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 2024-2025

BANKURA UNIVERSITY

BANKURA

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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)	Skill Enhancement Course (SEC) (3)	Ability Enhancement Course (AEC) (2)	Value Added Courses Common for all (4)	Summer Internship (2)	Research Project / Dissertation (12)	Total Credit / Number of Courses
Semester	DSC	DSE								
I	1× 4 =4		1× 4=4	1×3=3	1×3=3	1× 2=2	1× 4=4			20/6
II	1× 4 =4		1× 4=4	1×3=3	1×3=3	1× 2=2	1× 4=4			20/6
Certificate (Total Credit)	8		8	6	6	4	8	1×4=4* (ADDITIONAL)		40/12
III	2×4 =8		1× 4=4	1×3=3	1×3=3	1 × 2=2				20/6
IV	4×4 = 16		1×4=4			1 × 2=2				22/6
Diploma (Total Credit)	32		16	9	9	8	8	1×4=4* (ADDITIONAL)		82/24
V	4×4 =16		1×4=4					1×2 =2 Mandatory		22/6
VI	4×4 = 16		1×4=4							20/5
UG Degree (Total Credit)	64		24	9	9	8	8	2		124/35
VII	4×4 =16		1×4=4							20/5
VIII	4× 4 =16		1×4=4							20/5
UG HONS. (Total Credit)	24×4 =96		32	9	9	8	8	2		164/45
UG HONS. With Research (Total Credit)	21×4= 84		32	9	9	8	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)	24	24×4 =96
Minor (MN)	8	8×4=32
Multidisciplinary (MD)	3	3×3=9
Skill Enhancement Courses (SEC)	3	3×3=9
Ability Enhancement Language Courses (AEC)	4	1×2=2 (ENG) 3×2=6 (MIL)
Value Added Course (VAC)	2	2×4=8
Internship (INT)	1	1×2=2
Research Project/Dissertation	1	1×12=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 MJCP-1: Cellular Basis of Physiology Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 102/MN-1	MNT-1: Cellular Physiology MNP-1: Cellular Physiology Lab	3 1	10	25 15	50	3	NA	2
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 MJCP-2: Circulating Body Fluids Lab	3 1	10	25 15	50	3	NA	2
S/PHY/202/ MN-2	MNT-2: Blood and Body Fluids MNP-2: Blood and Body Fluids Lab	3 1	10	25 15	50	3	NA	2
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 MJCP-3: Biophysics and Enzymes Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 302/MJC-4	MJCT-4: Chemistry of Biomolecules MJCP-4: Chemistry of Biomolecules Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 303/MN-3	MNT-3: Biophysics and Biochemistry MNP-3: Biophysics and Biochemistry Lab	3 1	10	25 15	50	3	NA	2
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: (Bengali/ Sanskrit/ Santali/)	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	Compulsory English: Literature Language and Communication	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 MJCP-9: Physiology of Nervous System Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 502/MJC-10	MJCT-10: Special Senses MJCP-10: Special Senses Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 503/MJC-11	MJCT-11: Microbiology and Immunology MJCP-11: Microbiology and Immunology Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 504/MJC-12	MJCT-12: Human Nutrition and Dietetics MJCP-12: Human Nutrition and Dietetics Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 505/MN-5	MNT-5: Neuro-muscular Physiology MNP-5: Neuro-muscular Physiology Lab	3 1	10	25 15	50	3	NA	2
ACS/ 506/INT-3	INT-3: Internship**	2	NA	50	50	NA	NA	4 hours/ Week. Total 60 Hours
Total in Semester – V		**22**	**60**	**240**	**300**	**15**		**10**

N.B. MJC – Major Core, 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-13	MJCT-13: Endocrinology	3	10	25	50	3	NA	2
	MJCP-13: Endocrinology Lab	1		15				
S/PHY/ 602/MJC-14	MJCT-14: Reproductive Physiology and Embryology	3	10	25	50	3	NA	2
	MJCP-14: Reproductive Physiology and Embryology Lab	1		15				
S/PHY/ 603/MJC-15	MJCT-15: Excretory System and Body Temperature Regulation	3	10	25	50	3	NA	2
	MJCP-15: Excretory System and Body Temperature Regulation Lab	1		15				
S/PHY/ 604/MJC-16	MJCT-16: Biostatistics and Computer Application	3	10	25	50	3	NA	2
	MJCP-16: 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, 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-17	MJCT-17: Ergonomics and Sports Physiology MJCP-17: Ergonomics and Sports Physiology Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 702/MJC-18	MJCT-18: Instrumentation MJCP-18: Instrumentation Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 703/MJC-19	MJCT-19: Genetics, Molecular Biology and Biotechnology MJCP-19: Genetics, Molecular Biology and Biotechnology Lab	3 1	10	25 15	50	3	NA	2
S/PHY/ 704/MJC-20	MJCT-20: Research Methodology and Research Ethics	4	10	40	50	4	NA	NA
S/PHY/ 705/MN-7	MNT-7: Microbiology and Immunology MNP-7: Microbiology and Immunology Lab	3 1	10	25 15	50	3	NA	2
Total in Semester – VII		**20**	**50**	**240**	**300**	**18**		**04**

N.B. MJC – Major Core, 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-21	MJCT-21: Social Physiology MJCP-21: Social Physiology Lab	3 1	10	25 15	50	4	NA	2
S/PHY/ 802/MJC-22	MJCT-22: Nanobiotechnology	4	10	40	50	4	NA	NA
S/PHY/ 803/MJC-23	MJCT-23: Physiological Basis of Pharmacology and Toxicology MJCP-23: Physiological Basis of Pharmacology and Toxicology Lab	3 1	10	25 15	50	4	NA	2
S/PHY/ 804/MJC-24	MJCT-24: Environmental Physiology MJCP-24: Environmental Physiology Lab	3 1	10	25 15	50	4	NA	2
S/PHY/ 805/MN-8	MNT-8: Endocrine and Reproductive Physiology MNP-8: Endocrine and Reproductive Physiology Lab	3 1	**10**	25 **15**	**50**	**4**	**NA**	**4**
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; 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
	MJC-11	MJCT-11: Microbiology and Immunology MJCP-11: Microbiology and Immunology Lab
	MJC-12	MJCT-12: Human Nutrition and Dietetics MJCP-12: Human Nutrition and Dietetics Lab

VI	MJC-13	MJCT-13: Endocrinology MJCP-13: Endocrinology Lab
	MJC-14	MJCT-14: Reproductive Physiology and Embryology MJCP-14: Reproductive Physiology and Embryology Lab
	MJC-15	MJCT-15: Excretory System and Body Temperature Regulation MJCP-15: Excretory System and Body Temperature Regulation Lab
	MJC-16	MJCT-16: Biostatistics and Computer Application MJCP-16: Biostatistics and Computer Application Lab
VII	MJC-17	MJCT-17: Ergonomics and Sports Physiology MJCP-17: Ergonomics and Sports Physiology Lab
	MJC-18	MJCT-18: Instrumentation MJCP-18: Instrumentation Lab
	MJC-19	MJCT-19: Genetics, Molecular Biology and Biotechnology MJCP-19: Genetics, Molecular Biology and Biotechnology Lab
	MJC-20	MJCT-20: Research Methodology and Research Ethics
VIII	MJC-21	MJCT-21: Social Physiology MJCP-21: Social Physiology Lab
	MJC-22	MJCT-22: Nanobiotechnology
	MJC-23	MJCT-23: Physiological Basis of Pharmacology and Toxicology MJCP-23: Physiological Basis of Pharmacology and Toxicology Lab
	MJC-24	MJCT-24: Environmental Physiology MJCP-24: Environmental Physiology Lab

2.4 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

2.5 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

2.6 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 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, MI and 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, MI and MD	1	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	3	Practical Work	10	3	30	3
			Laboratory Note Book	5	NA	5	NA
			Viva voce	5	NA	5	NA

Duration of Examinations

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

3.0 Major Core (MJC) Courses

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. Thirteen 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. and Pal P. (2013). Textbook of Practical Physiology. Third Edition. Universities Press.
18. Jana K. The role of reactive oxygen species in health and disease. (2024). Nova Publication. USA. https://doi.org/10.52305/TRSI2511. ISBN: 979-8-89113-283-2.

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 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.

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.

Suggested Readings:

1. Mahapatra A.B.S.M. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
2. Sembulingam K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
3. Khurana I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
4. Chatterjee C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
5. Chaudhuri S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
6. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
7. 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.

8. Cyril, A. Keele, C. A. Neil, E, Joels, N. (2015). Samson Wrights Applied Physiology. 13th Edition, Oxford University Press. 2015.
9. Tripathi, Y. Tandon, O.P. (2011). Best & Taylor's Physiological Basis of Medical Practice. Thirteen Edition. Wolters Kluwer.
10. Jain, A. K. (2017). Textbook of Physiology. Vol I & II, Seventh Edition Avichal Publishing Company.
11. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill. 22. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
12. Godkar, P.B. Godkar, O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition
13. Debnath, J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.
14. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
15. Varshney, Bedi, M. (2022). Ghai's A Textbook of Practical Physiology. Jaypee Brothers Med Pub Pvt Ltd
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–III

3.5 MJCT-3: Biophysics and Enzymes

Course Code: S/PHY/301/MJC-3 **Course ID: 32511**

[Theory: Credits 3/ (3 Lectures /Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Understand and apply units of measurement for chemical concentrations, including normality, molarity, molality, moles, equivalents, and osmoles.
- Comprehend acid-base balance in biological systems, including the concepts of acidosis, alkalosis, and their physiological tolerance levels.
- Analyze pH and buffer systems using the Henderson-Hasselbalch equation; understand their definitions, types, and significance in physiological pH regulation.
- Define and classify colloids, explain their properties, biological importance, and the concept of protective colloids and gold number.
- Describe osmosis and diffusion, their physiological importance, and explain osmotic pressure.
- Understand the basic laws of thermodynamics (1st and 2nd laws), and concepts like entropy, enthalpy, and Gibbs free energy with their relevance to physiological systems.
- Define enzymes, and differentiate between apoenzyme, holoenzyme, coenzymes, isoenzymes, ribozymes, and abzymes; understand enzyme classification and properties.
- Analyze enzyme kinetics including hyperbolic and sigmoid curves, Michaelis constant (Km), and turnover number (Kcat) along with understand types of enzyme inhibition: competitive, non-competitive, and uncompetitive; explore allosteric regulation.

Unit 1

1. Study of Units for Measurements, Concentration of Solutes: Normality, molarity, molality, moles, equivalents, osmoles.
2. Acids and Bases: Acidosis, alkalosis, tolerance level of acidosis and alkalosis.
3. pH and Buffer – Henderson Hasselbalch equation (Quantitative problems), pH - Definition, explanation and significance. Buffer - Definition, types, buffers in pH regulation.

Unit 2

1. Colloids - Definition, types, properties, importance, protective colloid and gold number.
2. Osmosis and Diffusion – Definition, physiological importance and osmotic pressure.
3. Surface Tension, Specific Gravity – Definition and biological application.
4. Viscosity and Resistance – Definition and physiological importance.
5. Volume pressure flow relationship – Poiseuille-Hagen formula, Law of Laplace, laminar and turbulent flow.
6. Dialysis and Ultracentrifugation – Definition, principle, mechanism in brief and biological application.

Unit 3

1. Autoradiography - Definition, principle and applied value.
2. Cell Fractionation and Tracer Techniques – Process and applied value.
3. Thermodynamics -1st Law, 2nd Law, entropy, enthalpy, Gibbs free energy - General concept and application in human body. Physiological steady state and living body as a thermodynamic system.
4. Gravity and acceleration – Effect of gravity, G forces, protection against positive G and negative G force; zero gravity.

