabolism, Nutrition and Excretory System** **CP-3: Digestive System, Metabolism, Nutrition and Excretory System Lab**	4 2	10	25 15	50	4	NA	4
UGP/302/C-2C	Discipline – 2 From another discipline	6	10	40	50			
UGP/ 303/ C-3C	Discipline – 3 From another discipline	6	10	40	50			
UGP/PHYG/ 304/ SEC-1	**SECP-1: Food Pollutants Lab**	2	10	40	50	NA	NA	4
Total in Semester – III		**20**	**40**	**160**	**200**	**4**		**8**

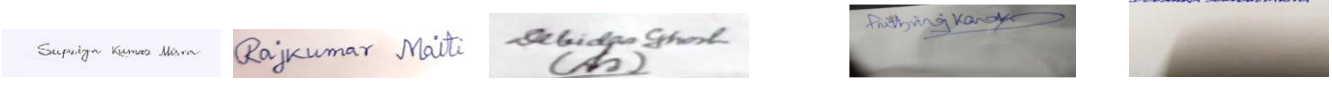
N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER –IV

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UGP/PHYG/ 401/C-1D	**CT-4: Endocrine, Reproductive, Nervous System and Special Senses** **CP-4: Endocrine, Reproductive, Nervous System and Special Senses Lab**	4 2	10	25 15	50	4	NA	4
UGP/ 402/C-2D	Discipline-2	6	10	40	50			
UGP/ 403/C-3D	Discipline-3	6	10	40	50			
UGP/ PHYG/ 404/ SEC-2	**SECP-2: Methods in Hematology Lab**	2	10	40	50	NA	NA	4
Total in Semester – IV		**20**	**40**	**160**	**200**	**4**		**8**

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week



SEMESTER – V

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec	Tu.	Pr.
UGP/PHYG/ 501/DSE-1A	Any one of the following **DSET-1: Sports and Work Physiology** **DSEP-1: Sports and Work Physiology Lab** **or** **DSET-1: Social Physiology and Community Health** **DSEP-1: Social Physiology and Community Health Lab**	4 2	10	25 15	50	4	NA	4
UGP/502/DSE-2A	Discipline – 2 From another discipline	6	10	40	50			
UGP/503/DSE-3A	Discipline – 3 From another discipline	6	10	40	50			
UGP/ PHYG/ 504/SEC-3	**SECT-1: Biostatistics, Computer and Instrumentation**	2	10	40	50	2	NA	NA
Total in Semester – V		**20**	**40**	**160**	**200**	**6**		**4**

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

SEMESTER – VI

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
UGP/PHYG/ 601/DSE-1B	Any one of the following **DSET-2: Microbiology and Immunology** **DSET-2: Microbiology and Immunology Lab** **OR** **DSET-2: Environmental Physiology** **DSEP-2: Environmental Physiology Lab**	4 2	10	25 15	50	4	NA	4
UGP/602/DSE-2B	Discipline – 2 From another discipline	6	10	40	50			
UGP/603/DSE-3B	Discipline – 3 From another discipline	6	10	40	50			
UGP/PHYG/ 604/SEC-4	**SECT-2: Applied Biochemistry**	2	10	40	50	4	NA	NA
Total in Semester – VI		**20**	**40**	**160**	**200**	**8**		**4**

N.B. Theory:- 1 Credit= 1 hour/Week, Practical:- 1 Credit= 2 hours/Week, Tutorial:- 1 Credit= 1 hour/Week

UGP= Under Graduate programme/Pass, S.C.= Subject Code C= Core Course, E/H/MIL= English/ Hindi/ Modern Indian Language, H/MIL/E= Hindi/ Modern Indian Language/ English, AECC-E= Ability Enhancement Compulsory Course-English, AECC-ENV= Ability Enhancement Compulsory Course-Environmental Science, SEC= Skill Enhancement Course, GE= Generic Elective, DSE= Discipline Specific Elective IA= Internal Assessment, ESE= End-Semester Examination, Lec.= Lecture, Tu.= Tutorial, and Pr.=Practical

1.3 Choices for Discipline Specific Electives

DSET-1: Sports and Work Physiology

DSEP-1: Sports and Work Physiology Lab

Or

DSET-1: Social Physiology and Community Health

DSEP-1: Social Physiology and Community Health Lab

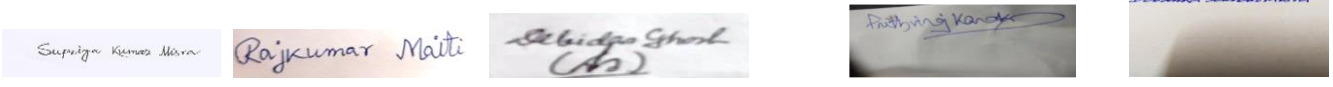
DSET-2: Microbiology and Immunology

DSEP-2: Microbiology and Immunology Lab

Or

DSET-2: Environmental Physiology

DSEP-2: Environmental Physiology Lab



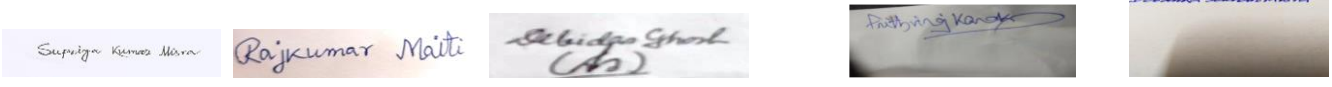
1.4 Choices of Skill Enhancement Courses

SEC P1 – Food Pollutants Lab

SEC P2 – Methods in Hematology Lab

SEC T1 – Biostatistics, Computer and Instrumentation

SEC T2 - Applied Biochemistry



Program Outcomes

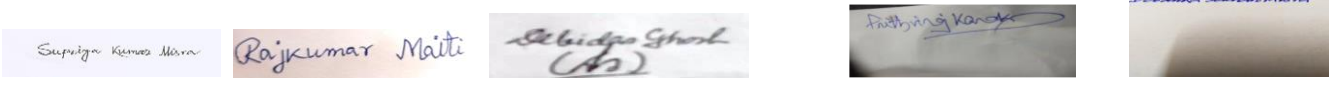
P.O.1: Students will be enriched about the knowledge covering the functional activities of different physiological systems operating in co-ordinated fashion from molecular and cellular levels to the system levels.

