



SYLLABUS

FOR

FOUR YEARS UNDERGRADUATE PROGRAMME

IN

PHYSIOLOGY

**Curriculum and Credit Framework for Undergraduate Programmes
(CCFUP) Based on NEP 2020**

With effect from the Academic Session 2023-2024



BANKURA UNIVERSITY

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1. Introduction

Curriculum Framework of Undergraduate programme in Physiology has been modified based on National Education Policy-2020. NEP-2020 has conceptualized the ideas for overall development of individuals and for making the Nation a self-reliant and global leader. In the same spirit, we at Department of Physiology under Bankura University have developed a curriculum framework encompass the goals of NEP 2020. To this end, we have focused on choice of subject/disciplines of study, creating academic pathways having constructive combinations of disciplines for study with multiple entry and exit points as well as giving emphasis on experiential learning for students by introducing multidisciplinary and skill enhancement courses and actual hands-on training in the recent and trending aspects of the area concern.

In accordance with the NEP 2020, the UGC has formulated a new student-centric “Curriculum and Credit Framework for Undergraduate Programmes (CCFUP)” which will facilitate students to pursue their career path by choosing the subject/field of their interest. NEP, 2020 states that imaginative and flexible curricular structures will enable creative combinations of disciplines for study and would offer multiple entry and exit points and thus, remove the currently prevalent rigid boundaries.

To take this forward, NEP, 2020 promotes rigorous research-based specialization and opportunities for multidisciplinary work, including academia, government and interdisciplinary thinking at the under graduate level. It also points out that, “Higher education qualifications leading to a degree/diploma/certificate shall be described by the National Higher Education Qualification Framework (NHEQF) in terms of such learning outcomes.” The undergraduate degree should be of either a three- or four-year duration, with multiple entry and exit options within this period, with appropriate certifications. For example, a certificate after completing one year in a discipline or field including vocational and professional areas; a diploma after two years of study; or a Bachelor’s degree after a three-year programme. The 4-year multidisciplinary Bachelor's programme, however, shall be the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student”.

4-year UG Degree (Honours with Research): Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the College. The research project/dissertation will be in the major discipline. The students who secure 164 credits, including 12 credits from a research project/dissertation, are awarded UG Degree (Honours with Research).



Objectives

The guidelines of the proposed multiple entry and exit option will serve the following objectives:

- Remove rigid boundaries and facilitate new possibilities for learners.
- Curtail the dropout rate and improve GER.
- Offer creative combinations of disciplines of study that would enable multiple entry and exit points.
- Offer flexibility in curriculum and novel course options to students in addition to discipline specific specializations.
- Offer different designs of the Master's programme.
- Enable credit accumulation and transfer along with provision of evaluation and validation of non-formal and informal learning for the award of a degree and encourage lifelong learning.
- Facilitate encashing credits earned when the learner resumes his/her programmes of study.

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 expertise 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: Learners will be skilled and expertise themselves for doing different haematological techniques for analysis of human blood samples.

P.O.5: 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.6: Undergraduate students will themselves achieved integrated and interdependent knowledge among human body activities in collaborative manners with plant and animal kingdom in a holistic fashion.

P.O.7: Students will get idea about the different disease causing agents and their prevention; personal hygiene. They will also enrich about the knowledge of ideal nutrients and balanced diet.

P.O.8: Learners will skill themselves about the knowledge of different instruments like ECG, Chromatography, ELISA, RIA etc.

P.O.9: Statistical analysis and computer knowledge will help them better for future study and research work.

P.O.10: Biotechnological knowledge will help them advanced treatment for different genetic diseases, modern vaccination techniques etc.

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 Curriculum and Credit Framework for Undergraduate Programmes (CCFUP)

2.1 Course Structure with Credit Distribution

Programme and Course Structure with Credit Distribution: UG Degree Programmes with Single Major										
Category of Course (Credit)	Major (4)		Minor Stream (4)	Multidisciplinary (3)	Ability Enhancement Course (AEC) (2)	Skill Enhancement Course (SEC) (3)	Value Added Courses Common for all (4)	Summer Internship (2)	Research Project / Dissertation (12)	Total Credit / Number of Courses
	Semester	DSC								
I	1×4 =4		1×4=4	1×3=3	1×2=2	1×3=3	1×2=2			20/6
II	1×4 =4		1×4=4	1×3=3	1×2=2	1×3=3	1×2=2			20/6
Certificate (Total Credit)	8		8	6	4	6	4	1×4=4* (ADDITIONAL)		40/12
III	2×4 =8		1×4=4	1×3=3	1×2=2	1×3=3	1×2=2			20/6
IV	4×4 =16		1×4=4		1×2=2		1×2=2			22/6
Diploma (Total Credit)	32		16	9	8	9	8	1×4=4* (ADDITIONAL)		82/24
V	2×4 =8	2×4 =8	1×4=4					1×2=2 Mandatory		22/6
VI	2×4 =8	2×4 =8	1×4=4							20/5
UG Degree (Total Credit)	64		24	9	8	9	8	2		124/35
VII	1×4 =4	3×4 =12	1×4=4							20/5
VIII	1×4 =4	3×4 =12**	1×4=4							20/5
UG HONS. (Total Credit)	96		32	9	8	9	8	2		164/45
UG HONS. With Research (Total Credit)	84		32	9	8	9	8	2	12**	

Certificate course in Physiology 1 year duration (I-II Semester); Diploma course in Physiology 2 years duration (I-IV Semester); UG Degree in Physiology 3 years of duration (I-VI); UG Degree in Physiology Honours 4 years of duration (I-VIII; without Research) and UG Degree in Physiology Honours 4 years of duration (I-VIII; with Research).

