



**CBCS SYLLABUS**  
**FOR**  
**THREE YEARS UNDER-GRADUATE COURSE**  
**IN**  
**PHYSIOLOGY (PROGRAMME)**  
*(w.e.f. 2022)*



**BANKURA UNIVERSITY**  
**BANKURA**  
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**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.

The revised CBCS curriculum to be implemented from the academic session 2022-2023 conforms to Learning Outcome Based Curriculum Framework (LOCF) and aims at imparting concept-based learning with emphasis on skill development and research. The overall objective of this programme is to enable students to learn and integrate knowledge in different physiological processes involving in system functions of human body.

Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject.

The syllabus has also been framed in such a way that the basic skills of subject are taught to the students and everyone might not need to go for higher studies and the scope of securing a job after graduation will increase.



## 1.1. Program Outcome (PO)

**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.O.3:** 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.O.4:** 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.O.5:** 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.



## 1.2. Program Specific Outcome (PSO)

### 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. Development of practical knowledge and skills that is required for pursuing a career in clinical diagnosis, drug design, vaccine development, pharmaceutical industry.

**P.S.O5:** On working in different designing industry as an Ergonomist, in Defence Research Institute as Scientist and also at the Sports Training Institute as Sports Scientist/Physiologist.



## 2. Scheme for CBCS Curriculum

### 2.1. Credit Distribution Across Courses

		Credits	
Course Type	Total Papers	Theory + Practical	Theory*
Core Courses	12	$12*4 = 48$	$14*5 = 70$
		$12*2 = 24$	$14*1 = 14$
Discipline Specific Electives	6	$6*4=24$	$4*5= 20$
		$6*2=12$	$4*1= 4$
Ability Enhancement Language Courses	2	$1*2=2$ (ENG / MIL)	$1*2= 2$ (ENG/MIL)
		$1*4=4$ (ENVS)	$1*4= 4$ (ENVS)
Skill Enhancement Courses	4	$4*2=8$	$4*2=8$
<b>Totals</b>	<b>24</b>	<b>122</b>	<b>122</b>

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

**2.2 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.
SP/PHY/101/ C-1A	<b>CT-1: Cellular Basis of Physiology and Biophysical Principles</b>	4	10	25	50	4	NA	4
	<b>CP-1: Cellular Basis of Physiology and Biophysical Principles Lab</b>	2		15				
SP/102/ C-2A	Discipline-2 From another discipline	6	10	40	50			
SP/103/ C-3A	Discipline-3 From another discipline	6	10	40	50			
SP/104/AECC- EVS	<b>Environmental Studies</b>	4	10	40	50	4	NA	NA
<b>Total in Semester – I</b>		<b>22</b>	<b>40</b>	<b>160</b>	<b>200</b>	<b>8</b>		<b>4</b>

**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.
SP/PHY/ 201/C-1B	<b>CT-2: Cardiovascular, Respiratory and Neuromuscular Physiology</b>	4	10	25	50	4	NA	4
	<b>CP-2: Cardiovascular, Respiratory and Neuromuscular Physiology Lab</b>	2		15				
SP/202/ C-2B	Discipline – 2 From another discipline	6	10	40	50			
SP/203/C- 3B	Discipline – 3 From another discipline	6	10	40	50			
SP/204/ AECC-E/MIL	<b>English/MIL</b>	2	10	40	50	4	NA	NA
<b>Total in Semester – II</b>		<b>20</b>	<b>40</b>	<b>160</b>	<b>200</b>	<b>8</b>		<b>4</b>

**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.
SP/PHY/ 301/C-1C	CT-3: Digestive System, Metabolism, Nutrition and Excretory System	4	10	25	50	4	NA	4
	CP-3: Digestive System, Metabolism, Nutrition and Excretory System Lab	2		15				
SP/302/C-2C	Discipline – 2 From another discipline	6	10	40	50			
SP/303/ C-3C	Discipline – 3 From another discipline	6	10	40	50			
SP/PHY/ 304/SEC-1	SECP-1: Food Pollutants Lab	2	10	40	50	NA	NA	4
<b>Total in Semester – III</b>		<b>20</b>	<b>40</b>	<b>160</b>	<b>200</b>	<b>4</b>		<b>8</b>