Unit 4

1. **Enzymes:**
   a. Definition, apo-enzyme, holoenzyme, co-enzyme, properties and classification of enzyme, isoenzymes, ribozymes and abzymes.
   b. Mechanism of enzyme action.
   c. Factors regulating enzyme activity.
   d. Kinetics – Hyperbolic and sigmoid kinetics; Michaelis constant and Kcat.
   e. Enzyme Inhibition - Competitive, non-competitive and uncompetitive.
   f. Allosteric modulation of enzymes activities.
   g. Concept of rate limiting enzymes – Definition, features and example.
   h. Basic concept of enzyme synthesis.

3.6 MJCP-3: Biophysics and Enzymes Lab

Course Code: SH/PHY/301/ MJC-3 **Course ID: 32521**

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

Course Learning Outcomes:

- Demonstrate the ability to determine systolic, diastolic, pulse, and mean arterial blood pressure using a non-invasive auscultatory method.
- Perform quantitative analysis of enzyme activity, including amylase, GOT (Glutamate Oxaloacetate Transaminase), and GPT (Glutamate Pyruvate Transaminase) using commercial diagnostic kits.
- Prepare buffer solutions such as phosphate buffer and bicarbonate buffer, and understand their role in maintaining pH stability.
- Determine the strength (normality/molarity) of NaOH, HCl, and H_2SO_4 solutions through acid-base titration techniques.

1. Determination of systolic, diastolic, pulse and mean blood pressure by non-invasive method (Auscultatory Method).
2. Determination of enzyme activity (e.g., Amylase, GOT and GPT by kit method).
3. Preparation of buffer solution (Phosphate buffer and Bi-carbonate buffer).
4. Determination of pH of different fluids by pH meter.
5. Determination of strength of NaOH, HCl and H_2SO_4 by titration.

3.7 MJCT-4: Chemistry of Biomolecules

Course Code: S/PHY/302/MJC-4 **Course ID:32512**

[Theory: Credits 3/ (3 Lectures /Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Define and classify carbohydrates, identify their dietary sources, and describe their chemical structures including types of glycosidic bonds.
- Explain the physical, chemical, and optical properties of carbohydrates and their relevance to biological systems.
- Describe the functions of carbohydrates in the body, including the role of resistant starch and dietary fiber in health and disease.
- Define and classify lipids and fatty acids, and identify their dietary sources.
- Describe the structure and properties of lipids and their functions in biological systems.
- Explain the structure of nucleosides and nucleotides, and distinguish between DNA and RNA in terms of structure, types, and biological functions.

A. Introduction on biomolecules and its importance on human system.

B. Carbohydrates

1. Definition.
2. Classification of carbohydrates and their sources.
3. Structure of carbohydrates and different types of glycosidic bonds.
4. Properties of carbohydrates: Physical, chemical and optical.
5. Functions of carbohydrates.
6. Resistance starch, dietary fibres.
7. Applied aspects of carbohydrates.

C. Proteins

1. Definition
2. Classification of proteins and their sources.
3. Different levels of protein structure - Primary, secondary (α-helix and β- pleated sheet), tertiary and quaternary. Forces stabilizing protein structures.
4. Bonds present in protein structure.
5. Properties of proteins.
6. Functions of proteins.
7. Amino acid - Classification and properties.
8. Applied aspects of proteins.

D. Lipids

1. Definition
2. Classification of lipids and their sources.
3. Classification of fatty acids.
4. Structure of lipids.
5. Properties of lipids.
6. Functions of lipids.

7. Lipoproteins: Properties, classification and their importance.
8. Applied aspects of lipids.

E. Nucleic acids

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

3.8 MJCP-4: Chemistry of Biomolecules Lab

Course Code: S/PHY/ 302/MJP-4 **Course ID: 32522**

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

Course Learning Outcomes:

- Identify and understand the use of glassware and basic equipment commonly used in a biochemistry laboratory.
- Understand the principles of qualitative analysis and perform preliminary tests for physiologically important biomolecules**.**
- Perform systematic and confirmatory qualitative tests for identification of the physiologically relevant substances like acids, carbohydrates, proteins, urea, glycerol and bile salts.

1. Introduction to the glass goods and preliminary devices used in biochemistry lab.
2. Safety profile followed in biochemistry lab.
3. Introduction of qualitative assessment of physiologically important biomolecules.
4. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic acid, uric acid, glucose, galactose, fructose, sucrose, lactose, albumin, gelatin, peptone, starch, dextrin, urea, glycerol and bile salts - Systematic analysis and confirmatory test.

Suggested Readings

1. Das, D. (2004). Biophysics and Biophysical Chemistry. Fifth Edition. Academic Publishers.
2. Roy, R.N. (2015). A. Text Book of Biophysics. New Central Book Agency (P) Ltd.
3. Das, D. (2008). Biochemistry. Academic Publishers.
4. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
5. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
6. Kenneley, P.J. Botham, K.M. McGuinness, O.P. Rodwell, V.W. Weil, P.A. (2023). Harper's Illustrated Biochemistry, Thirty-Second Edition. McGrawHill. Lange.
7. Satyanarayana, U and Chakrapani, U. (2021). Essential of Biochemistry. Elsevier.
8. Voet, D, Voet, J.G. (2011). Biochemistry. 4th Edition. CBS Publishers & Distributors-New Delhi.
9. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2019). Biochemistry Ninth Edition. W.H. Freeman.
10. Nelson, D.L. Cox M. M. (2017). Lehninger Principles of Biochemistry. 7th Edition. W H Freeman & Co.
11. Alberts, B. Alexander, Johnson, A.D. Lewis, J. Morgan, D. Raff, M. Roberts, K. (2014). Molecular Biology of the Cell. W. W. 6th Edition. Norton & Company.

SEMESTER–IV

3.9 MJCT-5: Nerve and Muscle Physiology

Course Code: S/PHY/401/MJC-5 **Course ID: 42511**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Students will develop their knowledge on structure and function of muscle, nerve, synapse and neuromuscular junction.
- From this core paper they will learn the properties of muscle and nerve and mechanism of muscle contraction.
- This core course will provide knowledge about receptors and their function.

Excitable Tissue: Nerve

1. Introduction
2. Neuron – Types, structure and function.
3. Neuroglia - Types, structure and functions with special reference to myelinogenesis.
4. Nerve fiber – Types, functions and properties.
5. Special emphasis on - Stimuli, resting membrane potential, action potential, phases and ionic basis of action potential.
6. Propagation of nerve impulse in myelinated and nonmyelinated nerve fibres.
7. Degeneration and regeneration of nerve fiber.
8. Neurotrophins – Definition, chemical nature and function.
9. Receptors – Definition, classification and properties.
10. Ionic basis of origin of receptor potential in different types of receptors.

Synaptic and Junctional Transmission

1. Introduction
2. Neurotransmitter – Types and function.
3. Synapse – Types, EM structure and properties, mechanism of synaptic transmission, EPSP and IPSP.
4. EM structure of neuromuscular junction. Mechanism of neuromuscular transmission. EPP, MEPP, neuromuscular blocker (in brief).
5. Applied aspects – Myasthenia Gravis, Lambert-Eaton syndrome and denervation hypersensitivity in brief.

Excitable Tissue: Muscle

1. Introduction – Etiology of specific type of muscle, classification and general function.
2. Skeletal muscle

a. Electron microscopic structure of muscle fibre and its classification.
b. Properties – Summation, tetanus, fatigue, chronaxie and rheobase.
c. Mechanism of contraction.
d. Function
e. Applied aspects of muscle - Muscle cramp and muscle flexibility.

3. Cardiac muscle
    a. Structure, properties and functions.
    b. Properties of cardiac muscle.
    c. Mechanism of contraction.
4. Smooth muscle
    a. Structure, properties and functions.
    b. Single unit and multi-unit smooth muscle.
    c. Mechanism of contraction.
5. Comparative discussion between skeletal muscle, smooth muscle and cardiac muscle.

3.10 MJCP-5: Nerve and Muscle Physiology Lab

Course Code: S/PHY/401/MJC-5 **Course ID: 42512**

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

Course Learning Outcomes:

- This course gives a wide knowledge about different parts of kymograph, induction coil and their functions.
- From this course students will develop their skill on staining of nerve and muscle fibres for microscopic observation.
- Learner will increase their ability to prepare nerve muscle preparation and study about different mechanical events of muscle contraction.

1. Study of kymograph, induction coil, key and other instruments used to study mechanical responses of skeletal muscle.
2. Isolation and staining of node(s) of Ranvier ($AgNO_3$ method) and muscle fibers (Using methylene blue).
3. Gastrocnemius-sciatic nerve and muscle preparation of toad.
4. Kymographic recording of simple muscle curve of toad.
5. Calculation of latent period, contraction period, relaxation period, maximum height of contraction from the kymographic recording of simple muscle curve of toad with interpretation.
6. Kymographic recording of warm and cold saline on isolated nerve muscle preparation of toad.

3.11 MJCT-6: Cardiovascular and Respiratory Physiology

Course Code: S/PHY/402/MJC-6 **Course ID: 42513**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Describe the anatomy and physiology of the cardiovascular system, including cardiac conduction, mechanical events of the cardiac cycle, cardiac output, ECG interpretation, and coronary circulation.
- Explain the regulation of heart rate and blood pressure, including the physiological basis and mechanisms behind junctional tissues, pacemaker activity, and jugular venous pressure (JVP).
- Identify and explain the causes, symptoms, and management of common cardiovascular diseases such as hypertension, myocardial infarction, heart block, and atherosclerosis.
- Understand the structure and functions of the respiratory system, mechanisms of breathing, gas exchange, oxygen and carbon dioxide transport, and the significance of pulmonary function tests.
- Analyze the regulatory mechanisms (neural and chemical) of respiration, and discuss respiratory pathologies like COPD, hypoxia, and mountain sickness, along with their physiological adaptations and therapeutic approaches.

Cardiovascular System:

1. Anatomy of human heart and circulation through heart.
2. Special junctional tissues – Location, structure and function.
3. Origin and spread of cardiac impulse and pacemaker potential.
4. Properties of cardiac muscle.
5. Mechanical events of the cardiac cycle, volume & pressure change and heart sounds,
6. Cardiac Output - Definition, types, factors affecting, regulation and measurement.
7. Anatomy, peculiarities and regulation of coronary circulation.
8. Regulation of heart rate, JVP.
9. Blood pressure, factors affecting and regulation.
10. ECG – Leads, Einthoven's triangle & law, normal waves, segments and intervals with significance, cardiac vector and mean electrical axis of heart.
11. Common cardiovascular diseases (Hypertension, myocardial ischaemia, atherosclerosis, myocardial infarction and heart block) – Causes and Management.

Respiratory System:

1. Anatomy and function of respiratory system.
2. Non-respiratory functions of lungs.
3. Static and dynamic lung volumes and capacities.
4. Lung surfactant, lung compliance and dead space.

5. Breathing – Types, respiratory muscles and mechanism.
6. Respiratory membrane, gas exchange and ventilation perfusion ratio.
7. Pulmonary circulation.
8. Oxygen transport – Mechanism, oxygen dissociation curve.
9. Carbon dioxide transport – Mechanism, CO_2 dissociation curve.
10. Neural and chemical regulation of respiration.
11. Hypoxia, asphyxia, apnoea, cyanosis, acclimatization, mountain sickness, Cheyne-stroke breathing and Bitot's breathing.
12. Hyperbaric syndrome, oxygen therapy and SCUBA.
13. COPD and artificial respiration.
14. Pulmonary function test and its importance.