P.O.2: Participants of this course will be empowered by perceiving information about the impact of environmental biotic and abiotic factors for the maintenance of homeostasis of human body.

P.O3: Learners will be skilled and expertised themselves for doing biophysical and biochemical analysis of human body samples for assessment of health status and dissemination of public health awareness package to the community.

P.O4: Student will be oriented for cognitive power upgradation and problem-solving activity in different biological deviated conditions in connection with acclimatization to real life situation.

P.O5: Undergraduate students will capable to achieved integrated and interdependent knowledge among human body activities in collaborative manners with plant and animal kingdom in a holistic fashion.



Program Specific Outcomes

Course Objectives

Physiology provides a broad scientific education, which allows our graduates to pursue a career in research work or in related subjects and in areas such as Universities, Research Institute, the Pharmaceutical Industry and scientific publishing or public health. As a graduate, the students will have a number of direct avenues -

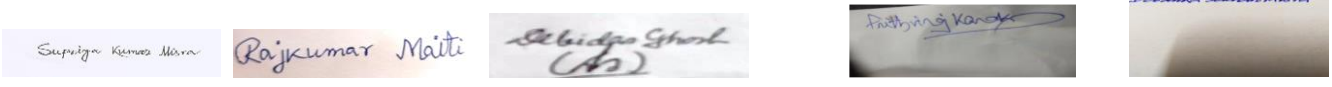
P.S.O1: Will orient the students and attract them for pursuing higher studies in this line and for carrier building in the field of health sector, formal education sector, pharma industries, biotechnological corporates etc.

P.S.O2: Will facilitate the student for fundamental knowledge perception which will drive them to conduct further study in research in the field of allied health sciences, medical sciences, veterinary sciences and others.

P.S.O3: Will support the students for self-dependent learning and understanding to conduct experiments, knowledge bank enrichment and spreading the health awareness information through information-communication-technology.

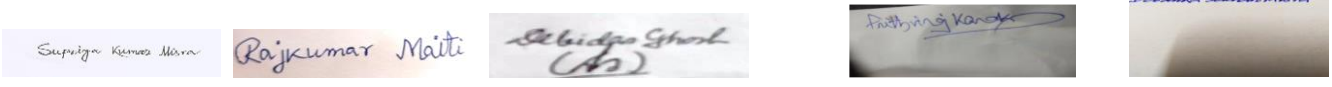
P.S.O4: This course will provide a sound basis in human physiology to support further study in health and medical sciences or related fields.

P.S.O5: On working in different designing industry as an Ergonomist.



Knowledge and Understanding

1. Will facilitate disease prevention, early recovery from diseases and health promotion by improving DALY through developing health friendly attitude and practices by adopting healthy food style, life style, hygiene and sanitation.
2. Will help for understanding the different physiological events operating in our body from the viewpoints of biochemical and biophysical dimensions.
3. Will favour to achieve knowledge for explaining the physiological process at cellular level from the dimension of genomics, proteomics and metabolomics.
4. Will drive the students for experience gathering about data collection from societal events covering community health followed by data analysis and statistical testing to find out the cause and effect relationship establishment in favour of community programs and plane design.
5. Will induce the student for obtaining knowledge upgradation about impact of environment on human health considering environment-gene interaction, nutrient-gene interaction, pharma-gene interaction.
6. Will tune the students to expertise themselves about different molecular techniques for unfolding the molecular level of action that give confidents for research conduction in future for benefit of human society.



2. CORE COURSES

SEMESTER – I

Course Outcome (CO)

COT-1: Cellular Basis of Physiology and Biophysical Principles – From this paper students deals with the knowledge in cellular function, biomolecules, enzymes and a variety of terms specific to the bio-physics.

COP-1: Cellular Basis of Physiology and Biophysical Principles Lab - Students will learn about different parts and use of compound microscope along with histological structure of different organs and glands.

2.1 CC-1A T1: Cellular Basis of Physiology and Biophysical Principles

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Units of Human System

1. Introduction to Human Physiology.
2. Structure and functions of plasma membrane, nucleus and different cell organelles - Endoplasmic reticulum, golgi bodies, mitochondria, ribosome and lysosome.
3. Classification and function of epithelial, connective, muscular and nervous tissues.

Biophysical Principles

1. Physiological importance biophysical processes: Diffusion, osmosis, surface tension and absorption.
2. pH and Buffers: Brief idea and significance in human body.
3. Colloids: Definition, classification, properties and physiological importance.

Enzyme

1. Definition, classification, factors affecting enzyme action.
2. Michelis Menten equation and hyperbolic kinetics of enzyme action in brief.
3. Concept of coenzymes, co-factors and isozymes.

Chemistry of Bio-molecules

1. Carbohydrates: Definition, classification with examples, sources, fundamental properties, and physiological importance.
2. Lipids: Definition, classification, properties and physiological importance.
3. Proteins: Definition, classification, important properties and function, essential and non-essential amino acids. Amino acid pool.
4. Nucleic acids: Structure of DNA and RNA.

2.2 CC-1A P1: Cellular Basis of Physiology and Biophysical Principles Lab

(Practical: Credits 2/ Marks 15) 2 Credits

Identification of permanent slides and fresh tissue preparation

1. Compound microscope and its various parts.
2. Elementary idea on preparation of permanent slide.
3. Lung, spleen, lymph gland, liver, pancreas, esophagus, stomach, small intestine, large intestine, ovary, adrenal gland, testis, thyroid gland, spinal cord, cerebellum, cerebrum, kidney, skin and tongue.