2.1a Credit Distribution Across Courses

Course Type	Total Papers	Credits
Major Core (MJC)	14	$14 \times 4 = 56$
Major Electives (MJE)	10	$10 \times 4 = 40$
Minor (MN)	8	$8 \times 4 = 32$
Multidisciplinary (MD)	3	$3 \times 3 = 9$
Skill Enhancement Courses (SEC)	3	$3 \times 3 = 9$
Ability Enhancement Language Courses (AEC)	4	$1 \times 2 = 2$ (ENG) $3 \times 2 = 6$ (MIL)
Value Added Course (VAC)	2	$2 \times 4 = 8$
Internship (INT)	1	$1 \times 2 = 2$
Research Project/Dissertation	1	$1 \times 12 = 12^{**}$
Totals	46	164

*Additional Summer Internship of 4 credit is mandatory for certificate and diploma courses.

2.2 Curriculum and Credit Framework for Course in Physiology

SEMESTER-I

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/PHY/ 101/MJC-1	MJCT-1: Cellular Basis of Physiology	3	10	25	50	3	NA	2
	MJCP-1: Cellular Basis of Physiology Lab	1		15				
S/PHY/ 102/MN-1	MNT-1: Cellular Physiology	3	10	25	50	3	NA	2
	MNP-1: Cellular Physiology Lab	1		15				
S/PHY/ 103/MD-1	MDT-1: Social Physiology	3	10	40	50	3	NA	NA
S/PHY/ 104/SEC-1	SECP-1: Cytology and Hematological Techniques Lab	3	10	40	50	NA	NA	6
ACS/105/ AEC-1	Compulsory English: Literature and Communication	2	10	40	50	2	NA	NA
ACS/106/ VAC-1	Environmental Studies	4	10	40	50	4	NA	NA
Total in Semester - I		20	60	240	300	15		10

N.B. MJC – Major Core, MN – Minor; MD – Multidisciplinary; SEC- Skill Enhancement Course; AEC- Ability Enhancement Course; VAC- Value Added Course.

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.
S/PHY/ 201/MJC-2	MJCT-2: Circulating Body Fluids	3	10	25	50	3	NA	2
	MJCP-2: Circulating Body Fluids Lab	1		15				
S/PHY/202/ MN-2	MNT-2: Blood and Body Fluids	3	10	25	50	3	NA	2
	MNP-2: Blood and Body Fluids Lab	1		15				
S/PHY/203/ MD-2	MDT-2: Environmental Physiology and Human Health	3	10	40	50	3	NA	NA
S/PHY/204/ SEC-2	SECT-1: Clinical Biochemistry	3	10	40	50	3	NA	NA
ACS/205/ AEC-2	MIL-1 (Santali/Sanskrit/Bengali)	2	10	40	50	2	NA	NA
ACS/206 /VAC-2	Any one of the following a. Health and Wellness b. Understanding India: Indian Philosophical Traditions and Value Systems c. Basics of Indian Constitution d. Arts and Crafts of Bengal e. Historical Tourism in West Bengal	4	10	40	50	4	NA	NA
ACS/207/ INT-1	Internship	4*		50	50	NA	NA	NA
Total in Semester - II		20+4*	60	240	300	18		04
First Year (Certificate Course) Total Credit		40+4*	120	480	600			

N.B. MJC –Major Core, MN – Minor; MD – Multidisciplinary; SEC- Skill Enhancement Course; AEC- Ability Enhancement Course; VAC- Value Added Course; INT- Internship; 4*- Additional

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

* Certificate course in Physiology will be awarded to a student if he or she completes Internship of 4 credits in addition to total 40 credits in Semester I & II.

SEMESTER-III

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/PHY/ 301/MJC-3	MJCT-3: Biophysics and Enzymes	3	10	25	50	3	NA	2
	MJCP-3: Biophysics and Enzymes Lab	1		15				
S/PHY/ 302/MJC-4	MJCT-4: Chemistry of Biomolecules	3	10	25	50	3	NA	2
	MJCP-4: Chemistry of Biomolecules Lab	1		15				
S/PHY/ 303/MN-3	MNT-3: Biophysics and Biochemistry	3	10	25	50	3	NA	2
	MNP-3: Biophysics and Biochemistry Lab	1		15				
S/PHY/ 304/MD-3	MDT-3: Preventive and Social Medicine	3	10	40	50	3	NA	NA
S/PHY/305/ SEC-3	SECP-2: Food Adulteration and Nutritional Biochemistry Lab	3	10	40	50	NA	NA	6
ACS/306/ AEC-3	MIL-2	2	10	40	50	2	NA	NA
Total in Semester - III		20	60	240	300	14		12

N.B. MJC – Major Core; MN – Minor; MD – Multidisciplinary; AEC- Ability Enhancement Course; SEC- Skill Enhancement Course.

