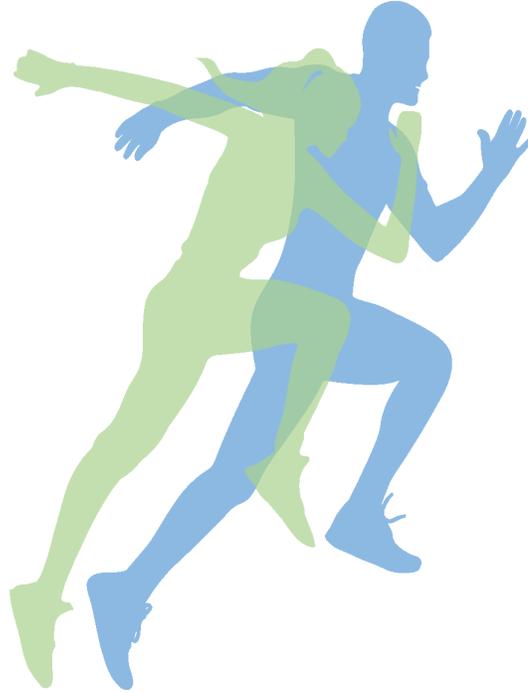




TAMILNADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY
CHENNAI- 600 127



SYLLABUS
M.Sc., EXERCISE PHYSIOLOGY AND NUTRITION
(REGULAR-2023-2024)

DEPARTMENT OF EXERCISE PHYSIOLOGY AND NUTRITION
TAMIL NADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY
CHENNAI - 600 127

DESCRIPTION OF THE DEPARTMENT

The Department of Exercise Physiology and Nutrition (EPN) examines the physiological responses and adaptations of the human organism to physical activity. Considerable emphasis is given toward understanding how the body functions during exercise and adapts to long-term training. Subjects related to neuromuscular physiology, bioenergetics, cardiorespiratory physiology, neuroendocrinology, clinical nutrition and sports nutrition will be taught. In addition, the physiological effects of factors such as age, gender, body composition, and the environment on human performance will be imparted, along with various sports training. Opportunities for research and applied, practical experiences are the core of the instructional methods for both undergraduate and post graduate students.

MISSION OF THE DEPARTMENT

The Department of Exercise Physiology and Nutrition seeks to promote the health of individuals and communities through research, teaching, and service activities in exercise physiology, human nutrition and the application of these sciences in academic, Sports, clinical, public health, and industry settings

REGULATIONS

The Choice Based Credit System (CBCS) and Learning Outcomes Based Curriculum Framework (LOCF) for two years M.Sc. Degree programme in Exercise Physiology and Nutrition will be implemented from the academic year 2023-2024.

1. ELIGIBILITY FOR ADMISSION

- 1.1 A Candidate shall be admitted to the degree of M.Sc., Exercise Physiology and Nutrition only if he/she produces satisfactory evidence to the effect that he/she has completed B.Sc. in Exercise Physiology and Nutrition/Sports Science/ Physiology / Home Sciences / Food Science & Nutrition Dietics/ Biotechnology / Zoology / Microbiology / Biochemistry/ Sports Coaching/Physical Education and Sports / BPT / or any undergraduate **science Degree** recognized by the syndicate of Tamil Nadu Physical Education & Sports University and an equivalent there in 10+2+3 or 10+2+4 pattern from a recognized university with a minimum of 50% marks in aggregate.

1.2 Reservation as per university / State Government rules, from time to time at par with the UGC norms and regulations of the Government of Tamilnadu. The total number of seats for PG is 20 (Twenty). Period of completion is not more than six years from the date of first admission.

2. COURSE OF STUDY

2.1 The normal duration of the M.Sc., Exercise Physiology and Nutrition Programme shall be four semester (Two years).

2.2 Each academic year shall comprise of two semester's viz. **ODD** and **EVEN** semesters. Odd semesters shall be from July to November and Even Semesters shall be from December to May.

2.3 There shall be not less than 90 working days which shall comprise 450 teaching/Practical Activity clock hours for each semester.