Staining of fresh tissue

1. Preparation and staining of fresh tissue: Squamous and skeletal muscle fibre by methylene blue stain.

Suggested Readings

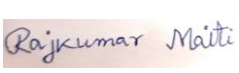
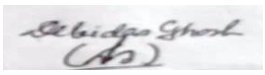
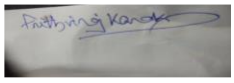
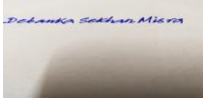
1. Rastogy, S. C. (2005). Cell and molecular biology. New Age International Publishers.
2. Das, D. (2008). Biochemistry. Academic Publishers.
3. Das, D. (2004). Biophysics and Biophysical Chemistry. Fifth Edition. Academic Publishers
4. Satyanarayana, U. and Chakrapani. U. (2013). Biochemistry. 4th Edition. Elsevier India.
5. Keele, C.A., Neil, E., Toels N. (1982). Samson Wright's Applied Physiology. Thirteenth Edition. Oxford University Press.
6. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company
7. Eroschenko, V.P. (2012). Difiore's Atlas of Histology: With Functional Correlations. Twelfth Edition. Lippincott Williams Wilkins Company.
8. 16. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education, Inc. U.S.A. 8th edition.
9. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
10. Mahapatra, A.B.S.M. (2014). Essentials of Medical Physiology. Forth Edition. Current Books International.
11. K Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
12. Khurana, I. (2015).Medical Physiology. 2nd Edition. Elsevier India.
13. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
14. Chaudhuri, S.K.(2008). Concise Medical Physiology. Sixth Edition. NCBA.
15. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.
16. Masanta, N and Das, T. (2019). Snatak Sarirbidya. (UG CBCS syllabus) Vol I. & II Santra Publication Pvt. Ltd
17. Debnath J. (1998). Sharir Bigyan. Vol. I Shreedhar Prokashani, Kolkata.
18. Debnath J . Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.

SEMESTER – II

Course Outcome (CO)

COT-2: Cardiovascular, Respiratory and Neuromuscular Physiology – This paper helps to learn about components of blood and their function along with synthesis of hemoglobin. They also learn about cardiorespiratory functions and nerve muscle physiology.

COP-2: Cardiovascular, Respiratory and Neuromuscular Physiology Lab – From this core paper student acquire the practical knowledge about blood film preparation, identification of different blood cells, bleeding time, clotting time, lung function test and pneumographic recording of chest movement.

2.3 CC-1B T2 – Cardiovascular, Respiratory and Neuromuscular Physiology

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

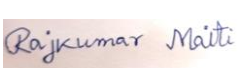
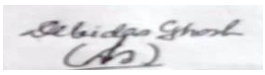
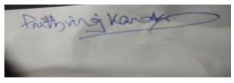
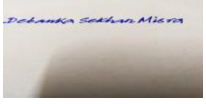
Blood and Body Fluid

1. Blood: Composition, functions, plasma and serum.
2. Plasma proteins: Origin, classification and functions.
3. Blood cells: Types, sites of generation, morphology and functions.
4. Erythropoiesis: Different stages and factors affecting RBC.
5. Anaemia: Types (Definition and causes).
6. Haemoglobin: Types and functions.
7. Coagulation of blood: Factors, mechanism and anticoagulants.
8. Lymph and tissue fluids: Composition and functions.
9. Blood groups: ABO system and Rh typing. Major, minor cross matching, blood transfusion and its hazards.

Cardiovascular Physiology

1. Anatomy of the heart.
2. Properties of cardiac muscle.
3. Origin and propagation of cardiac impulse.
4. Cardiac cycle: Definition and Events.
5. Heart sounds and heart rate.
6. Cardiac output: Determination by Fick principle and factors affecting.
7. Blood pressure and factors controlling.
8. Methods of measurement of blood pressure.
9. Peculiarities of regional circulations: Coronary and cerebral.
10. Cardiac block, ischemic heart disease.

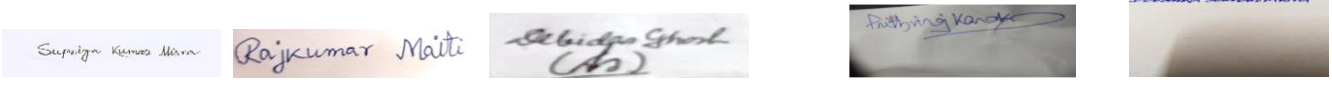
Respiratory Physiology

1. Functional anatomy of the respiratory system.
2. Mechanism of breathing. Significance of physiological and anatomical dead space. Lung volume and capacities.
3. Transport of oxygen and carbon dioxide in blood and tissue.
4. Regulation of respiration: Neural and chemical.
5. Hypoxia, Caisson's disease, cyanosis, emphysema, pulmonary embolism and acclimatization in brief.

Nerve Muscle Physiology

1. Structure of neurons.
2. Origin and propagation of nerve impulse.
3. Properties of nerve fibers.
4. Synapses: EM structure, mechanism of synaptic transmission.
5. Myoneural junction - Structure, mechanism of impulse transmission. Degeneration and regeneration in nerve fibers (Brief idea).
6. Different types of muscle and their structure. Red and white muscle. Properties of skeletal muscle. Mechanism of skeletal muscle contraction. Isotonic, isometric contractions and muscle cramp.



2.4 CC-1B P2: Cardiovascular, Respiratory and Neuromuscular Physiology Lab

(Practical: Credits 2/ Marks 15) 2 Credits

Haematological experiments

1. Preparation and staining of human blood film with Leishman's stain and identification of different types of blood corpuscles.
2. Estimation of haemoglobin by Sahli's method.
3. Preparation of haemin crystals.
4. Determination of bleeding time and clotting time.

Lung function tests

Measurement of TV and VC by spirometer.