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.
S/PHY/401 /MJC-5	MJCT-5: Nerve and Muscle Physiology	3	10	25	50	3	NA	2
	MJCP-5: Nerve and Muscle Physiology Lab	1		15				
S/PHY/402 /MJC-6	MJCT-6: Cardiovascular and Respiratory Physiology	3	10	25	50	3		2
	MJCP-6: Cardiovascular and Respiratory Physiology Lab	1		15				
S/PHY/403 /MJC-7	MJCT-7: Gastrointestinal Physiology	3	10	25	50	3	NA	2
	MJCP-7: Gastrointestinal Physiology Lab	1		15				
S/PHY/404 /MJC-8	MJCT-8: Energy Balance and Metabolism	3	10	25	50	3	NA	2
	MJCP-8: Energy Balance and Metabolism Lab	1		15				
S/PHY/ 405/MN-4	MNT-4: Cardio-respiratory Physiology	3	10	25	50	3	NA	2
	MNP-4: Cardio-respiratory Physiology Lab	1		15				
ACS/406/ AEC-4	English	2	10	40	50	2	NA	NA
ACS/407/ INT-2	Internship	4*		50	50	NA	NA	NA
Total in Semester - IV		22+4*	60	240	300	17		10
Second Year (Diploma Course) Total Credit		(40+42) +4*	120	480	600			

N.B. MJC – Major Core; MN – Minor; MD – Multidisciplinary; AEC- Ability Enhancement Course; INT- Internship; 4*- Additional

Theory: 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week. * Diploma in Physiology will be awarded to a student if he or she completes Internship of 4 credits at least 1 in 2 years in addition to total 82 credits in Semester I, II, III & IV.

**SEMESTER-V**

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/PHY/ 501/MJC-9	MJCT-9: Physiology of Nervous System	3	10	25	50	3	NA	2
	MJCP-9: Physiology of Nervous System Lab	1		15				
S/PHY/ 502/MJC-10	MJCT-10: Special Senses	3	10	25	50	3	NA	2
	MJCP-10: Special Senses Lab	1		15				
S/PHY/ 503/MJE-1	MJET-1: Microbiology and Immunology	3	10	25	50	3	NA	2
	MJEP-1: Microbiology and Immunology Lab	1		15				
S/PHY/ 504/MJE-2	MJET-2: Human Nutrition and Dietetics	3	10	25	50	3	NA	2
	MJEP-2: Human Nutrition and Dietetics Lab	1		15				
S/PHY/ 505/MN-5	MNT-5: Neuro-muscular Physiology	3	10	25	50	3	NA	2
	MNP-5: Neuro-muscular Physiology Lab	1		15				
ACS/PHY/ 506/INT-3	INT-3: Internship**	2	NA	50	50	NA	NA	7 days (6 Hr. per day)
Total in Semester – V		22	60	240	300	15		10

N.B. MJC – Major Core, MJE – Major Elective; MN – Minor; MD – Multidisciplinary; INT-Internship **(Mandatory)

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.
S/PHY/ 601/MJC-11	MJCT-11: Endocrinology	3	10	25	50	3	NA	2
	MJCP-11: Endocrinology Lab	1		15				
S/PHY/ 602/MJC-12	MJCT-12: Reproductive Physiology and Embryology	3	10	25	50	3	NA	2
	MJCP-12: Reproductive Physiology and Embryology Lab	1		15				
S/PHY/ 603/MJE-3	MJET-3: Ergonomics and Sports Physiology	3	10	25	50	3	NA	2
	MJEP-3: Ergonomics and Sports Physiology Lab	1		15				
S/PHY/ 604/MJE-4	MJET-4: Biostatistics and Computer Application	3	10	25	50	3	NA	2
	MJEP-4: Biostatistics and Computer Application Lab	1		15				
S/PHY/ 605/MN-6	MNT-6: Digestion, Absorption and Metabolism	3	10	25	50	3	NA	2
	MNP-6: Digestion, Absorption and Metabolism Lab	1		15				
Total in Semester – VI		20	50	240	250	15		10
Third Year (UG Degree Course) Total Credit		82+42	110	480	550			

N.B. MJC – Major Core, MJE – Major Elective; MN – Minor; Theory: 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week* Degree in Physiology will be awarded to a student if he or she completes Internship of 2 credits in addition to total 124 credits in Semester I, II, III, IV, V & VI.



SEMESTER-VII

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/PHY/ 701/MJC-13	MJCT-13: Excretory System and Body Temperature Regulation	3	10	25	50	3	NA	2
	MJCP-13: Excretory System and Body Temperature Regulation Lab	1		15				
S/PHY/ 702/MJE-5	MJET-5: Instrumentation	3	10	25	50	3	NA	2
	MJEP-5: Instrumentation Lab	1		15				
S/PHY/ 703/MJE-6	MJET-6: Genetics, Molecular Biology and Biotechnology	4	10	40	50	4	NA	NA
S/PHY/ 704/MJE-7	MJET-7: Research Methodology and Research Ethics	4	10	40	50	4	NA	NA
S/PHY/ 705/MN-7	MNT-7: Microbiology and Immunology	3	10	25	50	3	NA	2
	MNP-7: Microbiology and Immunology Lab	1		15				
Total in Semester – VII		20	50	240	300	18		04

N.B. MJC – Major Core, MJE – Major Elective; MN – Minor. Theory: - 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week

**SEMESTER–VIII**

Course Code	Course Title	Credit	Marks			No. of Hours/Week		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/PHY/ 801/MJC-14	MJCT-14: Social Physiology	3	10	25	50	4	NA	2
	MJCP-14: Social Physiology Lab	1		15				
S/PHY/ 802/MJE-8	MJET-8: Nanobiotechnology	4	10	40	50	4	NA	NA
S/PHY/ 803/MJE-9	MJET-9: Physiological Basis of Pharmacology and Toxicology	4	10	40	50	4	NA	NA
S/PHY/ 804/MJE-10	MJET-10: Environmental Physiology	3	10	25	50	4	NA	2
	MEP10: Environmental Physiology Lab	1		15				
S/PHY/ 805/MN-8	MNT-8: Endocrine and Reproductive Physiology	3	10	25	50	4	NA	4
	MNP-8: Endocrine and Reproductive Physiology Lab	1		15				
S/PHY/ 806/RPD-1	RESEARCH PROJECT Student secured more than 75%marks in last six semesters who opt for Honours with Research has one research project of 12 credits to complete under any of the faculty in lieu of 3 MJE papers	12	NA	150	150	NA	NA	NA
Total in Semester – VIII		20	50	240	250	16*		16
Fourth Year UG Hons. With Research		124+40 = 164	110	480	550			