3.12 MJCP-6: Cardiovascular and Respiratory Physiology Lab

Course Code: S/PHY/402/MJC-6 **Course ID: 42523**

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

Course Learning Outcomes:

- This course gives a wide knowledge about different parts of kymograph and demonstrates the ability to record and interpret the normal cardiac activity of a toad.
- Student will analyze the effects of temperature variations (warm and cold saline) on amphibian heart function through kymographic recordings.
- They perform and interpret lung function tests using a spirometer, understanding key pulmonary parameters.
- Learner will record and analyze chest movements using pneumography, and assess the effects of activities such as swallowing, hyperventilation, coughing, reading, laughing, and breath holding on respiratory patterns.
- Measure and evaluate oxygen saturation using a pulse oximeter before and after exercise.
- Students will record and compare respiratory rate at rest and in different postures, and analyze the influence of posture on respiratory function.
- Accurately calculate and interpret ECG parameters including heart rate, PR interval, and QRS complex duration from a given ECG graph, relating them to normal cardiac function.

Animal Experiment:

1. Kymographic recording of the normal heart curve of toad.
2. Kymographic recording of effect of warm and cold saline on toad's heart

Human Experiment:

1. Lung function test by spirometer.
2. Pneumographic recording of chest movement: Effect of swallowing, hyperventilation, coughing, reading and laughing and breath holding.
3. Measurement of oxygen saturation by pulse oxymeter before and after exercise.
4. Measurement of resting respiratory rate and effect of posture on respiratory rate.
5. Measurement of resting heart rate and effect of posture on heart rate.
6. Measurement of resting blood pressure and effect of posture on blood pressure.
7. Calculation and interpretation of HR, PR interval, duration of QRS complex from supplied ECG graph.

3.13 MJCT-7: Gastrointestinal Physiology

Course Code: S/PHY/403/MJC-7 **Course ID: 42514**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Students will gain a foundational understanding of the anatomy and histology of the gastrointestinal (GI) tract.
- They will learn the structure, composition, and physiological functions of secretions from the salivary, gastric, hepatic, biliary, pancreatic, and intestinal glands, along with associated clinical conditions such as peptic ulcer, fatty liver, gallstones, and pancreatitis.
- The course will provide insights into liver function tests and the pathophysiology of common liver disorders, including cirrhosis and hepatitis.
- Students will understand the synthesis, composition, secretion, and function of bile, as well as the importance of enterohepatic circulation in digestion and disease.
- They will acquire knowledge of gastrointestinal motility and the regulatory roles of gastrointestinal hormones in digestive processes.
- The course will also introduce the role and clinical significance of the intestinal microbiota, as well as the benefits of prebiotics and probiotics in maintaining gastrointestinal health.

Gastrointestinal structure

1. Introduction
2. Basic anatomy and histology of GI tract.
3. Digestive glands:
   a. Salivary gland – Histology, mechanism of salivary secretion, composition, function of saliva and applied aspects.
   b. Gastric gland – Histology; mechanism of secretion, composition, function of gastric juice, phases of gastric secretion and applied aspects with special emphasis on peptic ulcer.
   c. Liver – Histology, function, liver function test, fatty liver and liver cirrhosis.
   d. Biliary system – Synthesis, composition, function of bile, secretion and ejection of bile. Enterohepatic circulation. Gall stone, hepatitis and jaundice.
   e. Pancreas - Histology of exocrine portion; pancreatic juice – Composition, function mechanism of bicarbonate secretion, acute pancreatitis and cystic fibrosis.
   f. Intestinal glands – Secretion and function.
4. Gastrointestinal motility and function.
5. Gastrointestinal hormones.

Digestion and absorption

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

Normal microbial flora

General introduction of intestinal microbiota.

1. Brief ideas about prebiotics and probiotics and their clinical importance.

3.14 MJCP-7: Gastrointestinal Physiology Lab

Course Code: S/PHY/403/MJC-7 **Course ID 42524**

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

Course Learning Outcomes:

- Learners will understand the principle, components, and functioning of Dale's apparatus and demonstrate the preparation of Dale's fluid.
- Students will develop the ability to record and interpret normal intestinal movements of the rat using kymographic techniques.
- They will gain knowledge of the effects of physiological (e.g., anoxia) and pharmacological agents (e.g., acetylcholine, adrenaline) on intestinal motility.

1. Introduction on Dale's apparatus and preparation of Dale's fluid**.**
2. Kymographic recording of normal movements of rat's intestine in Dale's apparatus.
3. Effects of anoxia, acetylcholine and adrenaline on normal intestinal movements of rat.

3.15 MJCT-8: Energy Balance and Metabolism

Course Code: S/PHY/404/MJC-7 **Course ID: 42515**

[Theory: Credits 3/ (3 Lectures/Week) /Marks 25] **3 Credits**

Course Learning Outcomes:

- Students will understand the fundamentals of energy metabolism and redox potential.
- They will gain knowledge of mitochondrial electron transport, oxidative phosphorylation, and their inhibitors.
- They will learn the pathways and regulation of carbohydrate, protein, fat, and cholesterol metabolism.
- They will comprehend the integration of macronutrient metabolism.
- Students will understand purine and pyrimidine biosynthesis via de novo and salvage pathways.

1. Introduction
2. Energy metabolism
3. Redox potential. Mitochondrial electron transport chain. Oxidative phosphorylation - Inhibitors and uncouplers.
4. Carbohydrate metabolism – Glycolysis, Krebs Cycle, glycogenesis, glycogenolysis, neoglucogenesis, HMP Shunt and Cori cycle and their regulations.
5. Protein metabolism – Deamination, transamination, ornithine cycle, catecholamine, melanin, and melatonin biosynthesis.
6. Fat and cholesterol metabolism – Beta-oxidation, omega-oxidation, ketogenesis, fatty acid synthesis and cholesterol bio synthesis.
7. Integration of carbohydrate, fat and protein metabolism.
8. Purines and pyrimidines – Biosynthesis: de novo and salvage pathways.

3.16 MJCP-8: Energy Balance and Metabolism Lab

Course Code: S/PHY/404/MJC-8 **Course ID: 42525**

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

Course Learning Outcomes:

- Students will become familiar with laboratory glassware and devices used in the quantitative estimation of biomolecules.
- They will acquire skills in estimating glucose, sucrose, and lactose using Benedict's method and calculating their percentage and total quantity.
- They will learn to determine amino nitrogen content using Sorensen's Formol titration method and compute both percentage and total quantity.

Biochemical Estimation

1. Introduction to the glass goods and preliminary devices used for the quantitative estimation of biomolecules.
2. Quantitative estimation of glucose, sucrose and lactose by Benedict's method - Percentage and total quantity.
3. Quantitative estimation of amino nitrogen (Sorensen's Formol titration method) – Percentage and total quantity.

Suggested Readings:

1. Carpenter, M.B. Core Text Book of Neuro-Anatomy. Nineth Edition. The Williams and Wilkins Company.
2. Charles Nobach. (2005). The Human Nervous System. 6th Edition. Mc Graw Hill Book Co.
3. Mahapatra A.B.S.M. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
4. Sembulingam K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
5. Khurana I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
6. Chatterjee C.C. (2016). Human Physiology Volume 1& II. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
7. Chaudhuri S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
8. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
9. 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.
10. Cyril, A. Keele, C. A. Neil, E, Joels, N. (2015). Samson Wrights Applied Physiology. 13th Edition, Oxford University Press. 2015.
11. Tripathi, Y. Tandon, O.P. (2011). Best & Taylor's Physiological Basis of Medical Practice. Thirteen Edition. Wolters Kluwer.
12. Jain, A. K. (2017). Textbook of Physiology. Vol I & II, Seventh Edition Avichal Publishing Company.
13. Debnath, J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.
14. Note Books on Practical Histology. Published by The Physiological Society of India,

Kolkata.

15. Varshney, Bedi, M. (2022). Ghai's A Textbook of Practical Physiology. Jaypee Brothers Med Pub, Pvt Ltd
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. Das, D. (2008). Biochemistry, Academic Publishers.
19. Satyanarayana, U and Chakrapani, U. (2021). Essential of Biochemistry, Elsevier.
20. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2019). Biochemistry, Ninth Edition. W.H. Freeman.
21. Nelson, D.L. Cox M. M. (2017). Lehninger Principles of Biochemistry, 7th Edition.

W H Freeman & Co.

SEMESTER–V

3.17 MJCT-9: Physiology of Nervous System

Course Code: S/PHY/501/MJC-9 **Course ID: 52511**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Students will develop their knowledge on structure and function of nervous tissues, synapse, neuromuscular junction and transmission through such junctions.
- From this core paper they will learn about the reflexes, structure and functions of different parts of the brain.
- Content will provide information about visceral homeostasis maintenance through autonomic nervous system.
- They will have specific knowledge on human body's reflexogenic activities and their controlling measures.
- Content will help to gather knowledge about coordinating activities of these system and stimulus-response coupling process of the body with micro and macro environment.

1. **Structural and functional organization of the nervous system -** Classification of nervous system.

2. **Elementary idea on brain and spinal cord**
   a. Structural organization of different parts of brain and spinal cord.

3. **Reflexes**
   a. Introduction of Reflex - Conditioned, unconditioned, mono synaptic, disynaptic and poly synaptic. Reflex arc - Component.
   b. Monosynaptic reflexes: The stretch reflex.
   c. Polysynaptic Reflexes: The withdrawal reflex.
   d. General properties of reflexes.

4. **Cutaneous, deep &visceral sensory and motor pathways**
   a. Ascending and descending tracts: Origin, course, termination and functions.
   b. Functions of the spinal cord with special reference to functional changes- Following hemisection and complete section of spinal cord.
   c. Physiology of pain, origin of pain, perception, regulation, pain pathway and Gate control theory. Referred pain.

5. **Structure and functions of different parts of the brain**

   a. Introduction
   b. The reticular formation and the reticular activating system.
   c. Cerebral cortex – Structure, important areas and their function.
   d. Evoked cortical potentials.
   e. The electroencephalogram. Physiological basis of EEG and abnormal EEG pattern.
   f. Neuro-physiological basis of sleep.
   g. Thalamus- Structure, different nuclei, neural connection, function and abnormalities.

h. Cerebellum - Structure, different nuclei, neural connection, function and applied aspects.
i. Basal ganglia – Nuclei, neural connection, function and applied aspects.
j. Role of cerebellum, basal ganglia and vestibular apparatus on postural control and movement.
k. Different movement disorders (Ataxia, Chorea, Athetosis, Huntington's disease and Parkinson's disease).

6. The autonomic nervous system

a. Introduction
b. Anatomic organization of autonomic outflow.
c. Chemical transmission, responses of effector organs to autonomic nervous system.
d. Cholinergic and adrenergic discharge**.**

7. Central regulation of visceral function

a. Introduction
b. Medulla oblongata.
c. Hypothalamus
i. Anatomic considerations.
ii. Nuclear organization, connection and function.

8. Neural basis of instinctual behaviour and emotion

a. Introduction
b. Anatomic consideration of limbic system.
c. Limbic system in sexual behavior, fear and rage phenomenon.

9. Higher functions of the nervous system

a. Introduction
b. Learning – General concept; Memory – Short term and long term.
c. Functions of the neocortex.
d. Disorders relating learning and memory.

3.18 MJCP-9: Physiology of Nervous System Lab

Course Code: S/PHY/501/MJC-9 Course ID: 52521

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

Course Learning Outcomes:

- The learner will gain the hand-based work performance endurance assessment skill through various reflex related functioning of human body with their normal and abnormal interpretations.
- Student will be able to gather accurate idea on short term memory retaining capacity testing and on visual acuity.