Recording of chest movement by Pneumograph:

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

Suggested Readings

1. Mahapatra, A.B.S.M. (2011). Essentials of Medical Physiology Practical. First Edition. Current Books International'.
2. Ghai, C.L. A Text Book of Practical Physiology. 8th Edition. Jaypee.
3. Hall J.E. (2016).Guyton & Hall Textbook of Medical Physiology. Second South Asia Edition.
4. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Forth Edition. Current Books International.
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8. Chaudhuri, S.K.(2008). Concise Medical Physiology. Sixth Edition. NCBA.
9. Charles Nobach .The Human Nervous System. Mc Graw Hill Book Co.
10. Berne , R.M. and Levy M.N. Physiology. C.V.Mosby Co.
11. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
12. Barrett, K. E. Barman, S.M., Boitano, S. Brooks, H.L. (2012). Ganong's Review of Medical Physiology. 24th Edition. Lange Medical Book. Prentice-Hall International.
13. Pal, G.K. Pal, P. (2013).Textbook of Practical Physiology. Third Edition. Universities.
14. Shepherd, G.M. Neurobiology. Oxford University Press.
15. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
16. Debnath, J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
17. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.
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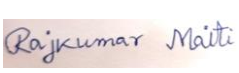
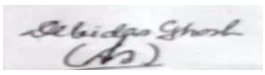
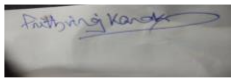
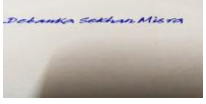
19. Masanta, N and Das, T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.
20. Debnath, J. (1998). Sharir Bignan. Vol. I & II. Shreedhar Prokashani, Kolkata.
21. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.

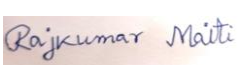
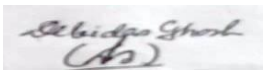
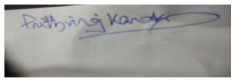
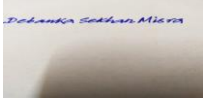






SEMESTER III

Course Outcome (CO)

COT-3: Digestive System, Metabolism, Nutrition and Excretory System – From this paper student will gather knowledge about digestion and absorption of food, different anabolic and catabolic reaction, basic components of food with their nutritional values and excretion of metabolic waste materials.

COP-3: Digestive System, Metabolism, Nutrition and Excretory System Lab – This practical paper will help to increase the ability of students in qualitative and quantitative importance of physiologically important biomolecules.

2.5 CC-1C T3 - Digestive System, Metabolism, Nutrition and Excretory System

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Digestive system:

1. Anatomy of alimentary system.
2. Mastication, deglutition, movements of the alimentary canal and significance.
3. Composition and functions of digestive juices and bile.
4. Digestion and absorption of carbohydrate, protein and lipid.

Metabolism

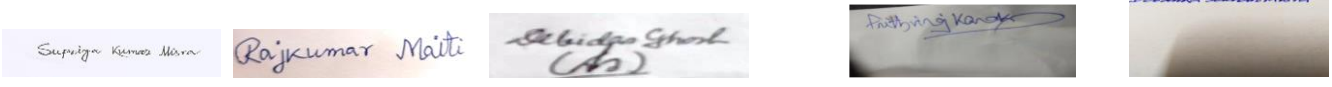
1. Metabolism of carbohydrate: Glycogenesis in brief, glycolysis, glycogenolysis, gluconeogenesis, TCA cycle and Cori cycle and their significances.
2. Metabolism of lipids: Beta oxidation of fatty, formation and fate of ketone bodies. Lipoprotein – Classification.
3. Metabolism of proteins: Transamination, oxidative and non-oxidative deamination, formation of urea.
4. Integration of carbohydrate, lipids and protein metabolism in brief.

Nutrition

1. Basic constituents of food and their nutritional significance, dietary fiber and its importance.
2. Vitamins: Definition, sources, daily requirements, functions, deficiency symptoms and hypervitaminosis,
3. Mineral: Sources, daily requirements, functions and deficiency (Na, K, Ca, I, P and Fe).
4. BMR: Definition, factors affecting and determination by Benedict-Roth apparatus. Respiratory quotient: Definition, factors affecting and significance.
5. Brief idea on: Nitrogen balance, biological value of proteins, digestibility coefficient, net protein utilization, protein efficiency ratio. Supplementary action of protein, specific dynamic action and protein sparing foods.
6. RDA, Adult Consumption Unit and NPN.
7. Diet chart preparation - College student, pregnant and lactating mother.

Excretory system

1. Anatomical organization of urinary system. Gross structure of kidney.
2. Renal circulation: Anatomy and peculiarities.
3. EM structure of nephron and Juxtaglomerular apparatus in brief.
4. Glomerular filtration rate, mechanism of formation of urine. Passive and active tubular transport.
5. Innervation of urinary bladder in brief, filling of bladder.
6. Micturition. Micturition reflexes.
7. Normal and abnormal constituents of urine and their significance. Concept of renal threshold. Functions of kidney and renal function tests (inulin and urea clearance tests), renal stone and dialysis.
8. Non-excretory functions of kidney.



2.6 CC-1C P3: Digestive System, Metabolism, Nutrition and Excretory System Lab

(Practical: Credits 2/ Marks 15) 2 Credits

Qualitative Experiments

1. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic acid, glucose, fructose, lactose, sucrose, starch, albumin, peptone, urea, acetone, glycerol, bile salts - Systematic analysis and confirmatory test.

Quantitative Experiments

1. Quantitative estimation of glucose by Benedict's method - Percentage and total quantity.
2. Quantitative estimation of amino nitrogen (Sorensen's Formol titration method) - Percentage and total quantity.

Suggested Readings

1. Srilakshmi, B. (2016). Nutrition Science. Fifth Edition. New Age International Publishers.
2. Srilakshmi, B. (2014). Dietetics. Seventh Edition. New Age International Publishers.
3. Das, S. Textbook of Normal and Therapeutic Nutrition. Academic Publishers.
4. Das S. (2016).Textbook of Community Nutrition. 2nd Edition. Academic Publishers.
5. Basu, P. Nutritional Biochemistry. Academic Publishers.
6. Srilakshmi, B. (2015). Food Science. Sixth Edition. Age International Publishers.
7. Swaminathan, M. (2012). Handbook of Food and Nutrition. Jain Book Agency.
8. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
9. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
10. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
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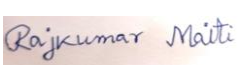
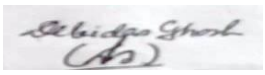
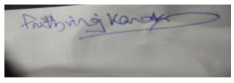
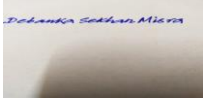
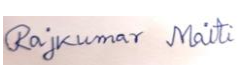
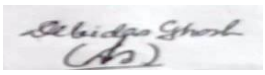
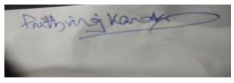
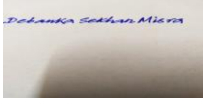





SEMESTER IV

Course Outcome (CO)

COT-4: Endocrine, Reproductive, Nervous System and Special Senses – Student will gather knowledge about physical and chemical coordination of human body system along with the male and female reproductive system.