N.B. MJC – Major Core; MJE – Major Elective; MN – Minor; RPD- Research Project. Theory: - 1 Credit= 1 hour/Week, Practical: - 1 Credit= 2 hours/Week, Tutorial: - 1 Credit= 1 hour/Week

Honours in Physiology will be awarded to a student if he or she completes Internship (in Semester V) of 2 credits in addition to total 162 credits in all Semesters

Honours with Research in Physiology will be awarded to a student if he or she completes Internship (in Semester V) of 2 credits in addition to total 162 credits in all Semesters provided He or She successfully completed Research Project in lieu of 3 DSE papers.

2.3 Choices for Major Core (MJC) Courses

SEMESTER	COURSE	CHOICE
I	MJC-1	MJCT-1: Cellular Basis of Physiology
		MJCP-1: Cellular Basis of Physiology Lab
II	MJC-2	MJCT-2: Circulating Body Fluids
		MJCP-2: Circulating Body Fluids Lab
III	MJC-3	MJCT-3: Biophysics and Enzymes MJCP-3: Biophysics and Enzymes Lab
	MJC-4	MJCT-4: Chemistry of Biomolecules MJCP-4: Chemistry of Biomolecules Lab
IV	MJC-5	MJCT-5: Nerve and Muscle Physiology MJCP-5: Nerve and Muscle Physiology Lab
	MJC-6	MJCT-6: Cardiovascular and Respiratory Physiology MJCP-6: Cardiovascular and Respiratory Physiology Lab
	MJC-7	MJCT-7: Gastrointestinal Physiology MJCP-7: Gastrointestinal Physiology Lab
	MJC-8	MJCT-8: Energy Balance and Metabolism MJCP-8: Energy Balance and Metabolism Lab
V	MJC-9	MJCT-9: Physiology of Nervous System MJCP-9: Physiology of Nervous System Lab
	MJC-10	MJCT-10: Special Senses MJCP-10: Special Senses Lab
VI	MJC-11	MJCT-11: Endocrinology MJCP-11: Endocrinology Lab
	MJC-12	MJCT-12: Reproductive Physiology and Embryology MJCP-12: Reproductive Physiology and Embryology Lab
VII	MJC-13	MJCT-13: Excretory System and Body Temperature Regulation MJCP-13: Excretory System and Body Temperature Regulation Lab
VIII	MJC-14	MJCT-14: Social Physiology MJCP-14: Social Physiology Lab

2.4 Choices for Major Electives (MJE) Courses

SEMESTER	COURSE	CHOICE
V	MJE-1	MJET-1: Microbiology and Immunology MJEP-1 Microbiology and Immunology Lab
	MJE-2	MJET-2: Human Nutrition and Dietetics MJEP-2: Human Nutrition and Dietetics Lab
VI	MJE-3	MJET-3: Ergonomics and Sports Physiology MJEP-3: Ergonomics and Sports Physiology Lab
	MJE-4	MJET-4: Biostatistics and Computer Application MJEP-4: Biostatistics and Computer Application Lab
VII	MJE-5	MJET-5: Instrumentation MJEP-5 Instrumentation Lab
	MJE-6	MJET-6: Genetics, Molecular Biology and Biotechnology
	MJE-7	MJET-7: Research Methodology and Research Ethics
VIII	MJE-8	MJET-8: Nanobiotechnology
	MJE-9	MJET-9: Physiological Basis Pharmacology and Toxicology
	MJE-10	MJET-10: Environmental Physiology MJEP-10: Environmental Physiology Lab
	RPD-1	OR RESEARCH PROJECT Student secured more than 75%marks in last six semesters who opt for Honours with Research has one research project of 12 credits to complete under any of the faculty in lieu of 3 MJE papers

2.5 Choices for Minor (MN) Courses

SEMESTER	COURSE	CHOICE
I	MN-1	MNT-1: Cellular Physiology MNP-1: Cellular Physiology Lab
II	MN-2	MNT-2: Blood and Body Fluids MNP-2: Blood and Body Fluids Lab
III	MN-3	MNT-3: Biophysics and Biochemistry MNP-3: Biophysics and Biochemistry Lab
IV	MN-4	MNT-4: Cardio-respiratory Physiology MNP-4: Cardio-respiratory Physiology Lab
V	MN-5	MNT-5: Neuro-muscular Physiology MNP-5: Neuro-muscular Physiology Lab
VI	MN-6	MNT-6: Digestion, Absorption and Metabolism MNP-6: Digestion, Absorption and Metabolism Lab
VII	MN-7	MNT-7: Microbiology and Immunology MNP-7: Microbiology and Immunology Lab
VIII	MN-8	MNT-8: Endocrine and Reproductive Physiology MNP-8: Endocrine and Reproductive Physiology Lab

2.6 Choices for Skill Enhancement Courses (SEC)

SEMESTER	COURSE	CHOICE
I	SEC-1	SECP-1: Cytology and Hematological Techniques Lab
II	SEC-2	SECT-1: Clinical Biochemistry
III	SEC-3	SECP-2: Food Adulteration and Nutritional Biochemistry Lab

2.7 Choices for Multidisciplinary (MD) Courses

SEMESTER	COURSE	CHOICE
I	MD-1	MDT-1: Social Physiology
II	MD-2	MDT-2: Environmental Physiology and Human Health
III	MD-3	MDT-3: Preventive and Social Medicine