List of Practical

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

Suggested Readings:

1. Chatterjee, C.C. (2016). Human Physiology Volume 2. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
3. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
4. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
5. Core Text Book of Neuro-Anatomy, by M.B. Carpenter: the Williams and Wilkins Company.
6. Charles Nobach. The Human Nervous System. Mc Graw Hill Book Co.
7. Berne, R.M. and Levy M.N. Physiology. C.V. Mosby Co.
8. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
9. 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.
10. Pal, G.K. Pal, P. (2013). Textbook of Practical Physiology. Third Edition. Universities.Shepherd. G.M. Neurobiology. Oxford University Press.
11. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
12. Debnath J. ByabaharikSharir Bignan. *Shreedhar* Prokashani, Kolkata.
13. Neuroscience: Editors, Dale Purves, George Augustine, David Fitzpatrick, William C Hall, Anthony LaMantia, Richard Mooney, Leonard E. White; Publisher: Sinauer, 2018.
14. Principles of Neural Science by Kandel, Schwartz, Jessell, Siegelbaum, and Hudspeth:

3.19 MJCT-10: Special Senses

Course Code: S/PHY/502/MJC-10 Course ID: 52512

[Theory: Credits 3 (3 Lectures/Week)/Marks 25] 3 Credits

Course Learning Outcomes:

- From this core course students will gain their knowledge about elementary ideas on visual process, photochemical changes of retina and errors in visual process.
- They will gather specific knowledge about auditory pathway and equilibrium of hearing process.
- The students will also know about the physiology behind smell and taste perception.

1. Introduction to special senses

2. Vision

a. Introduction
b. Anatomic considerations of eye.
c. Histological structure of retina. Structure and functions of rod and cone cells.
d. Errors of refraction. The image forming mechanism (accommodation and visual acuity), light adaptation and dark adaptation.
e. Photochemical changes in retina. Genesis of electrical responses, photopic and scotopic vision.
f. Visual pathways and effects of lesions of these pathways.
g. Color vision, theories of colour vision and colour blindness.
h. Other aspects of visual function – Monocular and binocular.
i. Types of muscles involving eye movements – Lateral and rotational movements and their applied aspects.

3. **Hearing and equilibrium**

a. Introduction
b. Anatomic considerations of ear.
c. Mechanism of hearing.
d. Auditory pathway.
e. Electrical activity in the cochlea.
f. Vestibular function.
g. Loss of hearing – Audiometry, test for conductive deafness, neural deafness and central deafness. Role of ear on equilibrium and posture.

4. Smell and taste

a. Introduction
b. Smell -Receptors and pathways.
c. Physiological basis of olfaction and its applied aspects.
d. Physiology of taste – Taste bud, basic modalities of taste.
   i. Receptor and pathways
   ii. Physiology of taste, taste adaptation and masking effect.
   iii. Applied aspects.

3.20 MJCP-10: Special Senses Lab

Course Code: S/PHY/502/MJC-10 **Course ID: 52522**

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

Course Learning Outcomes:

- The learner will increase their abilities and gather knowledge through fixation and staining processes of nervous tissue.
- They will develop their skill to measure visual acuity, colour blindness and tuning fork test for deafness.
- Student will be able to gather preliminary idea on audiometry through demonstration.

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

Suggested Readings:

1. Chatterjee, C.C. (2016). Human Physiology Volume 1 and II. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Sherwood, Lauralee. Human Physiology: From cells to systems.
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. Core Text Book of Neuro-Anatomy, by M.B. Carpenter: the Williams and Wilkins Company.
7. Charles Nobach. The Human Nervous System. Mc Graw Hill Book Co.
8. Berne, R.M. and Levy M.N. Physiology. C.V. Mosby Co.
9. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
10. 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.

11. Pal, G.K. Pal, P. (2013). Textbook of Practical Physiology. Third Edition. Universities.Shepherd. G.M. Neurobiology. Oxford University Press.

12. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
13. Debnath J. ByabaharikSharir Bignan. *Shreedhar* Prokashani, Kolkata.
14. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
15. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
16. Walter F. Boron, and Emile L. Boulpaep. Boron & Boulpaep Medical Physiology, Edition 4.

3.21 MJCT-11: Microbiology and Immunology

Course Code: S/PHY/503/MJC-11 **Course ID: 52513**

[Theory: Credits 3 (3 Lectures/Week)/Marks 25] **3 Credits**

Course Learning Outcomes:

- From this core course student will develop their knowledge about microbes, classification of microbes and their growth.
- This course will fortify our students to develop their knowledge about bacterial metabolism and reproduction.
- They will get elementary idea on bacterial growth interfering agents.
- This course will provide knowledge about COVID-19.
- Students will improve their knowledge about different types of immunity and universal immunization protocol against diseases.
- Students will be enriched about the techniques for immunomodulation.

Microbes

1. Brief introduction about microbes, structure and morphological classification of different microbes and bacterial spore, plasmid and cosmid.
2. Gram-positive, Gram-negative, pathogenic and nonpathogenic bacteria.
3. Brief idea on acid-fast stain and acid-fast bacteria.
4. Bacterial nutrition, bacterial culture media, bacterial growth curve and factors affecting growth curve.
5. Bacterial genetics – Conjugation, transformation and transduction.
6. Bacterial metabolism – Fermentation (Ethanol and lactic acid) and Entner-Doudoroff Pathway and their importance.
7. Elementary idea of bacteriostatic, bactericidal agents, antibiotics, antibiotic resistance and sensitive bacteria.
8. Sterilization and Pasteurization.
9. Viruses - Structure and types, lytic and lysogenic cycles, effect of RNA virus on human body system. Prions – Basic ideas and prion diseases.
10. Basic concept of COVID-19, causative agents, transmission, pathogenesis, sign and symptoms. Co-morbidities of COVID-19. Ideas about CT value.

Overview of immune system

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

3.22 MJCP-11: Microbiology and Immunology Lab

Course Code: S/PHY/503/MJC-11 **Course ID: 52523**

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

Course Learning Outcomes:

- The course content will enable our students to develop their ability of bacterial identification through Gram staining.
- The core course will enrich the students to develop their skill for preparing microbial culture media and quantification of microbes.
- Learner will gain the techniques of antigen antibody reaction through blood grouping and Rh typing.
- They acquire their ideas on radial immuno-diffusion and Acid-fast staining of bacteria through demonstration process.

1. Gram staining of bacteria and identification of Gram positive and Gram-negative bacteria.
2. Blood grouping and Rh typing.
3. Bacterial spore staining.
4. Preparation of bacteria culture media and single colony isolation techniques.
5. Demonstration: Radial immuno-diffusion (RID) and Acid-fast staining of bacteria.

Suggested Reading:

1. Pelczar, M.J. (2001) Microbiology. 5th edition, Tata McGraw-Hill Co, New Delhi.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V. Jackson R.B. (2008). Biology. Pearson Benjamin Cummings, USA. 8th edition.
4. Das, D. Handbook of Practical Microbiology, Cell Biology Genetics and Biometry. Academic Publishers.
5. Ananthanarayan, R. Kapil, A. A & P Textbook of Microbiology. 9th Edition.
6. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
7. Jenni Punt, Sharon Stranford, Patricia Jones, Judith A Owen. Kuby Immunology. 8th ed. 2018. WH Freeman Publisher.
8. Arvind Kumar. Textbook of Immunology. TERI Press, New Delhi.
9. Ajoy Paul. Textbook of Immunology. 2016. Books & Allied (P) Ltd. Kolkata.
10. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt's Essential Immunology. 13th Edition 2016. Wiley-Blackwell.
11. Venugopal Jayapal. Fundamentals of Medical Immunology. 2007. Jaypee.

3.23 MJCT-12: Human Nutrition and Dietetics

Course Code: S/PHY/504/MJC-12 **Course ID: 52514**

[Theory: Credits 3 (3 Lectures/Week)/Marks 25] **3 Credits**

Course Learning Outcomes:

- This core course will enrich our students to develop their knowledge about health, nutrition, dietary pattern and nutrient deficiency disorders of community members.
- This course will fortify our students to learn about dietary requirements, calorie requirements and biological value of nutrients.
- They will get knowledge about physiological importance of micronutrients and nutraceuticals.
- The content will help to enlighten the importance of nutrition on sports performance and physiological homeostasis of aeronautics.

1. Introduction - Basic concept of nutrition and dietetics, concept of malnutrition, undernutrition and overnutrition.
2. Constituents of food - Macro and micro-nutrients and their significance.
3. Basal metabolic rate - Factors, determination by Benedict-Roth apparatus and significance.
4. Respiratory quotient and its significance.
5. Specific dynamic action- Definition, normal values of different food stuffs and its importance.
6. Calorific value of macronutrients.
7. Calorie requirements – In different types of work and adult consumption unit.
8. Dietary requirements of carbohydrate, protein, lipid and other nutrients at different phases of human life cycle, RDA as per ICMR 2020.
9. Nitrogen balance, essential amino acids, biological value of proteins, NPU, DC and PER.
10. Supplementary value of protein.
11. Dietary fibres – Source, types, composition and importance.
12. Resistance starch and its importance.
13. Vitamins and minerals (Fe, Na, K, Ca, P, I, Zn and selenium) – Sources, daily requirement, physiological role, deficiency symptoms and hypervitaminosis.
14. Principle of diet survey and its operation protocol.
15. Balanced diet and principles of formulation of balanced diet chart for growing child, college students, adult man and woman, pregnant woman and lactating woman.
16. Nutraceutical - Concepts and their importance.
17. Physiology of starvation and obesity.
18. Brief idea on sports and space nutrition.

3.24 MJCP-12: Human Nutrition and Dietetics Lab

Course Code: S/PHY/504/MJC-12 **Course ID: 52524**

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

Course Learning Outcomes:

- This practical course will develop students' ability to collect nutritional data for the preparation of diet survey report.
- This practical course will enrich the students for transferring the knowledge from laboratory to community through preparation field survey report.

Diet Survey

Any one report (Hand-written) on the basis of diet survey or field survey from the following topics-

1. Diet survey report (Hand-written) of a family (As per ICMR specification): Each student has to submit a report on his/her locality/ costal area/ hilly area/ coal mines area.

Suggested Reading:

1. Srilakshmi, B. (2016). Nutrition Science. Fifth Edition. New Age International Publishers.
2. Srilakshmi, B. (2014). Dietetics. Seventh Edition. New Age International Publishers.
3. Das S. Textbook of Normal and Therapeutic Nutrition. Academic Publishers.
4. Das S. (2016). Textbook of Community Nutrition. 2nd Edition. Academic Publishers.
5. Basu, P. Nutritional Biochemistry. Academic Publishers.
6. Srilakshmi, B. (2015). Food Science. Sixth Edition. Age International Publishers.
7. Swaminathan, M. (2012). Handbook of Food and Nutrition. Jain Book Agency.
8. Swaminathan, M. (2012). Essentials of Food and Nutrition. Vol. I and Vol. II. Jain Book Agency.
9. Das, D. (2008). Biochemistry, Academic Publishers.
10. Satyanarayana, U and Chakrapani, U. (2021). Essential of Biochemistry. Elsevier.
11. Biswajit Mukherjee. (2025). Dietary Supplements and Nutraceuticals. Springer Singapore
12. Voet, D, Voet, J.G. (2011). Biochemistry. 4th Edition. CBS Publishers & Distributors-New Delhi.
13. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2019). Biochemistry Ninth Edition. W.H. Freeman.
14. Nelson, D.L. Cox M. M. (2017). Lehninger Principles of Biochemistry. 7th Edition. W H Freeman & Co.