COP-4: Endocrine, Reproductive, Nervous System and Special Senses Lab – This practical paper helps our students to know about basic idea on kymograph and its application on mechanical activity of the muscle. They will be able to measure visual function and histology of male and female reproductive organs.

2.7 CC-1C T4 - Endocrine, Reproductive, Nervous System and Special Senses

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Endocrine System

1. Hypothalamus: Basic concept of releasing hormones. Hypothalamo-hypophyseal-endocrine axis and portal system.
2. Pituitary: Histological structure, hormones, functions.
3. Thyroid: Histological structure, functions and of thyroid hormones (T_4 and T_3). Thyrocalcitonin. Hypo and hyper-active states of thyroid.
4. Parathyroid: Histological structure, functions of parathyroid hormone.
5. Adrenal gland: Histological structure and function.
6. Pancreas: Histology of islets of Langerhans. Origin and functions of pancreatic hormones.
7. Brief idea of gastrointestinal hormone.
8. Cause of major pathophysiology of endocrine gland in brief (Gigantism, dwarfism, acromegaly, goiter, tetany, Cushing's syndrome and diabetes mellitus).

Reproductive Physiology

1. Primary and accessory sex organs. Secondary sex characters.
2. Testis: Histology, spermatogenesis, hormonal control, testicular hormones and their functions.
3. Ovary: Histology, oogenesis, hormonal control. Ovarian hormones and their functions.
4. Menstrual cycle and its hormonal control.
5. Development of mammary gland and lactation - Role of hormones.
6. Fertilization and Implantation.
7. Pregnancy: Physiology and hormonal control in brief.

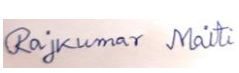
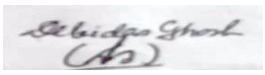
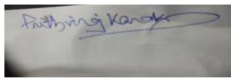
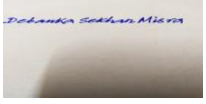
Nervous System

1. A brief outline on organization and basic functions of (Sensory, motor and association) the nervous system.
2. Origin, course, termination and functions of – Gall and Burdach tract, spino-thalamic tract, cortico-spinal tact and pyramidal tract.

3. Reflex action - Definition, reflex arc, classification, properties and function.
4. A brief idea of the structure and functions of cerebellum.
5. Functions of thalamus and hypothalamus.
6. Cerebral cortex: Histological structure and functions.
7. CSF - Composition, formation and functions.
8. A brief description of the organization of the autonomic (sympathetic and parasympathetic) nervous system. Functions of sympathetic and parasympathetic nervous system.

Sensory Physiology

1. Olfaction and gustation: Structure and function of receptor organs, neural pathway. Olfactory and gustatory adaptation. After taste.
2. Audition: Structure of auditory apparatus, auditory pathway, mechanism of hearing. Deafness in brief.
3. Vision: Structure of the eye. Histology of retina. Visual pathway. Light reflex. Rhodopsin and iodopsin cycle. Accommodation - mechanism. Errors of refraction. Light and dark adaptation.
4. Elementary idea of colour vision and colour blindness.

2.8 CC-1C P4: Endocrine, Reproductive, Nervous System and Special Senses Lab

(Practical: Credits 2/ Marks 15) 2 Credits

1. Use of kymograph and its accessories.
2. Recording of simple muscle curve with sciatic-gastrocnemius muscle preparation of toad.
3. Determination of visual acuity by Snellen's chart / Landolt's C chart.
4. Determination of colour blindness by Ishihara chart.
5. Staining and identification of testis and ovary.
6. Pregnancy test (Strip test)

Suggested Readings:

1. Chatterjee, C.C. Human Physiology, Vol. 1 and II, Medical Allied Agency.

2. Pramanik, D. Principles of Physiology. Academic Publishers, Kolkata.

3. Chaudhuri, S. K. Concise Medical Physiology. New Central Book Agency.

4. Eroschenko, V.P. diFiore's Atlas of Histology. Wolters-Kluwer.

5. Shaver L.G. Essentials of Exercise Physiology.Surjeet Publications.

6. Guyton A.C. Text Book of Medical Physiology. Saunders Co.

7. Textbook of Medical Physiology, D. Venkatesh & H.H. Sudhakar, Wolters Kluwer

8. Textbook of Medical Physiology, Indu Khurana, Elsevier.

9. Medical Physiology, A.B. Singha Mahapatra, Current Books International.

10. Sembulingam K. Sembulingam P. Essentials of Medical Physiology. Jaypee Brothers Medical Publishers Pvt. Ltd.

11. Manna, M.K. Practical Physiology. Sritara Prakashani, Kolkata.

12. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.

13. Masanta, N and Das, T. (2019). Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.

14. Debnath, J. (1998). Sharir Bignan. Vol.I & II. Shreedhar Prokashani, Kolkata.

15. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.

3. Discipline Specific Elective Courses

Course Outcome (CO)

CO-DSET1: Sports and Work Physiology – In this paper student will learn about role of exercise and training on health and wellbeing, relation-ship of man-machine-environment in work places and they will gather knowledge about how to reduce the occupational health hazards.

CO-DSET1: Social Physiology and Community Health – This paper will help to learn about community nutrition management, epidemiology of communicable and non-communicable diseases along with the basic idea about principle of balanced diet chart preparation.

CO-DSET2: Microbiology and Immunology – From this paper knowledge of students will be developed about types of viruses, viral genome, lytic and lysogenic cycle, bacterial growth, genetics, factors regulating bacterial growth and disinfection techniques. This paper will also enhance the knowledge about immune mechanisms, vaccination and immunization.