2.8 Question Pattern Across Courses

Question Pattern							
Examination	Course type	Credits (Theory + Practical)	Type of questions	Marks/ question	Number of questions to be attempted	Total	Number of options (Out of)
	Total Marks (Theoretical)					25	
	MJC, MJE, MI, MD	3	Objective	1	5	5	8
			Short	5	2	10	4
			Broad	10	1	10	2
	Total Marks (Theoretical)					40	
	SEC	3	Very short	2	5	10	8
			Short	5	4	20	6
			Broad	10	1	10	2
	Total Marks (Practical)					15	
	MJC, MJE, MI and MD	1	Practical Work	10	Answer all the question	10	N A
			Laboratory Note Book	3		3	N A
			Viva voce	2		2	N A
	Total Marks (Practical)					40	
	SEC	3	Practical Work	10	3	30	3
			Laboratory Note Book	5	NA	5	N A
			Viva voce	5	NA	5	N A

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



3.0 Major Core (MJC) Courses

SEMESTER-I**3.1 MJCT-1: Cellular Basis of Physiology****Course Code: S/PHY/101/MJC-1****Course ID: 12511****[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] 3 Credits*****Course Learning Outcomes:***

- This course gives a wide knowledge about structure and functions of cell organelle.
- From this course students will gather the knowledge about the cell, tissue, organ and systems.
- The course would fortify to the students to acquire the knowledge about transport across cell membranes and intracellular communications.
- They acquire a concept about cell cycle, cell division, homeostasis and aging process.

Unit 1

1. Introduction
2. Structure and function of cell organelle – Plasma membrane, nucleus, mitochondria, ribosome, lysosome, Golgi body, endoplasmic reticulum, peroxisomes, cytoskeletal elements and centrosomes.
3. Transport across cell membranes - Active, passive, carrier mediated, antiport and symport.
4. Intercellular communication – Gap junction, tight junction, intercalated disc, desmosomes and cell adhesion molecules. Extracellular matrix components.
5. Tissue, organ and systems – General classification, special emphasis on epithelial tissue and connective tissue. Brief idea on organs and systems.

Unit 2

1. Cell cycle – Definition, different phases of cell cycles, regulation and check points of cell cycle.
2. Cell division
 - a. Mitosis – Phases and significance.
 - b. Meiosis – Phases and significance.
 - c. Special emphasis on homologous, heterologous, chiasma formation, crossing over, recombination and disjunction of chromosome.
3. Apoptosis and necrosis - Basic concept and pathways involved.
4. Aging - Definition, theories of aging, factors affecting and management.

3.2 MJCP-1: Cellular Basis of Physiology Lab

Course Code: S/PHY/101/MJC-1

Course ID: 12521

[Practical: Credits 1 (2 Practical Classes/Week) /Marks 15] 1 Credits

Course Learning Outcomes:

- From this course students will gather their knowledge about various parts of microscope.
- This practical course will provide wide range of knowledge about histological structure of different organs and glands.
- They will gather knowledge about structural morphology of different types of fresh tissue.

1. Principle, working procedure 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, trachea, lungs, spleen, lymph gland, tongue, esophagus, stomach, small intestine, large intestine, liver, kidney, salivary glands, pancreas, adrenal gland, thyroid gland, testes, ovary, uterus, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, smooth muscle, artery and vein.
4. Examination and staining of fresh squamous epithelium by methylene blue stain.
5. Staining of adipose tissue using Sudan III or IV.

Suggested Readings:

1. Rastogy S. C. (2005). Cell and molecular biology. New Age International Publishers.
2. Mescher A.L. (2013). Junqueira's Basic Histology Text and Atlas. Thirteenth Edition. The Tata McGraw Hill Companies.
3. Ross M.H and Reith, E.J. (2011). Histology - A Text and Atlas. Sixth Edition. The Williams and Wilkins Company.
4. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
5. Eroschenko V.P. (2012). Difiore's Atlas of Histology: With Functional Correlations. Twelfth Edition. Lippincott Williams Wilkins Company.
6. Hardin J. Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education, Inc. USA. 8th edition.
7. Cooper G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
8. Mahapatra A.B.S.M. (2014). Essentials of Medical Physiology. Forth Edition. Current Books International.
9. Sembulingam K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
10. Khurana I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
11. Chatterjee C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.



12. Chaudhuri S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
13. Debnath J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.
14. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
15. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
16. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
17. Pal G.K. Pal P. (2013). Textbook of Practical Physiology. Third Edition. Universities Press.
18. Halder H, Joardar N, Maiti R, Ghosh D and Jana K. The interplay between endoplasmic reticulum stress mediated ROS generation and Apoptosis in human diseases. Nova Publication. USA.

SEMESTER-II**3.3 MJCT-2: Circulating Body Fluids****Course Code: S/PHY/201/MJC-2****Course ID: 22511****[Theory: Credits 3 (3 Lectures/Week)/ Marks 25]****3 Credits*****Course Learning Outcomes:***

- From this course students will gain the knowledge about blood and its components.
- This course will enrich the learner about the morphology, classification and important function of formed elements.
- Student will acquire the knowledge on hemostatic mechanism and the clinical aspects of blood coagulation.
- The students will gain their knowledge on blood group, blood transfusion and its related health hazards.