ACS/506/INT-3

INT-3: Internship

Period of programme:

- For an internship, one credit of Internship means two-hour engagement per week. Accordingly, in a semester of 15 weeks' duration, one credit in this course is equivalent to 30 hours of engagement in a semester.
- 120 hours for Certificate/Diploma (4 credit).
- An internship of 60 hours duration (2 credit) after the 4th semester will be mandatory for the students enrolled in UG degree programmes.

Nature of Internship:

Students will be provided with opportunities for internships to actively engage with the practical side of their learning and, as a by-product, further improve their employability. There are indicative clusters identified at central, state, micro and local government/ administration levels and HEIs at their own level can identify and also go beyond these clusters for internships.

Internship Report:

After completion of the Internship, the student shall prepare, with Activity logbook as a reference, a comprehensive report in consultation with the mentor to indicate what he/she has observed and learned in the training period along with the internship outcomes. The training report should be signed by the internship supervisor of the concerned college, authorized for the purpose, before the date of evaluation.

Evaluation:

- The parent HEI will examine/evaluate the student's performance following its evaluation method.
- At HEI, the intern will be evaluated through an internship report/seminar/viva voce on his/ her work, by a committee where an external examiner will be appointed by the University.
- The Head of the concerned Department and the concerned Supervisor will be the other members of the committee of the Viva-voce/seminar.

Evaluation of the report will be on the basis of following suggestive aspects:

I. Activity logbook and evaluation of Internship report duly signed by appropriate authority

II. Format of presentation and the quality of the intern's report

III. Acquisition of skill sets by the intern
IV. Originality and any innovative contribution
V. Practical applications relationships with basic theory and concepts taught,
VI. Certificate by the concerned workplace head/manager
VII.

Proposed distribution of 50 marks for Internship evaluation	
Relevance of the Internship	05
New methods /Techniques Learnt	10
Internship report (5-10 Pages) Covering certificate from internship execution authority, introduction, aim and objective, learning areas with process (Jiotag pictorials), application, discussion, summery	10
Presentation of Skill/ Seminar presentation (Covering the internship report)	10
Viva-voce on internship report	15
Total	**50 marks**

A. First Aid Skill

About the Course:

The first aid training skill is a relatively inexpensive, but highly effective strategy to reduce the rate of morbidity and mortality of a community. It is an essential skill that equips individuals with the knowledge and confidence to respond to medical emergencies.

Aims and Objectives:

i) The primary aim of first aid is to provide immediate care to someone who is injured or ill, with the goal of preserving life, preventing the condition from worsening, and promoting recovery until professional medical help arrives.
ii) After completing a first aid training course, students can respond effectively in emergency situation and they also can provide the basic life support to prevent further worsening.

Course Learning Outcomes:

i) Ability to respond medical emergencies: Student learn to assess the situations and provide appropriate care.
ii) Life-saving skills: Trainees acquire skills such as basic Cardiopulmonary Resuscitation (CPR), wound management and other first aid procedure.
iii) Increased confidence: Students gain confidence in their ability to respond to medical emergencies.

iv) Improved decision–making: Trainees learn to make quick and effective decisions in emergency situation.
v) Help to understand the basic knowledge about the human systematic physiology.
vi) Learn the skill to identify Mental Health status and Psychological First Aid.

Course layout [Theory (lecture + demo) + Practical (Role play)]

UNIT-I

A. Basic concept of First Aid

i) Aims of first aid & first aid and the law.
ii) Dealing with an emergency
iii) Cardiopulmonary resuscitation (basic CPR).
iv) Recovery position, Initial top to toe assessment.
v) Hand washing and Hygiene.
vi) Types and Content of a First Aid Kit.

B. First Aid Techniques

i) Dressings and bandages.
ii) Fast evacuation techniques (single rescuer).
iii) Transport techniques.
iv) Stretchers

C. First aid related with respiratory system

i) Basics concept of respiration.
ii) No breathing or difficult breathing, drowning, choking, strangulation and hanging.
iii) Swelling within the throat, suffocation by smoke or gases and asthma.

D. First aid related with Heart, Blood and Circulation

i) Basics concept of the heart and the blood circulation.
ii) Chest discomfort and bleeding.

E. First aid related with Wounds and Injuries

i) Type of wounds, small cuts and abrasions.
ii) Head, chest, abdominal injuries.
iii) Amputation, crush injuries, shock.

F. First aid related with Bones, Joints and Muscle related injuries

i) Basics concept of skeleton, joints and muscles.
ii) Fractures (injuries to bones).
iii) Dislocations, sprains and strains.

UNIT-II

A. **First aid related with Nervous system and Unconsciousness**

i) Basic concept of the nervous system.

ii) Unconsciousness, stroke, fits – convulsions – seizures, epilepsy.

B. **First aid related with Gastrointestinal Tract**

i) Basic concept of the gastrointestinal system.

ii) Diarrhoea, food poisoning, diabetes and hyperglycaemia.

C. **First aid related with Skin, Burns**

i) Basic concept of the skin.

ii) Burn wounds, dry burns and scalds (burns from fire, heat and steam).

iii) Electrical and chemical burns, sun burns, heat exhaustion and heatstroke.

iv) Frost bites (cold burns), prevention of burns, fever and hypothermia.

D. **First aid related with Poisoning**

i) Poisoning by swallowing, gases, injection and skin absorption.

E. First aid related with Bites and Stings

i) Animal bites, snake bites, insect stings and bites.

F. First aid related with Sense Organs

i) Basic concept of sense organ.

ii) Foreign objects in the eye, ear, nose or skin.

iii) Swallowed foreign objects.

UNIT-III

A. Specific emergency situation and disaster management

i) Emergencies at educational institutes and work.

ii) Road and traffic accidents.

iv) Emergencies in rural areas.

iv) Disasters and multiple casualty accidents.

v) Triage

B. Mental Health and psychological first aid.

i) Definition of mental health first aid.

ii) Mental health problems in the India.

iii) The mental health first aid action Plan.

iv) Understanding depression and anxiety disorders.

v) Crisis first aid for suicidal behaviour and depressive symptoms.

vi) Non-suicidal self-injury.

vii) Non-crisis first aid for depression and anxiety.

viii) Crisis first aid for panic attacks, traumatic events (Psychological shock phase, reaction phase, processing phase and reorientation phase).

ix) Understanding disorders in which psychosis may occur.

x) Crisis first aid for acute psychosis, understanding substance use disorder, crisis first aid for overdose, withdrawal.

Suggested Readings:

- Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf
- Red Cross First Aid/CPR/AED Instructor Manual.
- https://www.coursera.org/learn/psychological-first-aid.
- https://www.coursera.org/learn/mental-health.
- Sahajj Chikitsa Padhhati, A. Sarkar (1st January 2023); Nabroop Institute of Natural Therapy.

B. Yoga and Meditation

About the Course:

Yoga and meditation are very common and regular practices that provide many benefits, including increasing flexibility, stress reduction, improved mental clarity and many more. Yoga and meditation are complemented to each other. While Yoga is used prepare the body for meditation by releasing tension and improving focus Meditation, can enhance the benefits of yoga by promoting mental clarity and relaxation. After completing the course students might be expert or professional in this field and they can use their knowledge in daily life to improve their heath and relationship also.

Objectives:

The objectives of this course are:

- Provides a comprehensive exploration of yoga, encompassing physical postures, breath control, meditation, and philosophical foundations.
- Students will learn how to incorporate these practices into their daily lives to enhance physical health, mental clarity, and overall well-being.

Course Learning Outcomes:

After completion of the program, the students would be able to:

- Understand the latest concepts and techniques of Meditation and Yoga and its applications in making the Yoga Instructor roles of the students effective and efficient.
- Acquaint student with the Practical knowledge of different Yogasana, Kriya, Bandhas, Mudra, Meditation and Pranayama etc.
- Students can work as Yoga Trainer in Yoga Studio, Yoga wellness Centres.
- Can conduct Yoga Protocol at work places.
- Have the skills to analyse and solve problems in group setting.
- Use appropriate strategies for effective planning, implementation and evaluation of institutional and community-based health and family welfare program.
- Develop skills with the focus on strategic responsibility for training and development of holistic health.
- Use oral and written communication skills and integrate appropriate technology and software skills to develop informative, explanatory, and persuasive presentations.

UNIT I

A. Introduction to Yoga:

1. Definitions, aims, scope, and objectives of yoga and meditation, historical background yoga and meditation. Significances of yoga and meditation.
2. Different schools of yoga (e.g., Raja Yoga, Hatha Yoga, Karma Yoga).

B. Yoga Philosophy: Understanding concepts like the Yoga Sutras of Patanjali, Sankhya philosophy, the concept of Purusha and Prakriti, and the role of yoga in self-realization.

C. Human Anatomy and Physiology of Yoga and meditation

Basic understanding of the human body systems (skeletal, muscular, respiratory, circulatory, digestive, nervous, etc.) and their relation to yoga practices.

D. Asanas (Postures):

Learning and practicing a variety of yoga asanas, including standing, sitting, prone, supine, and twisting postures. Emphasis on proper alignment, modifications, and variations for different body types and abilities.

E. Yogic Sukshma Vyayama, Sthula Vyayama, Surya Namaskar, Pranayama.

F. Pranayama (Breathing Techniques):

a) Learning and practicing different pranayama techniques, such as deep breathing, kapalabhati, bhastrika, and anulomvilom. Understanding the mechanism of breathing and the benefits of each technique.

b) Meditation-- its role in stress reduction and mental clarity. Brief concept on Dhyana, Samadhi (blissful absorption), Pranav and Soham Japa, Yoga Nidra, Chakra Meditation, Ajapa Dharana, AUM Meditation.

UNIT-II

A. Yoga Therapy:

Principles of yoga therapy, common ailments addressed by yoga, and the application of yoga techniques for specific conditions.

B. Yogic Diet and Lifestyle:

Understanding the principles of yogic nutrition and its role in maintaining health and well-being.

C. Ethics in Yoga:

Understanding the ethical guidelines and principles that govern the practice and teaching of yoga.

D. Meditation:

Learning and practicing various meditation techniques, including mindfulness meditation, guided meditation, and mantra meditation.

E. Shatkarmas (Cleansing Techniques):

Introduction to basic cleansing techniques like neti, dhauti, nauli, etc.

F. Bandhas and Mudras:

Learning and practicing bandhas (energy locks) and mudras (gestures) and their role in yoga practice.

UNIT-III

UNIT-3: Practical

1. Yogasana (Asana), Yogic Sukshma Vyayama, Sthula Vyayama and Surya Namaskar
2. Pranav and Soham Japa, Yoga Nidra, Chakra Meditation, Ajapa Dharana, AUM Meditation,
3. Shatkarma.(Neti), Dhauti , Nauli, Agnisara,Trataka, Kapalbhati).
4. Pranayama
5. Bandha and Mudra
6. Parthivi Dharana, Ambhasi Dharana,Agneyi Dharana, Vayviye Dharana, Akashi Dharna, Trataka and Concentration, Ujjayi and Concentration, OM Meditation, Ajapa Japa, Shoonya Meditation, Antar Mouna, Yoga Nidra, Cleansing of mind by Mantra chanting.