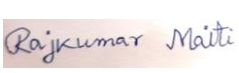
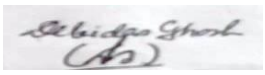
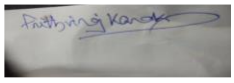
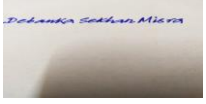
CO-DSET2: Environmental Physiology – This paper will help to enhance our student's knowledge about environmental pollutions and their health effects along with the knowledge about toxins, dose response curve, teratogens and carcinogens.

CO-DSEP1: Sports and Work Physiology Lab – This practical paper will help to increase their ability about preparation of project report by using different cardio-respiratory and anthropometric parameters.

CO-DSEP1: Social Physiology and Community Health Lab - From this paper student will learn about case study in relation with different critical physiological and nutritional status. It will also increase their ability in field study and dietary survey work.

CO-DSEP2: Microbiology and Immunology Lab – Students will learn about Gram staining, blood group test and bacterial spore staining from this practical paper.

CO-DSEP2: Environmental Physiology Lab - This paper will help to increase the ability of our students to measure the intensity of sound, light, amount of dissolved oxygen in water and relative humidity of air in different weather and environment.

3.1 DSE T1: Sports and Work Physiology

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Sports Physiology

1. Introduction to Sports Physiology.
2. Muscle: Types and fibre classification and their role in sports. Muscle fatigue and recovery.
3. Sports performance and endurance.
4. Glycogen loading, sports performance and sports drinks.
5. Pre-game, intra-game and post-game meal.
6. Training-Principles of physical training. Training to improve aerobic and anaerobic power.
7. Stress, sports performance and management.
8. Sports injuries and management.
9. Ergonic aids and doping.

Work Physiology

1. Concept of physical work and physiological work. Classification of work load.
2. Energetics of muscular work. Measurement of energy cost.
3. Cardiovascular and respiratory responses to graded exercise.
4. Aerobic work capacity: Physiological factors and application. Anaerobic work capacity.
5. Maximal oxygen consumption and post-exercise oxygen consumption: Definition, factors affecting, measurement and significance.
6. Occupational diseases: Pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.

3.2 DSE P1 - Sports and Work Physiology Lab

(Practical: Credits 2/ Marks 15) 2 Credits

1. Submission of hand written field study report by using at least five physiological parameters - Height, weight, heart-rate, blood pressure, respiratory rate, PFI, BSA and BMI.

Suggested Readings:

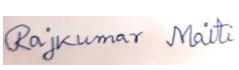
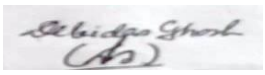
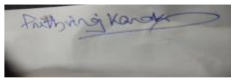
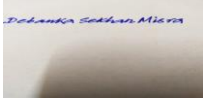
1. Katch, V.L. McArdle, W.D. Katch, F.I. Essentials of Exercise Physiology, Wolters Kluwer.
2. Goswami, A. Exercise Physiology and Ergonomics: An Introduction, Academic Publishers.
3. Dey S. K. A (2012). Textbook of Sports & Exercise Physiology. Jaypee.
4. Terry J. Housh, Dona J. Housh, Herbert A. deVries. (2016) Applied Exercise & Sport Physiology with Labs.
5. Bell C. (2008). Cardiovascular Physiology in Exercise and Sports. Elsevier.
6. Astrand, P.O.Rodhal. K. Dahl, H.A. (2003). Forth Edition. Mc Graw-Hill Book Co.
7. Shaver, L.G. Essentials of Exercise Physiology. Surjeet Publications.
8. McCormick, E.O. and Sanders, M. Human Factors in Engineering and Design by Tata Mc Graw Hill.
9. Fox, E.L. (1985). Sports Physiology. Saunders College Publishing Holt-Saunders
10. Fox, E.L. Mathews, D.K. The Physiological Basis of Physical Education and Athletics by and. Saunders College Publishing.
11. Durin, J.V.G.A. and Passmore, R. Energy, Work and Leisure. Heinemann Educational Books.

Or,

3.1 DSE T1: Social Physiology and Community Health

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

1. Basic idea about community, public health issues. Under nutrition, over nutrition and specific deficiency-Definition and remedial measures.
2. Basic idea of PCM and their prevention. PCM - Marasmus, Kwashiorkor. Endemic goiter, rickets, osteomalacia, xeropthalmia, beriberi and their social implications.
3. Etiology, epidemiology and prevention of Communicable diseases: Malaria, Dengue, Hepatitis and AIDS; Non-communicable diseases – Hypertension and Obesity.
4. Principles of formulation of diet chart of growing children, pregnant and lactating women and diabetic patients.
5. Dietary management of obesity and diabetes.
6. Population problem – Principles and methods of family planning and Assisted Reproductive Technologies (ART).

3.2 DSE P1 - Social Physiology and Community Health Lab

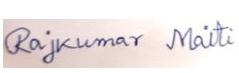
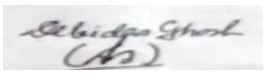
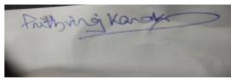
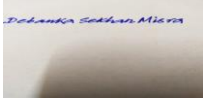
(Practical: Credits 2/ Marks 15) 2 Credits

Diet Survey (Field Study Record)

1. Basic concept of diet survey-Principle, methods and significance.
2. Diet survey report (hand-written) of a family (as per ICMR specification): Each student has to submit a report on his/her own family or locality or specific population.
3. Case study: Signs, symptoms and reasons with comments of abnormal nutritional cases (Photograph to be provided) within the syllabus.

Suggested Reading

1. Park's Textbook of Preventive and Social Medicine, K. Park, M/s. Banarasidas Bhanot, 2015.
2. Srilakshmi, B. (2016). Nutrition Science. Fifth Edition. New Age International Publishers.
3. Srilakshmi, B. (2014). Dietetics. Seventh Edition. New Age International Publishers.
4. Swaminathan, M. (2012). Handbook of Food and Nutrition. Jain Book Agency.
5. Swaminathan, M. (2015). Essentials of Food and Nutrition. Vol. I AND Vol. II. The Bangalore Printing and Publishing Co., Ltd.
6. Longvah, T. Ananthan, R. Bhaskarachary, K. Venkaiah, K. Indian Food Composition Tables. National Institute of Nutrition (ICMR). Hyderabad, India.