1. Introduction on circulating body fluids, body fluids compartments and significances.
2. Blood – Components, properties and general functions.
3. Plasma proteins - Origin, synthesis, classification and function.
4. Blood volume: Measurement and factors affecting blood volume.
5. Bone marrow – Types and functions.
6. Red blood cells – Morphology, Erythropoiesis and applied aspects.
7. Hemoglobin-Structure, types, synthesis and fate.
8. Brief idea on anaemia, polycythemia and hemoglobinopathies.
9. Brief idea on blood cell indices (MCV, MCH, MCHC and Colour index).
10. White blood cells – Morphology, classification, functions, leucopoiesis, applied aspects, Human leucocyte antigen (HLA) and Arneht index.
11. Platelets – Structure and thrombopoiesis.
12. Hemostasis – Definition, factors, modern concept and abnormalities in hemostasis and anticoagulants.
13. Blood group and Rh typing. Cross matching (Major and minor cross matching), blood transfusion and transfusion related hazards.
14. Lymph – Composition, formation, circulation and function.
15. Methods of separation of different components of blood in blood bank and their clinical importance.

3.4 MJCP-2: Circulating Body Fluids Lab

Course Code: S/PHY/201/MJC-2

Course ID: 22521

[Practical: Credit 1/ (2 Practical Classes/Week) /Marks 15] 1 Credit

Course Learning Outcomes:

- The course content will develop skill of our students on hematological techniques.
- Student will gain the knowledge on total count of RBC and WBC.
- They will increase their skill on blood film preparation and staining procedure.
- Student will develop their knowledge on blood group detection and Rh typing.

1. Preparation and staining of blood film with Leishman's stain and identification of blood cells.
2. Differential count of WBC.
3. Total count of RBC and WBC.
4. Bleeding time and clotting time.
5. Estimation of Hemoglobin by Sahli's method.
6. Preparation of haemin crystal.
7. Blood group determination and Rh typing.
8. ESR measurement by Wintrobe's or Westergren method.
9. Determination of haematocrit value, MCV, MCH and MCHC.

Suggestive Readings:

1. Chatterjee C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributors 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. Chaudhuri S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
7. Barrett K. E. Barman, S.M. Boitano, S. and Brooks, H.L. (2012). Ganong's Review of Medical Physiology. 24th Edition. Lange Medical Book. Prentice-Hall International.
8. Pal G.K. Pal P. (2013). Textbook of Practical Physiology. Third Edition. Universities.
9. Debnath J. Baboharik Sharir Bigyan. Shreedhar Prokashani, Kolkata.
10. Mukherjee K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
11. Godkar P.B. Godkar. O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition.



4.0 Major Elective (MJE) Courses



5.0 Minor (MN) Courses

SEMESTER-I**5.1 MNT-1: Cellular Physiology****Course Code: S/PHY/102/MN-1****Course ID: 12512****[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] 3 Credits*****Course Learning Outcomes:***

- This course gives a wide knowledge about structure and functions of cell organelle.
- From this course students will gather the knowledge about the cell, tissue, organ and systems.
- The course would fortify to the students to acquire the knowledge about transport across cell membranes and intracellular communications.
- They acquire a concept about cell cycle, cell division, homeostasis and aging process.

Unit 1

1. Introduction
2. Structure and function of cell organelle – Plasma membrane, nucleus, mitochondria, ribosome, lysosome, Golgi body, endoplasmic reticulum, peroxisomes, cytoskeletal elements and centrosomes.
3. Transport across cell membranes - Active, passive, carrier mediated, antiport and symport.
4. Intercellular communication – Gap junction, tight junction, intercalated disc, desmosomes and cell adhesion molecules. Extracellular matrix components.
5. Tissue, organ and systems – General classification, special emphasis on connective tissue and epithelial tissue. Brief idea on organs and systems.

Unit 2

1. Cell cycle – Definition, different phases of cell cycles, regulation and check points of cell cycle.
2. Cell division
 - a. Mitosis – Phases and significance.
 - b. Meiosis – Phases and significance.
 - c. Special emphasis on homologous, heterologous, chiasma formation, crossing over, recombination and disjunction of chromosome.
3. Apoptosis and Necrosis - Basic concept and pathways involved.
4. Aging: Definition, theories of aging, factors affecting and management.

5.2 MNP-1: Cellular Physiology Lab

Course Code: S/PHY/102/MN-1

Course ID: 12522

[Practical: Credits 1/ (2 Practical Classes/Week) /Marks 15] 1 Credits

Course Learning Outcomes:

- From this course students will gather their knowledge about various parts of microscope.
- This practical course will provide wide range of knowledge about histological structure of different organs and glands.
- They will gather knowledge about structural morphology of different types of fresh tissue.

1. Principle, working procedure 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, trachea, lungs, spleen, lymph gland, tongue, esophagus, stomach, small intestine, large intestine, liver, kidney, salivary glands, pancreas, adrenal gland, thyroid gland, testes, ovary, uterus, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, smooth muscle, artery and vein.
4. Examination and staining of fresh squamous epithelium by methylene blue stain.
5. Staining of adipose tissue using Sudan III or IV.

Suggested Readings:

1. Rastogy S. C. (2005). Cell and molecular biology. New Age International Publishers.
2. Mescher A.L. (2013). Junqueira's Basic Histology Text and Atlas. Thirteenth Edition. The Tata McGraw Hill Companies.
3. Ross M.H, and Reith E.J. (2011). Histology - A Text and Atlas. Sixth Edition. The Williams and Wilkins Company.
4. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
5. Eroschenko V.P. (2012). Difiore's Atlas of Histology: With Functional Correlations. Twelfth Edition. Lippincott Williams Wilkins Company.
6. Hardin, J. Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education, Inc. USA. 8th edition.
7. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
8. Mahapatra, A.B.S.M. (2014). Essentials of Medical Physiology. Forth Edition. Current Books International.
9. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
10. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
11. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.