Suggested Readings:

1. Anatomy and physiology of yogic practices by Kanchan Prakashan (Lonawala)
2. Notes on structure & functions of Human body & effects of Yogic practices on it by Sri Krishan
3. Principal of Nutrition by E. D. Wilson
4. Swasthavritta Vigya by Dr. Ramharsh Singh
5. Yogic Management of Asthma and Diabetic by Swami Shankardevan and
6. Practical yoga Psychology by Bihar School of Yoga
7. Gheranda Samhita by Swami Niranjanananda Saraswati
8. Concentration and Meditation by swami Sivananda Saraswati
9. Yoga & Mental Health by R. S. Bhogal
10. Yoga & Modern Psychology by KaivalyadhamAsharam
11. Yoga for Stress Management by Sri Venkatkrishnan

C. Clinical Biochemistry, Microbiology and Pathology Techniques for Biomedical Applications

About the Course

The "*Clinical Biochemistry, Microbiology, and Pathology Techniques for Biomedical Applications*" program is a comprehensive, interdisciplinary initiative designed to equip participants with theoretical knowledge and practical skills in essential biomedical laboratory techniques. The program is tailored for students aiming to deepen their understanding and application of diagnostic and research methodologies across the biomedical sciences. To provide practical knowledge and hands-on training in laboratory techniques relevant to disease diagnosis.

Objectives:

1. Expose students to standard procedures in clinical biochemistry such as blood glucose, liver and kidney function tests.
2. Train students in microbiological techniques including microbial culture, staining, and antimicrobial sensitivity testing.
3. Provide hands-on experience in histopathology and hematology procedures used in diagnostic laboratories.
4. Enhance the understanding of the role of these techniques in disease diagnosis, monitoring, and treatment planning.
5. Develop the ability to maintain proper documentation and reporting of laboratory results.
6. Promote awareness of safety protocols, waste disposal, and infection control measures in clinical labs.

Course Learning Outcomes:

1. Apply core techniques of clinical biochemistry, microbiology, and pathology in biomedical settings.
2. Demonstrate proficiency in handling clinical specimens and performing diagnostic tests.
3. Interpret biochemical, microbiological, and pathological data relevant to human health.
4. Follow good laboratory practices (GLP), biosafety standards, and ethical guidelines.
5. Collaborate effectively in clinical laboratory environments and communicate findings clearly.

COURSE LAYOUT (Theory + Practical & Field work, Hours specific unitization)

UNIT I

Clinical Biochemistry: Learn principles of biochemical analysis of body fluids, including enzyme assays, metabolic profiling, and clinical diagnostics relevant to diseases such as diabetes, cardiovascular disorders, and kidney dysfunction. (5-hours theory, 10 hours practical & 5-hours field work)

- ✓ Principles of clinical biochemistry
- ✓ Sample collection, preservation, and processing
- ✓ Biochemical assays for-
  - Glucose, urea, creatinine, uric acid
  - Liver function tests (LFT)
  - Kidney function tests (KFT)
  - Lipid profile
- ✓ Enzyme assays (AST, ALT and ALP)
- ✓ Clinical diagnostics relevant to diseases such as diabetes, cardiovascular disorders, and kidney dysfunction

UNIT-II

Medical Microbiology: Knowledge on hands-on experience in culturing, identifying, and characterizing pathogenic microorganisms. (5-hours theory, 10 hours practical & 5-hours field work)

- ✓ Basics of bacteriology, virology, mycology, and parasitology
- ✓ Sterilization and disinfection
- ✓ Collection and handling of microbiological samples (blood, urine, sputum, etc.)
- ✓ Staining techniques (Gram, Ziehl–Neelsen, etc.)
- ✓ Culture media and techniques
- ✓ Antimicrobial sensitivity testing (AST)
- ✓ Molecular diagnostics (PCR basics)

UNIT-III

Pathology Techniques: Explore tissue processing, histopathology, cytology, immunohistochemistry, and molecular pathology techniques used for disease diagnosis and research. (5-hours theory, 10 hours practical & 5-hours field work)

- ✓ Basics of histopathology and cytopathology
- ✓ Specimen collection and processing
- ✓ Tissue fixation, embedding, microtomy
- ✓ Staining techniques (H&E)
- ✓ Microscopic evaluation of tissue
- ✓ Cytological techniques (Pap smear)
- ✓ Immunohistochemistry (IHC) basics

UNIT-IV

Laboratory Safety and Quality Assurance

- ✓ Laboratory biosafety levels (BSL-1 to BSL-4)
- ✓ Handling of biohazardous materials
- ✓ Waste management in clinical labs
- ✓ Good Laboratory Practice (GLP)
- ✓ Internal and external quality control procedures

Suggested Readings:

1. Manual of Medical Laboratory Techniques by Ramakrishnan S and Sulochana KN.Jaypee Brothers Medical Publishers (P) Ltd.
2. Biochemistry and Clinical Pathology by P.C. Dandiya and P.K. Sharma. Vallabh Publications
3. Biochemistry & Clinical Pathology (English Edition) by R. Srinivasan, Ajay Pal Singh, and Devika K. Tilekar. Thakur Publication Private Limited.
4. Textbook of Medical Laboratory Technology Vol 1 and 2 - Revised Reprint 2021 with COVID-19 Pandemic Update - Set of 2 Books by B. Godkar, Darshan P. Godkar. Book Bundle; third edition (12 November 2024); Bhalani Publishing House.
5. Textbook of microbiology for diploma in medical laboratory technology and paramedical courses by Dr. D.R. Arora. CBS (1 January 2021); CBS Publishers & Distributors Pvt. Ltd.
6. Textbook of Pathology for DMLT & Paramedical Courses by Dr. I. Clement. Emmess Medical Publishers (1 January 2019)
7. Textbook of Pathology for Allied Health Sciences by Ramadas Nayak. Jaypee Brothers Medical Publishers; First Edition Reprint 2025 (1 June 2017)

SEMESTER–VI

3.25 MJCT-13: Endocrinology

Course Code: S/PHY/601/MJC-13 **Course ID:62511**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Content will help to upgrade the knowledge of the students with special emphasis on endocrine system as coordinating system.
- From this core course students will develop their knowledge about elementary idea on endocrine glands.
- Learner will gather specific knowledge on chemical nature, mode of action and Physiological functions of different hormones.
- They will also get information regarding pathophysiology of endocrine glands.

General concept on endocrinology

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

Pituitary gland

1. Introduction
2. Histology of pituitary gland.
3. Anterior pituitary and posterior pituitary hormones and their functions.
4. Growth hormone– Mechanism, function of GH and applied aspects.
5. Hyperfunction and hypofunction of pituitary in humans.

Thyroid gland

1. Introduction
2. Anatomic considerations of thyroid gland.
3. Biosynthesis and regulation of secretion of thyroid hormones.
4.Functions of thyroid hormones.
5. Primary and secondary hyper and hypo-thyrodism, LATS, Hashimoto disease, thyroiditis, goiter, thyroid storm and Grave's disease.

Parathyroid gland

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

Pancreas

1. Introduction
2. Histology of pancreas.
3. Structure, biosynthesis, mechanism of action, functionand regulation of insulin secretion.
4. Glucagon - Biosynthesis and function.
5. Blood sugar homeostasis.
6. Other Islet cell hormones.
7. Hypoglycemia and diabetes mellitus.

Adrenal cortex and medulla

1 Introduction
2. Histology of adrenal gland.
3. Adrenal Cortex-Biosynthesis and functions of adrenocortical hormones.
4. Adrenal Medulla- Biosynthesis and function of medullary hormones.
5. Regulation of adrenal hormone secretion.
6. Cushing syndrome, Addison's disease, Conn's syndrome and pheochromocytoma.

Endocrine functions of the kidneys, heart, thymus and pineal gland

1. Introduction
2. The renin-angiotensin system.
3. Erythropoietin.
4. The endocrine function of the heart: Atrial natriuretic peptide.
5. Thymus gland- Hormones and physiological functions.
6. Pineal gland-neuroendocrine gland and function of melatonin.
7. Human chronobiology, biological rhythms; basic concepts and implications.

3.26 MJCP-13: Endocrinology Lab

Course Code: S/PHY/601/MJC-13 **Course Id: 62521**

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

Course Learning Outcomes:

- Student will increase their ability to record the effect of oxytocin and adrenalin on uterine movement of rat.
- The learner will enhance their skill to determine obesity using anthropometric parameters.
- They will increase their skill on quantification of blood calcium and blood glucose levels.

1. Study of the effects of oxytocin on uterine contraction of albino rats.
2. Study of the effects of adrenaline on intestinal and uterine movements of albino rats
3. Growth chart of under 5 (ICMR protocol) and interpretation.
4. Measurement of obesity by anthropometric parameters: Height, weight, BMI, chest circumference, MUAC and waist-hip ratio.
5. Quantification of serum calcium by colorimetric method using calcon indicator.
6. Case study on the basis of endocrine pathophysiology using photograph provided through lottery.
7. Blood glucose determination by glucometer.

Suggested Readings:

1. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
2. Kronenberg, H.M. Melmed, S. Polonsky, K.S. Larsen, P.R. (2009). Williams Textbook of Endocrinology. Eleventh Edition. Saunders.
3. 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.
5. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
6. Khurana, I. (2015).Medical Physiology. 2nd Edition. Elsevier India.
7. Chatterjee, C.C. (2016). Human Physiology Volume 2. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
8. Chaudhuri, S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
9. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, II and III. Tata McGraw-Hill.
10. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
11. Godkar, P.B. Godkar. O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition.
12. Debnath, J. ByabaharikSharir Bignan. Shreedhar Prokashani, Kolkata.
13. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.
14. Richard J. Auchus, Allison B. Goldfine, Ronald J. Koenig, Clifford J Rosen. Williams Textbook of Endocrinology. Elsevier. 14th Edition. 2019.
15. Bernhard Kleine and Winfried G. Rossmanith. Hormones and the Endocrine System: Textbook of Endocrinology. Springer. 2016.
16. William J Kovacs (ed.), Sergio R Ojeda (ed.). Textbook of Endocrine Physiology. 6th Edition. 2016.Oxford University Press.

3.27 MJCT-14: Reproductive Physiology and Embryology

Course Code: S/PHY/602/MJC-14 **Course ID: 62512**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- The students will develop their knowledge on human reproduction and its associated abnormalities.
- Learner will also be enriched with knowledge about population control and family plaining
- They will learn about basic concept of menstruation and its hormonal control along with abnormalities.
- From this course our learners will learn about embryo development, physiology of pregnancy, parturition and lactation.

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

3.28 MJCP-14: Reproductive Physiology and Embryology Lab

Course Code: S/PHY/602/MJCP-14 Course ID: 62522

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

Course Learning Outcomes:

- The student will develop their skill to study of estrous cycle.
- Learner will increase their ability on staining and identification of reproductive tissues.
- They will be able to perform pregnancy test by immunological method.
- Student will also improve their skill for male fertility status assessment by performing semen analysis.

1.Study of estrous cycle.

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

Suggested Readings

1. Chatterjee, C.C. (2016). Human Physiology Volume 2. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
3. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
4. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
5. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
6. Chaudhuri, S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
7. Pal, G.K. Pal, P. (2013). Textbook of Practical Physiology. Third Edition. Universities.
8. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
9. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
10. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
11. Godkar, P.B. Godkar. O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition.
12. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
13. Manna, M.K. (2005). Practical Physiology. 1stEdition. Sritara Prakasani.
14. Veeramani R. Inderbir Singh's Human Embryology (2024). 14th Edition. Jaypee Brothers Medical Publishers Pvt. Ltd.

3.29 MJCT-15: Excretory System and Body Temperature Regulation

Course Code: S/PHY/603/MJC-15 **Course ID: 62513**

[Theory: Credits 3 (3 Lectures/Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- From this course the learner will study on excretory system with special emphasis on electrolytes and water balance of the human body.
- They will also get information about non-excretory function of kidney.
- Student will be enriched with the knowledge about structure and function of skin with physiology of sweating.
- This course will help to gather knowledge about regulation body temperature and its associated abnormalities.