2.4 Time = N+2 years for the completion of programme.

3. CHOICE BASED CREDIT SYSTEM (CBCS) AND LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)

The Choice Based Credit System (CBCS) and Learning Outcomes Based Curriculum Framework (LOCF) in M.Sc., programme would have the following five components and the minimum credit requirements for each component to be completed in two years are:

3.1 **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching or two hours of practical work.

3.2 **Core course:** Are course that are basic to the subject of the degree. This is a course which is to be compulsorily studied by a student as a core requirement to the completion of the program.

3.3 **Elective Courses:** This is a course that is supportive to the discipline of study, provides an expanded scope, enables exposure to some other domains or nurtures proficiency/skills. Elective papers can be of two types: Discipline Specific Elective (DSE) and Generic Elective (GE).

3.4 **Discipline Specific Elective (DSE):** These courses are inter disciplinary in nature and considered similar to core course. And, the students have to choose one course from the option provided for them.

3.5 **Generic Elective (GE):** These courses add generic proficiency to the students. Students have to choose generic elective courses in consultation with the head of the

department from the Generic Elective courses offered by other Division of study in Sports Science or from other Departments in university.

CREDIT ABSTRACT

Semester – Credit Subject	I	II	III	IV	Total Credit
Core course	12	12	12	12	48
Elective (Discipline Centric)	3	3	6	3	15
Generic Elective (GE)	3	3	-	-	06
Core - Practicum (Skill Enhancement Course)	2	2	2	2	08
Ability Enhancement Course (AECC)-Soft Skill	2	2	2	2	08
Thesis with Viva-Voce	-	-	-	3	03
Internship	-	-	2	-	02
Field Work / Extension Activity	-	-	-	1	01
Grand Total	22	22	24	23	91

4. COURSE WEIGHT

4.1 Courses have been designed with weightage of two /four credits, depending upon the content, duration and specialization. All courses need not carry the same weight. A course may comprise lectures/tutorials/laboratory/field work/outreach activities/project work/vocational training/viva/seminars etc. or a combination of some of these.

4.2 It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching or two hours of practical work.

5. ASSESSMENT AND EVALUATION

Post Graduate degree programme M.Sc., Exercise Physiology and Nutrition (Two Years), determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching or two hours of practical work.

SEMESTER	CREDITS	TOTAL MARKS
I	22	600
II	22	600
III	24	650
IV	23	650
Grant Total	91	2500

5.1 Each course will be assessed on the basis of 100 marks. The marks would be divided between internal and external assessment.

5.2 There shall be one end semester external examination for each course in every semester consisting of 75% (75 marks) weight in theory and 25% (25 marks) in practical courses.

5.3 Each Theory course shall have internal assessment of 25% weightage on the following:

Components of Internal Evaluation of Theory	Marks
Test Paper – I & Test Paper - II	10
Seminars	3
Assignments	2
Model Examination	10
Total	25

5.4 Each Practical Course shall have internal assessment of 25% weightage on the following:

Components of Internal Evaluation of practicum	Marks
Internal Viva	10
Lab Record	5
Lab Performance	10
Total	25

5.5 The minimum passing standard will be 50% for the external and internal component of each theory course, i.e. 38 marks out of 75 (External - 50% of 75 marks) and 12 marks out of 25. In practical minimum passing standard will be 50% for the external exam and internal assessment for each practical course.

6. ATTENDANCE

6.1 Every teaching faculty handling a course shall be responsible for the maintenance of attendance register for candidates who have registered for the course.

6.2 Students must have 75% of attendance in each course for appearing in the examination.

6.3 Students who have 74% to 70% of attendance shall apply for condonation in the prescribed form with the prescribed fee.

6.4 Students who have 69% to 65% of attendance shall apply for condonation in prescribed form with the prescribed fee along with the Medical Certificate.

6.5 Students who have below 64% to 60% of attendance are not eligible to appear for the examination. It is furthered clarified that the students, Carry over to the next semester.

6.6 Students who have below 60% of attendance are not eligible to appear for the examination. It is furthered clarified that the students, Re do the course

7. END SEMESTER EXAMINATION (ESE)

7.1 The ESE will consist of a written examination of three hours duration for a maximum score of 75. The following procedure will be followed for evaluation.