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



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

**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.
SP/PHY/ 501/DSE-1A	Any one of the following	4	10	25	50	4	NA	4
	<b>DSET-1: Sports and Work Physiology</b> <b>DSEP-1: Sports and Work Physiology Lab</b>  <b>or</b> <b>DSET-1: Social Physiology and Community Health</b> <b>DSEP-1: Social Physiology and Community Health Lab</b>	2		15				
SP/502/DSE-2A	Discipline – 2 From another discipline	6	10	40	50			
SP/503/DSE-3A	Discipline – 3 From another discipline	6	10	40	50			
SP/PHY/ 504/SEC-3	<b>SECT-1: Biostatistics, Computer and Instrumentation</b>	2	10	40	50	2	NA	NA
<b>Total in Semester – V</b>		<b>20</b>	<b>40</b>	<b>160</b>	<b>200</b>	<b>6</b>		<b>4</b>

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.
SP/PHY/ 601/DSE-1B	Any one of the following <b>DSET-2: Microbiology and Immunology</b>	4	10	25	50	4	NA	4
	<b>DSET-2: Microbiology and Immunology Lab</b>  <b>OR</b> <b>DSET-2: Environmental Physiology</b> <b>DSEP-2: Environmental Physiology Lab</b>	2		15				
SP/602/DSE-2B	Discipline – 2 From another discipline	6	10	40	50			
SP/603/DSE-3B	Discipline – 3 From another discipline	6	10	40	50			
SP/PHY/ 604/SEC-4	<b>SECT-2: Applied Biochemistry</b>	2	10	40	50	4	NA	NA
<b>Total in Semester – VI</b>		<b>20</b>	<b>40</b>	<b>160</b>	<b>200</b>	<b>8</b>		<b>4</b>

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

SP= Science 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



## 2.3 Choices for Discipline Specific Electives

<b>SEMESTER</b>	<b>COURSE</b>	<b>CHOICE</b>
<b>V</b>	<b>DSE-1A</b>	<b>DSET-1: Sports and Work Physiology</b> <b>DSEP-1: Sports and Work Physiology Lab</b> <b>OR</b> <b>DSET-1: Social Physiology and Community Health</b> <b>DSEP-1: Social Physiology and Community Health Lab</b>
<b>VI</b>	<b>DSE-1B</b>	<b>DSET-2: Microbiology and Immunology</b> <b>DSEP-2: Microbiology and Immunology Lab</b> <b>Or</b> <b>DSET-2: Environmental Physiology</b> <b>DSEP-2: Environmental Physiology Lab</b>



## 2.4 Choices of Skill Enhancement Courses

<b>SEMESTER</b>	<b>COURSE</b>	<b>CHOICE</b>
<b>III</b>	<b>SEC-1</b>	<b>SECP-1: Food Pollutants Lab</b>
<b>IV</b>	<b>SEC-2</b>	<b>SECP-2: Methods in Hematology Lab</b>
<b>V</b>	<b>SEC-3</b>	<b>SECT-1: Biostatistics, Computer and Instrumentation</b>
<b>VI</b>	<b>SEC-4</b>	<b>SECT-2: Applied Biochemistry</b>



## 2.5 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)
	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
Programme (Theoretical )	25	1 Hour 15 Minutes
Programme (Theoretical)	40	2 Hours
Programme (Practical )	15	2 Hours
Programme (Practical )	40	4 Hours

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### **3. CORE COURSES**



**SEMESTER–I****3.1 CC-1A T1: Cellular Basis of Physiology and Biophysical Principles****Course Code: SP/PHY/101/C-1A****Course ID: 12518****[Theory: Credit 4 (4 lectures/Week)/ Marks 25]****4 Credits*****Course Learning Outcomes:***

- This course gives a broad knowledge about cellular structure, functions of cell organelle and plasma membrane.
- From this course students will learn the knowledge about different type of tissues and their functions.
- The course would fortify to the students to acquire the knowledge about physiological importance of biophysical processes.
- They acquire a concept about enzymes and chemistry of biomolecules.