3.3 DSET2: Microbiology and Immunology

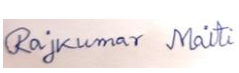
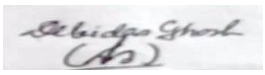
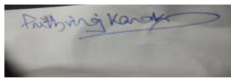
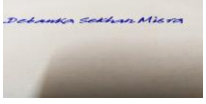
[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Microbiology

1. Viruses: Definition, structure. Types - DNA and RNA virus. Lytic and lysogenic cycle. Viroids and Prions. Bacteriophages.
2. Bacteria: Structure and morphological classification. Gram positive and Gram negative and acid-fast bacteria.
3. Pathogenic and non-pathogenic bacteria: Definition with examples.
4. Physical and chemical methods used in disinfection, sterilization and pasteurization.
5. Physical factors required for growth (Temperature, pH and gaseous requirement). Bacterial growth curve.
6. Elementary idea of bacteriostatic and bacteriocidal agents.
7. Beneficial and harmful microorganisms in food.

Immunology

1. Immunity: Definition and types.
2. Elementary knowledge of innate and acquired immunity. Humoral and cell mediated immunity.
3. Structure of Immunoglobulin.
4. Toxins and toxoids.
5. Vaccination: Passive and active immunization, types and uses of vaccine. Booster dose.
6. Immunological basis of allergy and inflammation. Hypersensitivity.
7. Hard immunity and immunity boosting.

3.4 DSE P2: Microbiology and Immunology Lab

(Practical: Credits 2/ Marks 15) 2 Credits

1. Staining of Gram positive and Gram negative bacteria.
2. Determination of human blood group using immunological method.
3. Demonstration on spore staining.

Suggested readings:

1. Prescott's Microbiology, J. Willey et.al., McGraw-Hill.
2. Pelczar, M.J. (2001) Microbiology. 5th edition, Tata McGraw-Hill Co, New Delhi.
3. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
4. Debnath J. Byabaharik Sharir Bignan (2008). Shreedhar Prokashani, Kolkata.
5. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
6. Punt, J. Stranford, S. Jones, P. Owen, J.A. (2018). Kuby Immunology. Eight Edition.
7. Sharma, P and Kumar, P. (2021). Basics of Immunology. Innovative Publication.

Or,

3.3 DSE T2: Environmental Physiology

[Theory: Credit 4 (4 lectures/Week)/ Marks 25] 4 Credits

Environmental Pollution:

1. Pollutant: Definition and types.
2. Air pollution: Definition, source, effects of air pollution on health, concept of ozone hole, green house effects, global warming and acid rain.
3. Water Pollution: D efinition, types, health hazards, water pollutants, biochemical oxygen demand(BOD), thermal pollution, concept of safe drinking water standards.
4. Soil Pollution: Causes, health hazards, solid waste managements - bioremediation and phytoremediation.
5. Sound Pollution: Definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index and noise standards.
6. Radionuclide Pollution: Ionizing radiations, effects of ionizing radiation on human health and permissible doses.
7. Arsenic Pollution: Sources of arsenic in ground water, drinking water standard for arsenic (WHO, USEPA and ICMR), health effects of chronic arsenic poisoning.
8. Light pollution- basic concepts.

Toxicology*:*

1. Definition of toxins, factors affecting toxicity, dose response curve, LD_{50} and ED_{50}.
2. Concept of acute and chronic effects.
3. Birth defects, teratogens and carcinogen.
4. Concept of biomagnification and bioconcentration.
5. Food toxicants: BPA, BPS, pesticides, PCB, heavy metals (Pb, Hg, Cd, As).

3.4 DSE P2: Environmental Physiology Lab

(Practical: Credits 2/ Marks 15) 2 Credits

1. Measurement of dissolved oxygen by Wrinkler's method.
2. Noise intensity measurement by sound level meter.
3. Measurement of light intensity by Lux meter.
4. Measurement of relative humidity by dry and wet bulb thermometer.

Suggested Readings:

1. Saha, T.K. (2013). Ecology and Environmental Biology. Books & Allied Ltd.

2. Agarwal, K. M. Sikdar, P. K. and Deb. S.C. (2002). A Text Book of Environment. Macmillan India Ltd.

3. Pal, G. Paribesh O Dushan. Dasgupta Publisher.

4. William, P. Cunningham and Mary Ann. Principles of Environmental Science. Tata Mc GrewHill. Publisher.

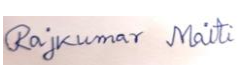
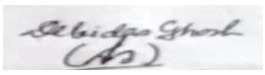
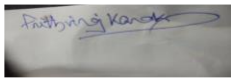
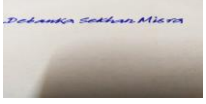
5. Tyler, G. Miller & Scott Spoolman. An introduction to Environmental science. Cengage Learning Publisher.

6. Note Books on Experimental Physiology. Published by The Physiological Society of India. Kolkata.

7. Debnath J. (2008). Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.

8. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.

9. Debnath J. (1998). Sharir Bignan. Vol. I. Shreedhar Prokashani, Kolkata.

4. Skill Enhancement Courses

Course Outcome (CO)

CO-SEC P1: Food Pollutants Lab – In this paper student will increase their ability to determine adulterants of common foods and spices, microbial contamination of foods, heavy metals and other chemicals in food.

CO-SEC P2: Methods in Hematology Lab – From this paper students will increase their knowledge about hematological estimations, measurement of hemoglobin percentage and biochemical estimations of blood glucose, serum urea, cholesterol and total protein.

CO-SEC T1: Biostatistics, Computer and Instrumentation – From this paper student will learn about bacterial growth with it's factors, disinfection, antibiotics, immunity, vaccination and immunization.

CO-SEC T2: Applied Biochemistry – From this paper students will learn about clinical importance of blood glucose, urea, creatinine and oxidative stress determinants along with the different types of electrophoresis and chromatography.