Excretion

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

Skin

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

Body temperature

1. Physiological processes of thermoregulation, factor affecting thermogenesis and thermolysis, concept of thermogenetic, homeotherm, poikilotherm, hibernation and aestivation.
2. Regulation of body temperature in homeotherms – Role of endocrine and nervous system.
3. Pyrexia, hyperthermia and hypothermia.

3.30 MJCP-15: Excretory System and Body Temperature Regulation Lab

Course Code: SH/PHY/603/MJCP-15 **Course ID: 62523**

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

Course Learning Outcomes:

- The learner will get their ability to perform routine examination of urine to identify abnormal constitutions.
- Student will grow their skill to perform microscopic examination of urine also to identify RBC, pus cell, cast etc.
- They will enhance their ability to identify the relation between exercise, heart rate and body temperature.

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

Suggested Readings

1. Chatterjee, C.C. (2016). Human Physiology Volume 2. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
3. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition, Jaypee.
4. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
5. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
6. Ganong, W.F. Review of Medical Physiology. Lange Medical Book. Prentice-Hall International.
7. Chaudhuri, S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
8. Pal, G.K. Pal, P. (2013). Textbook of Practical Physiology. Third Edition. Universities.
9. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
10. Mukherjee, K.L. (2004). Medical Laboratory Technology. Vol. I, Vol. II and Vol. III. Tata McGraw-Hill.
11. Hinkle, J.L. Kerry H. Cheever, K.H. (2013). Brunner & Suddarth's Handbook of Laboratory and Diagnostic Tests. 2nd Edition. LWW Publisher.
12. Godkar, P.B. Godkar. O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition.
13. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
14. Manna, M.K. (2005). Practical Physiology. 1stEdition. Sritara Prakasani.

3.31 MJCT-16: Biostatistics and Computer Application

Course Code: S/PHY/604/MJC-16 **Course ID: 62514**

[Theory: Credits 3 (3 Lectures/Week)/Marks 25] **3 Credits**

Course Learning Outcomes:

- The course will enable the students to develop their knowledge about principle and application of statistics in biology.
- This core course will enrich the students to learn about statistical sampling, frequency distribution and graphical representation of data.
- The course will enrich the skill of the students for statistical data analysis using computer.
- This core course will increase the capacity of the students for statistical toll applications for hypothesis testing, association correlation, and regression studies.
- The content will increase the ability of the students for using computer in different domains of Physiology

Concepts in Biostatistics

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, pie diagram and scattergram.
5. Measurement of central tendency- Mean, median, mode in grouped and ungrouped data.
6. Computation of dispersion-Mean deviation, standard deviation, standard error of mean and variance.
7. Standard score.
8. Probability- General concept.
9. Normal distribution - Properties and assumption, skewness and kurtosis.
10. Student's t-distribution- Properties and assumption.
11. Testing of hypothesis - Null hypothesis, alternative hypothesis, errors of inference (Type-I and type-II), degrees of freedom, levels of significance, students' t-test (Single group paired observation study, individual matched grouped study) and z-score for significance of difference.
12. Non-Parametric - Chi-square test (Assumption and test for independence).
13. Correlation and regression.

Concepts in computer application

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

3.32 MJCP-16: Biostatistics and Computer Application Lab

Course Code: S/PHY/604/MJCP-4 **Course ID: 62524**

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

Course Learning Outcomes:

- This practical course will enable students to calculate statistical data, collected from field study.
- This practical course will fortify the students to develop their skill for preparing survey report.

Field study report

Submission and power point presentation ofa computerized typing report on the basis of field survey from any one of the followings topics by using basic statistical tools -

1. Physiological parameters (At least three parameters to be measured): Heart rate, blood pressure, breathing rate, PFI, blood hemoglobin content, differential count of WBC and visual acuity.
2. Anthropometric measurements (At least three parameters): Height, weight, BMI, BSA, Chest Circumference, head circumference, MUAC, hip circumference, skin fold thickness, Waist-Hip ratio and waist-thigh ratio.
3. Epidemiological studies - Cross sectional and vertical.

Suggested Reading:

1. Das, D. Das A. (2013). Statistics In Biology and Psychology. Sixth Edition. Academic Publishers.
2. Chad L. Cross Wayne W. Daniel. (2014). Biostatistics: Basic Concepts and Methodology for the Health Sciences. Wiley.
3. Rao, S. (2012). Introduction to Biostatistics and Research Methods. Fifth Edition.
4. Bhadra, K.A. (2012). Mahajan'S Methods in Biostatistics for Medical Students And Research Workers. Eight Edition.
5. Dhara, P. (2006). Computer in Biological Science Book. Academic Publishers.
6. Salaria, R.S. (2017). Computer Fundamentals. Khanna Book Publishing.

4.0 Minor (MN) Courses

SEMESTER–I

4.1 MNT-1: Cellular Physiology

Course Code: S/PHY/102/MN-1 **Course ID: 12516**

[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.

4.2 MNP-1: Cellular Physiology Lab

Course Code: S/PHY/102/MN-1 **Course ID: 12526**

[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. Thirteen 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

4.3 MNT-2: Blood and Body Fluids

Course Code: S/PHY/202/MN-2 **Course ID: 22516**

[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.

4.4 MNP-2: Blood and Body Fluids Lab

Course Code: S/PHY/202/MN-2 **Course ID: 22526**

[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.

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Suggestive Readings:

1. Chatterjee C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
2. Hall J.E. (2016). Guyton & Hall Textbook of Medical Physiology. Second South Asia Edition
3. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
4. Sembulingam K and Sembulingam P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
5. Khurana I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
6. 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.

SEMESTER–III

4.5 MNT-3: Biophysics and Biochemistry

Course Code: S/PHY/ 303/MNT-3 **Course ID:32516**

[Theory: Credits 3/ (3 Lectures /Week)/ Marks 25] **3 Credits**

Course Learning Outcomes:

- Students will understand key biophysical processes (diffusion, osmosis, surface tension, absorption) and their physiological relevance.
- They will learn the concept of pH, buffers, basic thermodynamics, and the significance of colloids in biological systems.
- They will gain foundational knowledge of enzymes, including classification, kinetics (Michaelis-Menten), and the roles of coenzymes, cofactors, and isozymes.
- Students will understand the classification, properties, and physiological importance of carbohydrates, lipids, proteins, and nucleic acids.

Biophysics

1. Physiological importance of biophysical processes: Diffusion, osmosis, surface tension and absorption.
2. pH and Buffers: Brief idea and significance in human body.
3. Thermodynamics -1st Law and 2nd Law.
4. 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.

Biochemistry

1. Carbohydrates: Definition, classification with examples, sources, fundamental properties and physiological importance.
2. Lipids: Definition, sources, classification, properties, function and essential fatty acid. Lipoproteins and their functions.
3. Proteins: Definition, sources, classification, important properties and function, essential and non-essential amino acids. Amino acid pool.
4. Nucleic acids: Nucleoside, nucleotide, structure and types of DNA and RNA.

4.6 MNP-3: Biophysics and Biochemistry Lab

Course Code: S/PHY/303/MN-3 **Course ID:32526**

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

Course Learning Outcomes:

- Students will become familiar with basic laboratory glassware, devices, and safety protocols used in a biochemistry lab.
- They will perform acid-base titrations to determine the strength of NaOH and HCl.
- Larner will carry out qualitative tests to identify key physiologically important biomolecules through systematic and confirmatory analysis.

1. Introduction to the glass goods and preliminary devices used in biochemistry lab.
2. Safety profile followed in biochemistry lab.
3. Determination of strength of NaOH and HCl by titration against oxalic acid.
4. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic acid, glucose, fructose, sucrose, lactose, starch, albumin, gelatin, peptone, urea, glycerol and bile salts - Systematic analysis and confirmatory test.

Suggested Readings

1. Das, D. (2004). Biophysics and Biophysical Chemistry. Fifth Edition. Academic Publishers.
2. Roy, R.N. (2015). A. Text Book of Biophysics. New Central Book Agency (P) Ltd.
3. Das, D. (2008). Biochemistry. Academic Publishers.
4. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
5. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
6. Kenneley, P.J. Botham, K.M. McGuinness, O.P. Rodwell, V.W. Weil, P.A. (2023). Harper's Illustrated Biochemistry, Thirty-Second Edition. McGrawHill. Lange.
7. Satyanarayana, U and Chakrapani, U. (2021). Essential of Biochemistry. Elsevier.
8. Voet, D, Voet, J.G. (2011). Biochemistry. 4th Edition. CBS Publishers & Distributors-New Delhi.
9. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2019). Biochemistry Ninth Edition. W.H. Freeman.
10. Nelson, D.L. Cox M. M. (2017). Lehninger Principles of Biochemistry. 7th Edition. W H Freeman & Co.
11. Alberts, B. Alexander, Johnson, A.D. Lewis, J. Morgan, D. Raff, M. Roberts, K. (2014). Molecular Biology of the Cell. W. W. 6th Edition. Norton & Company.
12. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
13. Debnath J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.

14. Bandopadhyay A. Snatak Sarir Bidya (2018) (Based on CBCS Curriculum for Semester I & II). Calcutta Book House Pvt. Ltd.
15. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol I. Santra Publication Pvt. Ltd
16. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.
17. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.

SEMESTER–IV

4.7 MNT- 4: Cardio-respiratory Physiology

Course Code: S/PHY/405/MN-4 **Course ID: 42516**

[Theory: Credits 3/ (3 Lectures/Week) /Marks 25] **3 Credits**

Course Learning Outcomes:

- From this course, students will learn about the anatomy and physiology of the human cardiovascular and respiratory systems.
- They will understand the structure and function of the heart, cardiac conduction system, mechanical and electrical events of the cardiac cycle, regulation of cardiac output, heart rate, and blood pressure, and basics of ECG interpretation.
- The course also provides an overview of common cardiovascular conditions such as hypertension, myocardial ischemia, and stroke.
- Students will study the functional anatomy of the respiratory system, mechanics of breathing, lung volumes, gas exchange, and regulation of respiration.
- They will also gain insights into clinical conditions like hypoxia, COPD, and cyanosis, as well as the principles of artificial respiration and acclimatization.

Cardiovascular System:

1. Anatomy of human heart and circulation through heart.
2. Special junctional tissues – Location, structure and function.
3. Origin and spread of cardiac impulse and pacemaker potential.
4. Properties of cardiac muscle.
5. Mechanical events of the cardiac cycle and heart sounds.
6. Cardiac Output - Definition, types, factors affecting, regulation and measurement.
7. Anatomy, peculiarities and regulation of coronary circulation.
8. Regulation of heart rate.
9. Blood pressure, factors affecting and regulation.
10. ECG – Leads, Einthoven's triangle & law, normal waves, and significance.
11. Hypertension, myocardial ischaemia and stroke (in brief).

Respiratory System:

1. Functional anatomy of the respiratory system.
2. Mechanism of breathing.
3. Dead space and its significance.
4. Lung volumes and capacities.
5. Lung surfactant and lung compliance.
6. Transport of oxygen and carbon dioxide in blood and tissue. O_2 and CO_2 dissociation curve and factors affecting it.
7. Regulation of respiration: Neural and chemical.
8. Anoxia, hypoxia, cyanosis, caisson's disease and acclimatization in brief.
9. COPD and artificial respiration.