**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 of 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 and factors affecting enzyme action.
2. Michaelis 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.



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

**Course Code: SP/PHY/101/C-1A**

**Course ID: 12528**

**(Practical: Credits 2/ Marks 15)**

**2 Credits**

### *Course Learning Outcomes:*

- From this course students will gather the knowledge about various parts of microscope.
- They will acquire elementary knowledge on permanent slide preparation.
- This practical course will provide wide range of knowledge about histological structure of different organs.

### **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 – Identification with characters.

### **Staining of fresh tissue**

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 7<sup>th</sup> 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**

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

**Course Code: SP/PHY/201/C-1B**

**Course ID: 22518**

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

**4 Credits**

***Course Learning Outcomes:***

- This paper helps to learn about components of blood and their functions along with synthesis of hemoglobin.
- Student will be able to learn about cardiorespiratory functions and nerve muscle physiology.
- From this course learners will gather knowledge about mechanism of blood coagulation and its related factors.
- They will acquire the knowledge about the respiratory system and nerve muscle physiology along with their mechanism of action.

**Blood and Body Fluid**

1. Blood: Composition and 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 and 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.



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

Course Code: SP/PHY/201/C-1B

Course ID: 22528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- From this course students will acquire skill on different hematological techniques.
- They will develop their concept on capacity related lung function parameters and its abnormalities.

### **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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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**

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

Course Code: SP/PHY/301/C-1C

Course ID: 32518

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

4 Credits

***Course Learning Outcomes:***

- From this core course students will gather knowledge about digestion and absorption of principle food stuff.
- They will develop their knowledge in carbohydrate, protein and fat metabolism and their integrated pathway.
- Student will develop the knowledge about basic components of food with their nutritional values along with nutritional assessment in different food stuff.
- Developing the knowledge how excretory system functioning.

**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, Cori cycle and their significances.
2. Metabolism of lipids: Beta oxidation of fatty acid, formation and fate of ketone bodies. Lipoprotein – Classification and functions.
3. Metabolism of proteins: Transamination, oxidative and non-oxidative deamination and 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 (Vitamin-A, D, E, K, C & B<sub>12</sub>) 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. Micturition. Micturition reflexes.
6. 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.
7. Non-excretory functions of kidney.



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

Course Code: SP/PHY/301/C-1C

Course ID: 32528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- This practical paper will help to increase the ability of students in qualitative and quantitative importance of physiologically important biomolecules.
- Student will develop their skill in the titration process with high level of accuracy.

### **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 and 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 Distributors 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.



11. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.  
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. 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 II. Santra Publication Pvt. Ltd.
17. Debnath, J. (1998). Sharir Bignan. Vol.I & II. Shreedhar Prokashani, Kolkata.
18. Debnath J. Byabharik Sharir Bignan, Shreedhar Prokashani, Kolkata.

**SEMESTER-IV****3.7 CC-1C T4 - Endocrine, Reproductive, Nervous System and Special Senses**

Course Code: SP/PHY/401/C-1D

Course ID: 42518

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

4 Credits

***Course Learning Outcomes:***

- From this core course students will develop understanding the basic concept on endocrine system anatomically and histologically.
- To gather chemical messenger actions in physical and chemical coordinated function in our body including hyper and hypoactive conditions.
- They will develop important information about male and female reproductive systems.
- Student will acquire their knowledge about structure and function of nervous system and their higher centre for controlling different sensory and motor activities.
- From this course student will learn about structure and functions of special sensory organs.