12. Chaudhuri, S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
13. Debnath J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.
14. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
15. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
16. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
17. Pal G.K. Pal, P. (2013). Textbook of Practical Physiology. Third Edition. Universities. Press.

SEMESTER–II**5.3 MNT-2: Blood and Body Fluids****Course Code: S/PHY/202/MN-2****Course ID: 22512****[Theory: Credits 3/ (3 Lectures/Week)/ Marks 25]****3 Credits*****Course Learning Outcomes:***

- From this course students will gain the knowledge about blood and its components.
- This course will enrich the learner about the morphology, classification and important function of formed elements.
- Student will acquire the knowledge on hemostatic mechanism and the clinical aspects of blood coagulation.
- The students will gain their knowledge on blood group, blood transfusion and its related health hazards.

1. Introduction to blood and body fluids.
2. Blood – Components, properties and general functions.
3. Plasma proteins - Origin, synthesis, classification and function.
4. Blood volume: Measurement and factors affecting blood volume.
5. Bone marrow – Types and functions.
6. Red blood cells – Morphology, Erythropoiesis, fate of RBC and applied aspects.
7. Hemoglobin-Structure, types, synthesis and fate.
8. Brief idea on anaemia, polycythemia and hemoglobinopathies.
9. Brief idea on blood cell indices (MCV, MCH, MCHC and Colour index).
10. White blood cells – Morphology, classification, functions, leucopoiesis, applied aspects, Human leucocyte antigen (HLA) and Arneth index.
11. Platelets – Structure and thrombopoiesis
12. Hemostasis – Definition, factors, modern concept and abnormalities in hemostasis and anticoagulants.
13. Blood group and Rh typing. Cross matching (Major and minor cross matching), blood transfusion and transfusion related hazards.
14. Lymph – Composition, formation, circulation and function.
15. Methods of separation of different components of blood in blood bank and their clinical importance.

5.4 MNP-2: Blood and Body Fluids Lab

Course Code: S/PHY/202/MN-2

Course ID: 22522

[Practical: Credit 1/ (2 Practical Classes/Week) /Marks 15] 1 Credit

Course Learning Outcomes:

- The course content will develop skill of our students on hematological techniques.
- Student will gain the knowledge on total count of RBC and WBC.
- They will increase their skill on blood film preparation and staining procedure.
- Student will develop their knowledge on blood group detection and Rh typing.

1. Preparation and staining of blood film with Leishman's stain and identification of blood cells.
2. Differential count of WBC.
3. Total count of RBC and WBC.
4. Bleeding time and clotting time.
5. Estimation of hemoglobin by Sahli's method.
6. Preparation of haemin crystal.
7. Blood group determination and Rh typing.
8. ESR measurement by Wintrobe's or Westergren method.
9. Determination of haematocrit value, MCV, MCH and MCHC.

Suggestive Readings:

1. Chatterjee C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributors 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. Chaudhuri S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
7. Barrett K. E. Barman, S.M. Boitano, S. and Brooks, H.L. (2012). Ganong's Review of Medical Physiology. 24th Edition. Lange Medical Book. Prentice-Hall International.
8. Pal G.K. Pal P. (2013). Textbook of Practical Physiology. Third Edition. Universities.
9. Debnath J. Baboharik Sharir Bigyan. Shreedhar Prokashani, Kolkata.
10. Mukherjee K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
11. Godkar P.B. Godkar. O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition.



6.0 Multidisciplinary (MD) Courses

**SEMESTER-I****6.1 MDT-1: Social Physiology****Course Code: S/PHY/103/MD-1****Course ID: 12513****[Theory: Credits 3 (3 Lectures/Week)/ Marks 40] 3 Credits*****Course Learning Outcomes:***

- This course gives a wide knowledge about structural and functional organization of different body systems.
- From this course students will gather the knowledge about the role different nutrients and food on health management and disease prevention.
- The course would fortify to the students to acquire the knowledge about hygiene and health maintenance.
- They acquire a concept about the importance of physical activity, exercise, yoga and meditation on health.

1. An introductory idea on different systems of human body.
2. Brief idea on structural and functional organization of different systems.
3. Basic concept of Social Physiology.
4. Role of nutrients and food on health management and disease prevention - cardiovascular disease (Hypertension, atherosclerosis and stroke), anaemia, diabetes mellitus, undernutrition, obesity and immunodeficiency disease.
5. Basic concept of physical activity, exercise and sports: Role of physical activity and exercise on human health and wellbeing.
6. Hygiene and sanitation for health maintenance and disease prevention.
7. Concept of health, food hygiene, food style and life style for disease prevention.
8. Preliminary idea about the impact of Yoga and Meditation on human health.

Suggested Readings:

1. Park K. (2023) Park's Textbook of Preventive and Social Medicine. 27th Edition. M/s. Banarsidas Bhanot "Press Chowk", 1167, Prem Nagar, Jabalpur – 482001, M.P., India.
2. Lal S. Pankaj A. (2023). Textbook of Community Medicine Preventive Social Medicine. 7th Edition. CBS Publishers and Distributors Pvt. Ltd.
3. Bedi Y. (2022). Hand Book of Preventive and Social Medicine. 7th Edition. CBS Publishers and Distributors Pvt. Ltd.
4. Gupta, M.C. Mahajan, B.K. (2004). Textbook of Preventive and Social Medicine. 4th Edition. Jaypee.
5. Gupta P. Khan A.M. (2016). Textbook of Community Medicine: 1st Edition. CBS Publishers and Distributors Pvt. Ltd.
6. Saha S. Pathos of pandemic: COVID-19; New Delhi Publisher: ISSBN: 978-93-93878-00-7

**SEMESTER-II****6.2 MDT-2: Environmental Physiology and Human Health**

Course Code: S/PHY/203/MD-2

Course ID: 22513

[Theory: Credits 3/ (3 Lectures /Week)/ Marks 40] 3 Credits***Course Learning Outcomes:***

- This course will help our students to enhance their skill to measure dissolved oxygen in water sample.
- They will be able to measure relative humidity and suspended particulate matter in air.
- Lerner will also get their skill to measure noise and light intensity of different working places.
- From this discipline specific elective course student will also develop their ability to soil pH in different climatic areas.