Pattern	Total No. of Question	Number of Question to be Answered	Marks for each Question	Total Marks
MCQ	10	10	1	10
Short Answer	5	5	2	10
Short Essay / Problem	8	5	5	25
Essay / Problem Type	5	3	10	30
Total				75

7.2 Distribution of 25 Marks for Semester End Practical Examination weightage on the following:

Components of External Evaluation of practicum	Marks
Lab Experiment	10
Lab Performance	5
Viva-voce	5
Lab Record	5
Total	25

7.3 A candidate who has secured a minimum of 50 marks in all courses prescribed in the programme and earned a minimum of the credits will be considered to have passed the Master's Degree Programme.

7.4 A Student will be issued, hall ticket only if one produces “**No Dues**” certificates from the concerned department, the laboratory, the Registrar’s Office, the Library and Hostel.

8. GRADING SYSTEM

A ten point rating is used for the evaluation of the performance of the student to provide a letter grade for each course and overall grade for the Master’s Programme. The letter grade assigned is given below:

Letter	Grade	Grade Point	Range of Marks
O	Outstanding	10	91-100
A+	Excellent	9.0	81-90
A	Very Good	8.5	71-80
B+	Good	8.0	61-70
B	Above Average	7.5	51-60
C	Pass	7.0	50
RA	Reappear	6.5	0-49
AB	Absent	6.0	ABSENT

9. INTERNSHIP AND FIELD TRAINING

Internship and field training is an important component of Exercise Physiology and Nutrition that provides students with the opportunity to gain applied practical experience in the field of Exercise Physiology and Nutrition. It allows a student to employ what is learned in class in a supervised environment, which is critical in order to further develop professional skills and assure quality practice. The students will undergo Internship training / Clinical practice / Field training in TNPESU campus/ Sports Development Authority of TamilNadu (SDAT) coaching Centres / Sports Authority of India (Various coaching Centres of SAI) / Government Medical College/ Private Medical College and Hospitals other sporting centers / Academies shall be evaluated through internal assessment only. At the end of Internship/field training, the student shall submit a certificate from the organization where he /she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department.

* *Internship will be carried out during the summer vacation of the first year and marks should be sent to the University by the Department and the same will be included in the Third Semester Marks Statement.*

10. THESIS

The topic of thesis will be allocated in third Semester and candidate will work for one semesters and submit a written thesis in 4th semester. The student will be awarded grade for the total number of credits earned in dissertation in III and IV semesters of study at the end of the IV semester.

PROGRAMME OUTCOMES (POs):

By the end of the program, the students will be able to

PO1	Sports Science knowledge: Apply the knowledge of Exercise Physiology and Nutrition fundamentals, and a science specialization to the solution of complex science problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex science problems reaching substantiated conclusions using first principles of Research and statistics in Exercise Physiology and Nutrition.
PO3	Design/development of solutions: Design solutions for complex problems and design, plan that meet the specified needs with appropriate consideration for the public health , fitness, safety, counselling, cultural, societal, and environmental considerations
PO4	Environment and sustainability: Understand the impact of the professional Exercise Physiology and Nutrition solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO5	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Exercise Physiology and Nutrition.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

By the end of the program, the students will be able to

PSO1	Apply the principles and practices of discipline along with the basic Exercise Physiology and Nutrition sciences to solve the complex Exercise Physiology and Nutrition problems concerning the issues of environment, safety, economics, culture and society etc.
PSO2	Acquire and apply the new knowledge with professional responsibility and ethics towards the advancement of academic and research pursuits in Exercise Physiology and Nutrition and allied disciplines in the societal contexts.
PSO3	Design, develop and modify the training, menu planning, to analyze these by applying the various techniques and mechanism. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PSO4	Demonstrate and interpret the application of Exercise Physiology and Nutrition concepts. Communicate effectively on complex Exercise Physiology and Nutrition activities with the Sports persons, Fitness enthusiast, community and with society at large, such as, being able to comprehend and plan, prescribe ,write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PSO5	Demonstrate knowledge and understanding of the Exercise Physiology and Nutrition and apply these and function effectively as an individual and in multidisciplinary settings. Integrate advanced scientific and professional skills in the context of Exercise Physiology and Nutrition.