**Endocrine System**

1. Hypothalamus: Basic concept of releasing hormones. Hypothalamo-hypophyseal-endocrine axis and portal system.
2. Pituitary: Histological structure, hormones and functions.
3. Thyroid: Histological structure, functions and of thyroid hormones ( $T_3$  and  $T_4$ ). Thyrocalcitonin. Hypo and hyper-active states of thyroid.
4. Parathyroid: Histological structure and 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 tract 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. 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.
2. Elementary idea of colour vision and colour blindness.
3. Audition: Structure of auditory apparatus, auditory pathway, mechanism of hearing. Deafness in brief.
4. Olfaction and gustation: Structure and function of receptor organs, neural pathway. Olfactory and gustatory adaptation. After taste.



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

Course Code: SP/PHY/401/C-1D

Course ID: 42528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- The readers will be able to measure visual function with different errors and their preventive measures.
- Student will develop knowledge on histology related laboratory staining techniques and identification of respective male and female reproductive tissues.
- This practical paper helps our students to assure onset of pregnancy through clinical diagnostic method.

### **Practical work:**

1. Use of kymograph and its accessories.
2. Recording of simple muscle curve with sciatic nerve - 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.





## **4. Discipline Specific Elective Courses**

**SEMESTER-V****4.1 DSE T1: Sports and Work Physiology****Course Code: SP/PHY/501/DSE-1A****Course ID: 52518****[Theory: Credit 4 (4 lectures/Week)/ Marks 25]****4 Credits*****Course Learning Outcomes:***

- From this core course students will develop their knowledge on Sports and Work Physiology.
- Student will learn about role of exercise and training on health and wellbeing.
- Student will gather the knowledge how to reduce the occupational health hazards and on industrial safety devices.

**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. Ergogenic 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.



## 4.2DSE P1 - Sports and Work Physiology Lab

Course Code: SP/PHY/501/DSE-1A

Course ID: 52528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- This practical paper will help to increase their ability about preparation of project report.
- They will individually collect data on cardio-respiratory parameters in the field where men are at work.
- Students will gain their knowledge on BMI, BSA, obesity and fitness level using anthropometric parameters.

### **Field Study:**

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**

### **4.1 DSE T1: Social Physiology and Community Health**

**Course Code: SP/PHY/501/DSE-1A**

**Course ID: 52518**

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

**4 Credits**

#### ***Course Learning Outcomes:***

- From this course learners will be enriched about importance of community nutrition and its management.
- They acquire their knowledge on epidemiology of communicable and non-communicable diseases.
- Students will develop basic idea about balanced diet chart preparation and able to recommend the respective community people.

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, xerophthalmia, 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).



## 4.2 DSE P1 - Social Physiology and Community Health Lab

Course Code: SP/PHY/501/DSE-1A

Course ID: 52528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- From this course students will learn how to prepare case study report based on nutritional abnormalities.
- Students will develop basic idea about balanced diet chart preparation and able to recommend the respective community people.

### **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.

**SEMESTER–VI****DSE T2: Microbiology and Immunology****Course Code: SP/PHY/601/DSE-1B****Course ID: 62518****[Theory: Credit 4 (4 lectures/Week)/ Marks 25]****4 Credits*****Course Learning Outcomes:***

- From this discipline specific elective course students will rich about viruses and their types, structure, lytic and lysogenic cycle.
- They will gain their knowledge on bacteria, their structure, morphology, classification and their growth.
- Students will learn about bacterial genetics, lytic and lysogenic cycle, bacterial growth and culture.
- This paper will also enhance their knowledge about immune mechanisms, vaccination, immunization and how to develop hard immunity.

**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 bactericidal 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.



## 4.4 DSE P2: Microbiology and Immunology Lab

Course Code: SP/PHY/601/DSE-1B

Course ID: 62528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- From this course students will develop skill about Gram staining and identification.
- Students will develop basic idea about determination of blood group and Rh system.

### **Microbiology**

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. 5<sup>th</sup> 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**

### **4.3 DSE T2: Environmental Physiology**

**Course Code: SP/PHY/601/DSE-1B**

**Course ID: 62518**

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

**4 Credits**

#### ***Course Learning Outcomes:***

- This paper will help to enhance our student's knowledge about environmental pollutions, and their health effects and controlling measures.
- Students will develop basic idea on toxins, dose response curve, teratogens and carcinogens.
- They will gather knowledge on different ground water pollutants like arsenic and its adverse effect on human being.
- Students will develop basic idea about different pollutants and pollutions i.e., water, soil, sound and radioactive pollution.