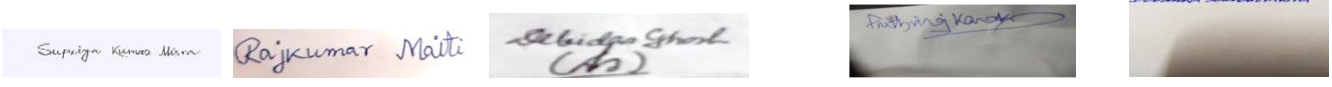
4.1 SEC P1- Food Pollutants Lab

[Practical: Credits 2/ (4 Practical Classes/Week)/Marks 40] 2 Credits

1. Determination and estimation of adulterants in foods: Honey, fats and oils, spices (Turmeric and red chili powder).
2. Determination of artificial sweetening agents.
3. Determination of heavy metals in foods.
4. Demonstration about different food flavors.
5. Identification of microorganisms in food: Mould in bread, microbes in curd and bacteriological testing of milk.

Suggested Readings:

1. Debnath J. (2008). Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
2. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
3. Jha, S.N. (2016). Rapid Detection of Food Adulterants and Contaminants: Theory and Practice. Academic Press.



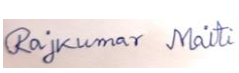
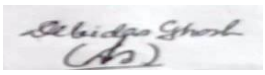
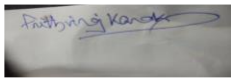
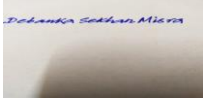
4.2 SEC P2- Methods in Hematology Lab

[Practical: Credits 2/ (4 Practical Classes/Week)/Marks 40] 2 Credits1.

1. Preparation of blood smear with identification of blood cells.
2. Total Count and differential count of blood cells.
3. Determination of hematocrit value.
4. Quantification of blood glucose by Folin-Wu method.
5. Quantification of serum total protein by biuret method.
6. Quantification of serum cholesterol by $FeCl_3$ method.

Suggested Readings:

1. Debnath J. (2008). Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
2. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
3. Note Book on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
4. Note Book on Practical Histology. Published by The Physiological Society of India. Kolkata.

4.3 SEC T1- Biostatistics, Computer and Instrumentation

[Theory: Credit 2 (2lectures/Week)/ Marks 40] 2 Credits

Concepts in Biological Statistics:

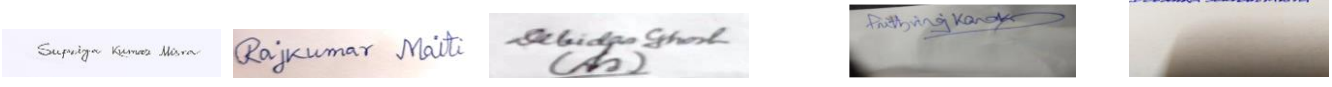
1. Scope of statistics – Principles of statistical analysis of biological data.
2. Basic concepts – Variable, parameter, statistics and sampling.
3. Classification of statistics (Brief idea of statistics of location, statistics of dispersion, statistics of co-relation and statistics of regression). Brief idea of parametric and non-parametric statistics.
4. Presentation of data - Frequency distribution, frequency polygon, histogram, bar diagram and pie diagram.
5. Different classes of statistics - Mean, median and mode.

Instrumentation:

1. Basics of microscopy: Features, working principle, advantages and limitations.
2. Bright field microscopy, Dark field microscopy, light microscopy and compound microscope – Introduction and working principle.
3. Electrophoresis – Introduction, types of electrophoresis, agarose gel electrophoresis,
4. Centrifugation - Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient, various types of centrifuges.
5. Blotting: Southern, northern and western blot techniques with their application.

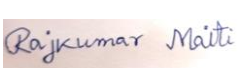
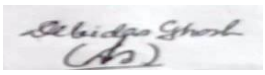
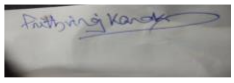
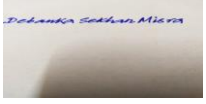
Computer:

2. History of computer, basic components of computer and their importance.
3. Application of computer in Physiology.
4. Concept of MS word, Excel and Power point.



Suggested Readings:

1. Dhara, P. (2006). Computer in Biological Science Book. Academic Publishers.
2. Salaria, R.S. (2017). Computer Fundamentals. Khanna Book Publishing.
3. Das, D. Das A. (2013). Statistics in Biology and Psychology. Sixth Edition. Academic Publishers.
4. Debnath J. (2008). Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
5. Sripathi, S.S. Pandey, P (2020). Overview of Blotting Techniques. Arcler Education Inc.
6. Magdeldin, S. (2012). Gel Electrophoresis - Principles and Basics. IntechOpen.

4.4 SEC T2- Applied Biochemistry

[Theory: Credit 2 (2 lectures/Week)/ Marks 40] 2 Credits

Quantitative estimation of blood constituents

1. Principle, normal value and clinical importance of determination of blood glucose, urea and creatinine.
2. Principle, normal value and clinical significance of serum inorganic phosphate, serum amylase, serum total cholesterol and serum total protein.

Oxidative stress and Antioxidants

1. ROS: Causes of formation.
2. Determination of oxidative stress: MDA, GSSG.
3. Neutralization of ROS: Catalase activity, role of GSH and role of GST.
4. Antioxidant: Source, mode of action, anti-aging role, role of vitamin C and E as antioxidant.

Chromatography

1. Basic principles of chromatography.
2. Types and application of chromatography.

Suggested Readings

1. Das, D. (2004). Biophysics and Biophysical Chemistry. Fifth Edition. Academic Publishers.
2. Das, D. (2008). Biochemistry. Academic Publishers.
3. Satyanarayana, U. and Chakrapani. U. (2013). Biochemistry. 4th Edition. Elsevier India.
4. Roy, R.N. A. (2015). Text Book of Biophysics. New Central Book Agency (P) Ltd.
5. Suzuki, M. Yamamoto, S. (2014). Handbook on Reactive Oxygen Species (ROS) Formation Mechanisms. Nova Science.
6. Dhanarasu, S. (2012). Chromatography and Its Applications. Published by InTech.