4.8 MNP-4: Cardio-respiratory Physiology Lab

Course Code: S/PHY/405/MN-4 **Course ID: 42526**

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

Course Learning Outcomes:

- Through this practical course, students will develop skills in recording and interpreting kymographic heart activity in toads under normal and altered temperature conditions
- hey will also perform non-invasive human experiments to assess respiratory and cardiovascular responses before and after exercise, including measurements of respiratory rate, heart rate, blood pressure, and oxygen saturation.
- Students will learn to record pneumographic chest movements.

Animal Experiment:

1. Kymographic recording of the normal heart curve of toad.
2. Effect of temperature on kymographic recording of the normal heart curve of toad.

Human Experiment:

1. Pneumographic recording of chest movement: Effect of swallowing, hyperventilation, coughing, reading, laughing and breath holding.
2. Measurement of oxygen saturation by pulse oxymeter before and after exercise.
3. Measurement of respiratory rate before and after exercise.
4. Measurement of heart rate before and after exercise.
5. Measurement of blood pressure before and after exercise.

Suggested Readings

1. Mahapatra A.B.S.M. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
2. Sembulingam K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
3. Khurana I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
4. Chatterjee C.C. (2016). Human Physiology Volume 1& II. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
5. Chaudhuri S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
6. Guyton, A.C. Hall, J.E. (2007) Text Book of Medical Physiology. Eleventh Edition. W.B. Saunders Co.
7. 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.
8. Cyril, A. Keele, C. A. Neil, E, Joels, N. (2015). Samson Wrights Applied Physiology. 13th Edition, Oxford University Press. 2015.
9. Jain, A. K. (2017). Textbook of Physiology. Vol I & II, Seventh Edition Avichal Publishing Company.
10. Godkar, P.B. Godkar, O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition
11. Debnath, J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolka

12. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
13. Varshney, Bedi, M. (2022). Ghai's A Textbook of Practical Physiology. Jaypee Brothers Med Pub Pvt Ltd
14. Debnath J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.
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. Santra Publication Pvt. Ltd
17. Masanta N and Das T. (2019) Snatak Sarirbidya. (UG CBCS syllabus) Vol II. Santra Publication Pvt. Ltd.
18. Note Books on Experimental Physiology. Published by The Physiological Society of India. Kolkata.
19. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
20. Pal G.K. Pal P. (2013). Textbook of Practical Physiology. Third Edition. Universities Press.

SEMESTER–V

4.9 MNT-5: Neuro-muscular Physiology

Course Code: S/PHY/505/MN-5 **Course ID: 52516**

[Theory: Credits 3(3 Lectures/Week)/Marks 25] **3 Credits**

Course Learning Outcomes:

- Students will develop their knowledge on structure and function of muscle, nerve, synapse and neuromuscular junction.
- From this core paper they will learn the properties of muscle and nerve, and mechanism of muscle contraction.
- This core course will provide knowledge about receptors and their function.

Excitable Tissue: Nerve

1. Introduction
2. Structure and function of neuron.
3. Glial Cells - Types, structure and function.
4. Properties of nerve fibers, types and functions.
5. Origin and propagation of nerve impulse.
6. Nerve Fiber - Degeneration and regeneration.
7. Neurotrophins – Definition, chemical nature and function.

Excitable Tissue: Muscle

1. Introduction
2. Different types of muscle - Structure and properties. Functions of skeletal muscle, cardiac muscle and smooth muscle. Red and white muscle fibres.
3. Mechanism of skeletal muscle contraction. Isotonic, isometric, isokinetic contractions and muscle cramp.
4. Rigor mortis.

Synaptic and Neuromuscular Transmission

1. Synapses: Definition, types, EM structure and mechanism of synaptic transmission.
2. Myoneural junction - Structure, mechanism of impulse transmission.
3. Applied aspects – Myasthenia Gravis and Lambert-Eaton syndrome.

Receptor

1. Introduction
2. Receptors – Definition, bio-transducers, classification, functions and receptor potential.

4.10 MNP-5: Neuro-muscular Physiology Lab

Course Code: S/PHY/504/MN-3 **Course ID: 52526**

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

Course Learning Outcomes:

- Student will learn the techniques for node of Ranvier and muscle fiber detection through staining.
- The contents will help to gain the ability of the students for the detection of nerve muscle coordination and signal propagation along with different components in this phenomenon.
- Student will gain the knowledge about the environmental hot and cold modulators on nerve-muscle activities.

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

Suggested Readings:

1. Mahapatra, A.B.S.M. (2014). Essentials of Medical Physiology. Forth Edition. Current Books International.
2. Sembulingam, K. and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition. Jaypee.
3. Khurana, I. (2015). Medical Physiology. 2nd Edition. Elsevier India.
4. Chatterjee, C.C. (2016). Human Physiology Volume 1. Eleventh Coloured Edition. CBS. Publishers and Distributers Pvt. Ltd.
5. Chaudhuri, S.K. (2008). Concise Medical Physiology. Sixth Edition. NCBA.
6. Debnath J. (1998). Sharir Bigyan. Vol. I. Shreedhar Prokashani, Kolkata.
7. Note Books on Practical Human Experiment. Published by The Physiological Society of India. Kolkata.
8. Note Books on Practical Histology. Published by The Physiological Society of India. Kolkata.
9. Debnath J. ByabaharikSharir Bignan. Shreedhar Prokashani, Kolkata.
10. Pal G.K. Pal, P. (2013). Textbook of Practical Physiology. Third Edition. Universities Press.
11. Manna, M.K. (2005). Practical Physiology. 1st Edition. Sritara Prakasani.

SEMESTER–VI

4.11 MNT-6: Digestion, Absorption and Metabolism

Course Code: S/PHY/605/MN-6 **Course ID: 62516**

[Theory: Credits 3(3 Lectures/Week)/Marks 25] **3 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 pathways.
- Student will develop the knowledge about basic components of food with their nutritional values.

Digestive system

Digestion and absorption

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.

4.12 MNT-6: Digestion, Absorption and Metabolism Lab

Course Code: S/PHY/605/MNP-6 **Course ID: 62526**

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

Course Learning Outcomes:

- This practical paper will help to increase the skill 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, gelatine, 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 Distributers Pvt. Ltd.
9. Mahapatra, A.B.S. (2014). Essentials of Medical Physiology. Fourth Edition. Current Books International.
10. Sembulingam, K and Sembulingam, P. (2016). Essentials of Medical Physiology 7th Edition.

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. 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. Byabaharik Sharir Bignan, Shreedhar Prokashani, Kolkata.
19. Das, D. (2008). Biochemistry, Academic Publishers.
20. Satyanarayana, U and Chakrapani, U. (2021). Essential of Biochemistry. Elsevier.
21. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2019). Biochemistry Ninth Edition. W.H. Freeman.
22. Nelson, D.L. Cox M. M. (2017). Lehninger Principles of Biochemistry. 7th Edition. W H Freeman & Co.

5.0 Multidisciplinary (MD) Courses

SEMESTER–I

5.1 MDT-1: Social Physiology

Course Code: S/PHY/103/MD-1 **Course ID: 12514**

[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

5.2 MDT-2: Environmental Physiology and Human Health

Course Code: S/PHY/203/MD-2 **Course ID: 22514**

[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 (SOX, NOX COX and particulate matter) on human health and control measurement in brief.
5. Water p ollution: D efinition, 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.

SEMESTER–III

5.3 MDT-3: Preventive and Social Medicine

Course Code: S/PHY/304/MD-3 **Course ID:32514**

[Theory: Credits 3/ (3 Lectures /Week)/ Marks 40] **3 Credit**

Course Learning Outcomes:

- From this course, students will gain an understanding of the evolution of social medicine and community health, along with the dimensions, determinants, and indicators of health and wellbeing.
- They will explore the impact of globalization on health.
- The course covers the etiology, epidemiology, and prevention of both and communicable diseases.
- Students will also learn about PCM and micronutrient deficiencies such as goiter, rickets, and

1. History of social medicine and community health. Dimensions and determinants of health. Concepts and indicators of health and wellbeing.
2. Globalization and its impact on health.
3. Health committees and development of health services in India.
4. Etiology, epidemiology and prevention of noncommunicable diseases - Cardio-vascular diseases (Hypertension, atherosclerosis, angina pectoris and rheumatic heart disease), obesity, diabetes mellitus, cancer, blindness, mental health and occupational diseases.
5. Etiology, epidemiology and prevention of communicable diseases: Malaria, dengue, hepatitis, COVID and AIDS.
6. Basic idea of PCM and their prevention. Endemic goiter, rickets, osteomalacia, xeropthalmia, beriberi and their social implications.
7. Principles of formulation of diet chart of growing children, pregnant and lactating women.
8. Dietary management of obesity and diabetes mellitus.
9. Population explosion – Principles and methods of family planning. Morbidity and mortality.

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.
7. Pal R, Ghosh A, Agarwal A, Chatterjee S, Paul SK, Murlimanju BV. (2023) Recent advances in community medicine and public health (Volume-2), Mahi Publication Pvt. Ltd. ISBN: 978-81-19492-46-6.
8. Sinha NK, Das R, Dutta D, Acharya SK. (2024). Introduction to food, nutrition and health research. Vidyakutir Publication ISBN: 978-93-92403-43-9.

6.0 Skill Enhancement Courses (SEC)

SEMESTER–I

6.1 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

6.2 SECT-1: Clinical Biochemistry

Course Code: S/PHY/204/SEC-2 **Course ID: 22515**

[Theory: Credits 3/ (3 Lectures /Week)/ Marks 40] **3 Credit**

Course Learning Outcomes:

- Student will be developing their 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.
7. Chadha, P.V. Handbook of Experimental Physiology and Biochemistry. Jaypee Brothers Medical Publishers.
8. Kenneley, P.J. Botham, K.M. McGuinness, O.P. Rodwell, V.W. Weil, P.A. (2023). Harper's Illustrated Biochemistry, Thirty-Second Edition. McGrawHill. Lange.
9. Voet, D, Voet, J.G. (2011). Biochemistry. 4th Edition. CBS Publishers & Distributors-New Delhi.
10. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2019). Biochemistry Ninth Edition. W.H. Freeman.

SEMESTER–III

6.3 SECP-1: Food Adulteration and Nutritional Biochemistry Lab

Course Code: S/PHY/305/SEC-3 **Course ID:32525**
[Practical: Credits 3/ (6 Practical Classes/Week) /Marks 40] 3 Credits

Course Learning Outcomes:

- From this practical course, students will learn to identify food adulterants in common food items such as honey, fats, oils, and spices, and detect artificial sweeteners and heavy metals like lead and mercury in food samples
- They will gain hands-on experience in the identification of foodborne microorganisms
- Students will also be introduced to the sensory evaluation of food flavors, enhancing their practical skills in food quality and safety assessment.

1. Qualitative assessment of food adulterants: Honey, fats, oils and spices (Turmeric and red chili powder).
2. Determination of artificial sweetening agents.
3. Determination of heavy metals (Lead and mercury) in foods.
4. Identification of microorganisms in food: Mould in bread, microbes in curd and bacteriological testing of milk.
5. Qualitative analysis for carbohydrate, protein and fat present in milk, potato, flour, rice and pulses.
6. Demonstration about different food flavors.

Suggested Readings

1. Debnath J. Byabaharik Sharir Bignan. Shreedhar Prokashani, Kolkata.
2. Godkar, P.B. Godkar, O.D. (2014). Textbook of Medical Laboratory Technology. 14th Edition
3. Note Books on Practical Biochemistry. Published by The Physiological Society of India. Kolkata.
4. Varshney, Bedi, M. (2022). Ghai's A Textbook of Practical Physiology. Jaypee Brothers Med Pub Pvt Ltd.
5. Srilakshmi, B. (2015). Food Science. Sixth Edition. New Age International Publishers.