#### **Environmental Pollution:**

1. Pollutant: Definition and types.
2. Air pollution: Definition, source, effects of air pollution on health, control in brief, concept of ozone hole, green house effects, global warming and acid rain.
3. Water Pollution: Definition, types, water pollutants and health hazards, preventive measures, biological oxygen demand (BOD), thermal pollution, concept of safe drinking water standards.
4. Soil Pollution: Causes, health hazards, control of soil pollution, solid waste managements - Bioremediation and phytoremediation.
5. Sound Pollution: Definition, concept of noise, source of sound pollution, effects on human health, preventive measures of sound pollution, noise index and noise standards.
6. Radionuclide Pollution: Ionizing radiations, effects of ionizing radiation on human health, permissible doses and controlling measure.





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<sub>50</sub> and ED<sub>50</sub>.
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 and As).



## 4.4 DSE P2: Environmental Physiology Lab

Course Code: SP/PHY/601/DSE-1B

Course ID: 62528

(Practical: Credits 2/ Marks 15)

2 Credits

### *Course Learning Outcomes:*

- This paper will help to enhance our student's develop their knowledge about quality of water by measuring dissolve oxygen.
- Student will develop their skill on noise intensity measurement, light intensity measurement and humidity measurement.

### **Contents:**

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.



## **5. Skill Enhancement Courses**



**SEMESTER-III**

**SEC P1: Food Pollutants Lab**

**Course Code: SP/PHY/304/SEC-1**

**Course ID: 32520**

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

**2 Credits**

***Course Learning Outcomes:***

- This skill enhancement course will help to detect different adulterants in food stuff.
- Students enhance their knowledge about determination of heavy metals in food.
- Student will develop their skill on different artificial sweeteners determination.
- They gather their knowledge on identification of microorganism.

**Contents:**

1. Determination and estimation of adulterants in foods: Honey, fats & oils and 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.



## SEMESTER-IV

### 4.4 SEC P2: Methods in Hematology Lab

Course Code: SP/PHY/404/SEC-2

Course ID: 42520

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

2 Credits.

#### *Course Learning Outcomes:*

- This skill enhancement course will help to preparation of blood smear, staining along with identification of blood cells.
- From this paper students will increase their knowledge and techniques about hematological estimations.
- They acquire their skill for measurement of hemoglobin percentage and biochemical estimations of blood glucose, serum urea, cholesterol and total protein.

#### **Contents:**

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  $\text{FeCl}_3$  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.

**SEMESTER-V****4.5 SEC T1: Biostatistics, Computer and Instrumentation**

Course Code: SP/PHY/504/SEC-3

Course ID: 52510

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

2 Credits

***Course Learning Outcomes:***

- This skill enhancement course will help to develop the knowledge on scope and application of statistics on biology.
- Student will be enriched about presentation of data with the help of frequency polygon, histogram, bar diagram and pie diagram.
- They will gather proper knowledge on disinfection, antibiotics, immunity, vaccination and immunization.
- From this course learners will acquire their knowledge on different parts of computer and its application.

**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:**

1. History of computer, basic components of computer and their importance.
2. Application of computer in Physiology.
3. 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.



## SEMESTER–VI

### 4.6 SEC T2: Applied Biochemistry

Course Code: SP/PHY/604/SEC-4

Course ID: 62510

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

2 Credits

#### *Course Learning Outcomes:*

- Student will be developing their knowledge on clinical importance of determination of blood glucose, urea and creatinine.
- They may acquire their information about the normal values and clinical importance of inorganic phosphate, amylase, total cholesterol and total protein in serum.
- From this course learners will acquire their knowledge on oxidative stress management and its application.
- Within this course the student will get opportunity on chromatography and its application.

#### **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.