1. Basic concept of environment and its components.
2. Interrelationship of different components of an environment.
3. Pollutants: Definition and types.
4. Air pollution: Definition, sources, effects of air pollutant (SO_x, NO_x CO_x and particulate matter) on human health and control measurement in brief.
5. Water pollution: Definition, sources, water pollutants and health hazards, preventive measures, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), thermal pollution, concept of safe drinking water standards.
6. Pesticides, fungicides and herbicides and their effects on human health.
7. Heavy metals (arsenic, mercury and lead) and halide (fluoride) pollution and effects on human health.
8. Sound pollution: Definition, concept of noise, source of sound pollution, effects on human health, preventive measures of sound pollution, noise index and noise standards.
9. Soil pollution: Causes, effects of soil pollution on human and control of soil pollution, Solid waste managements, Bioremediation and Phytoremediation.
10. Radionuclide pollution: Ionizing radiations, effects of ionizing radiation on human health, permissible doses and controlling measure.

Suggested Readings:

1. Saha T.K. (2013). Ecology and Environmental Biology. Books and Allied Ltd.
2. Agarwal K.M. Sikdar P.K. Deb S.C. (2002). A text book of environment. Macmillan India Limited.
3. Pal G. (2006). Paribesh O dushan. Dasgupta Publisher.
4. Cunningham W.P. (2019) Principles of Environmental Science. Tata Mc GrewHill Publisher.
5. Miller G. T. Spoolman S. (2010) An introduction to environmental Science. 13th Edition. Brooks/Cole Publisher.



7.0 Skill Enhancement Courses (SEC)

SEMESTER-I**7.1 SECP-1: Cytological and Hematological Techniques Lab****Course Code: S/PHY/104/SEC-1****Course ID: 12525****[Practical: Credits 3/ (6 Practical Classes/Week) /Marks 40]****3 Credits*****Course Learning Outcomes:***

- This skill enhancement course learner will gain their knowledge about preparation of blood smear, staining along with identification of blood cells.
- From this paper students will increase their knowledge and techniques about total count of RBC and WBC.
- They acquire their skill for measurement of hemoglobin percentage and determination of haematocrit, MCV, MCH, MCHC, bleeding time and clotting time.
- Learner will fortify their skill on estimation of urea and creatinine in serum sample along with estimation of blood sugar level.

1. Preparation and staining of blood film with Leishman's stain and identification of blood cells.
2. Estimation of hemoglobin by Sahli's method.
3. Preparation of haemin crystal.
4. Cell viability study by eosin and nigrosine.
5. Staining of ciliated epithelial tissue by methylene blue.
6. Preparation and staining of skeletal muscle fiber by methylene blue.
7. Cell fragility test after exposure in different osmolar solution.
8. Identification of different phases of cell division from permanent slide.

Suggested Readings:

1. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
2. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
3. Pal G.K. Pal P. (2013). Textbook of Practical Physiology. Third Edition. Universities.
4. Manna M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
5. Mukherjee K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
6. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
7. Godkar P.B. Godkar. O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition.

**SEMESTER-II****7.2 SECT-1: Clinical Biochemistry****Course Code: S/PHY/204/SEC-2****Course ID: 22515****[Practical: Credits 3/ (3 Lectures/Week) /Marks 40]****3 Credits*****Course Learning Outcomes:***

- Student will be developing their hands of knowledge on principle and application of colorimeter and spectrophotometer.
- Learner will gain their ideas on pathophysiological significance of blood parameters.
- From this course learners will acquire their knowledge on pathological significance of some enzymes and proteins.

1. Introduction to Clinical Biochemistry.
2. Principle, working procedure and application of colorimeter and spectrophotometer.
3. Pathophysiological significance of blood parameters – Glucose, serum protein, albumin, albumin globulin ratio, urea, creatinine, uric acid and ketone bodies.
4. Pathophysiological significance serum bilirubin and biliverdin.
5. Alteration of lipid profile and thyroid profile in human health and disease.
6. Pathological significance of some enzymes and proteins: Lactate dehydrogenase, glucose-6-phosphate dehydrogenase, creatine kinase, amylase, ACP, ALP, Beta-glucuronidase, ALT, AST, Lipase, Gamma-glutamyl transpeptidase, cardiac troponins and CRP.

Suggested Readings:

1. Basu P. Biochemistry Laboratory Manual. Academic Publishers.
2. Jayaraman, J. Laboratory Manual in Biochemistry. 2nd Edition. New Age International Publisher.
3. Das D. (2008). Biochemistry. Academic Publishers.
4. Satyanarayana, U. and Chakrapani. U. (2013). Biochemistry. 4th Edition. Elsevier India.
5. Nelson D.L and Cox M.M. (2017). Lehninger Principles of Biochemistry, 7th Edition., W.H. Freeman and Company.
6. Campbell M.K. (2012) Biochemistry, 7th ed., Published by Cengage Learning.