SEMESTER I

Course code	Course Title	Hours/ Week				C	Marks		
		L	T	P	CIA		ESE	Total	
23PC1CT101	Bioenergetics and Muscular Physiology	4	1	-	4	25	75	100	
23PC1CT102	Cardiovascular and Respiratory Physiology	4	1	-	4	25	75	100	
23PC1CT103	Advanced Human Nutrition	4	1	-	4	25	75	100	
ELECTIVE - DISCIPLINE CENTRIC - I CHOOSE ANY ONE									
23PC1CE001	Exercise and Sports Biochemistry	3	1	-	3	25	75	100	
23PC1CE002	Exercise Science and Functional Assessment								
23PC1CE003	Clinical Sports Nutrition								
23PC1CE004	Nutrition and Immune Function In Athletes								
GENERIC ELECTIVE									
	Interdepartmental Elective – II (Generic)	3		-	3	25	75	100	
PRACTICUM									
23PC1SE101	Cardiovascular and Respiratory Physiology Practicum - I	-		4	2	25	75	100	
23PC1AE101	Communication Skill I	4		-	2	-	-	-	
		22	4	4	22	150	450	600	

Note:

1. Students shall take Department Electives (DEs) from the choices available.
2. Students shall take Interdepartmental Electives (IDEs) from a range of choices available.

SEMESTER II

Course code	Course Title	Hours/ Week			C	Marks		
		L	T	P		CIA	ESE	Total
23PC1CT201	Environmental Exercise Physiology	4	1	-	4	25	75	100
23PC1CT202	Exercise and Sports Nutrition	4	1	-	4	25	75	100
23PC1CT203	Research Methods in Exercise Physiology and Nutrition	4	1	-	4	25	75	100
ELECTIVE- DISCIPLINE CENTRIC - III CHOOSE ANY ONE								
23PC1CE005	Strength Training and Conditioning for Fitness	3	1	-	3	25	75	100
23PC1CE006	Exercise Rehabilitation and Injury Management							
23PC1CE007	Renal Physiology							
23PC1CE008	Training and Performance							
GENERIC ELECTIVE								
	Interdepartmental Elective – IV (Generic)	3	-	-	3	25	75	100
PRACTICUM								
23PC1SE201	Exercise and Sports Nutrition Practicum - II	-	-	4	2	25	75	100
23PC1AE201	Computer Application in Exercise Physiology and Nutrition	4	-	-	2	-	-	-
		22	4	4	22	150	450	600

Note:

1. Students shall take Department Electives (DEs) from the choices available in the Department, in consultation with HOD.
2. Students shall take Interdepartmental Electives (IDEs) from a range of choices available.

SEMESTER III

Course code	Course Title	Hours / Week			C	Marks		
		L	T	P		CIA	ESE	Total
23PC1CT301	Clinical Exercise Physiology - I	4	-	-	4	25	75	100
23PC1CT302	Neurophysiology	4	1	-	4	25	75	100
23PC1CT303	Statistics in Exercise Physiology and Nutrition	4	-	-	4	25	75	100
23PC1CT304	Exercise and Sports for Women	4	-	-	3	25	75	100
ELECTIVE- DISCIPLINE CENTRIC – III CHOOSE ANY ONE								
23PC1CE001	Exercise and Sports Biochemistry	3	-	-	3	25	75	100
23PC1CE002	Exercise Science and Functional Assessment							
23PC1CE003	Clinical Sports Nutrition							
23PC1CE004	Nutrition and Immune Function In Athletes							
PRACTICUM								
23PC1SE301	Clinical Exercise Physiology Practicum - III	-	-	4	2	25	75	100
23PC1AE301	Life Skills Management	2	-	-	2	-	-	-
23PC1IT301	Multispecialty Hospitals / Sports Academies/Fitness centers- Training Internship - Report and Viva-voce	-	-	4	2	50	-	50
		21	1	8	24	200	450	650

Note:

- *Internship will be carried out during the summer vacation of the first year and marks shall be sent to the COE of the University by the Department and the same will be included in the Third Semester Marks Statement.
- *15 days training in multi-specialty hospital/ Sports Academies/Fitness center to qualify for the degree and submit a mini project.

SEMESTER – IV

Course code	Course Title	Hours/ Week			C	Marks		
		L	T	P		CIA	ESE	Total
23PC1CT401	Clinical Exercise Physiology -II	4	1	-	4	25	75	100
23PC1CT402	Endocrine Physiology	4	1	-	4	25	75	100
23PC1CT403	Ergogenic Aids and Sports Performance	4	-	-	4	25	75	100
ELECTIVE - DISCIPLINE CENTRIC – VI CHOOSE ANY ONE								
23PC1CE005	Strength Training and Conditioning for Fitness	3	-	-	3	25	75	100
23PC1CE006	Exercise Rehabilitation and Injury Management							
23PC1CE007	Renal Physiology							
23PC1CE008	Training and Performance							
23PC1TH403	Thesis with Viva -Voce	-	-	4	3	25	75	100
PRACTICUM								
23PC1SE401	Clinical Exercise Physiology Practicum - IV	4	1	-	2	25	75	100
PRACTICUM								
23PC1AE401	Yogic Science	2	-	-	2	-	-	-
23PC1EA404	Extension Activity- (Field visit)	-	-	2	1	50	-	50
		21	3	6	23	200	450	650

SEMESTER- I

COURSE CODE – 23PC1CT101

BIOENERGETICS AND MUSCULAR PHYSIOLOGY

Learning Objective (LO):

By the end of the course, the student will be able to

1. Explain mechanisms of Bioenergetics system and Muscular systems that for physiological adaptations to physical activity and exercise.
2. Demonstrate and practice procedures to measure Energy Expenditure, metabolic responses to sub-maximal and maximal exercise.
3. Assess physiological responses to resistance exercise and provide recommendations on methods that prompt adaptations to training

Unit I Metabolism and Energy : Definition of Bioenergetics, Metabolism and Energy- Energy Sources- Biologic work in human- Factors that affect the rate of Bioenergetics - ATP-Creatine Phosphate (CrP) Energy System – Anaerobic Glycolysis Energy System- Glycolysis and the Formation of Lactate- Cori cycle- Oxidative system - Krebs cycle - Electron Transport System – EPOC (Excess Post Exercise Oxygen Consumption) – Energy release from carbohydrate - Energy release from Fat - Energy release from Protein.

Unit II - Metabolic Adaptations to Anaerobic and Aerobic Training: Adaptations in the ATP-PCr System- Adaptations in the Glycolytic System-Other Adaptations to Anaerobic and Aerobic Trainings. Measuring Energy Use during Exercise: Direct Calorimetry - Indirect Calorimetry - Respiratory Quotient (RQ) - Respiratory Exchange Ratio - Energy Expenditure at Rest and during exercise- Factor that affect Energy Expenditure- Exercise- Physiological basis of Fatigue - Fatigue and its Causes and types, Fatigue and Recovery

Unit III- Muscle Physiology: Classification of Muscles- Structure and Function of Skeletal Muscle - Characteristics of Muscle Tissue - Microscopic Structure of a Myofibril – Sarcotubular System - Sliding Filament Mechanism of Muscle Contraction - All-or-None Principle. Physiological and Biochemical properties of Skeletal Muscle Fiber – Types of Muscle fiber - Assessment of Muscle Fiber Type.

Unit IV – Neuromuscular Physiology: Neuromuscular Junction – motor unit - Neuromuscular Transmission - Muscle Spindles and Golgi Tendon Organs - Length Tension Relationship – Force velocity relationship - Refractory Period - Muscle Tone - Action Potential – mechanism of

Remodeling of Muscle Functions – mechanism of Muscle Hypertrophy and Atrophy-Hyperplasia-Rigor Mortis.

Unit V - Neuromuscular Adaptations, to Resistance Training: Define Muscular Strength, Muscular Power, Muscular Endurance - Types of Resistance Training - Resistance Training Guidelines - Resistance Training Systems - Basic Adaptations to resistance Training: Acute Adaptations- Chronic Adaptations- Factors that Influence Adaptations to Resistance Training- Overtraining-Detraining-Neuromuscular Adaptation to Endurance Exercise - Designing Resistance Training Programs.

Reference Books:

1. Jack H. Wilmore and David L. Costill, (1994), Physiology of sport and exercise, Human Kinetics, Champaign, United States.
2. Victor L. Katch, William D. McArdle, Frank I. Katch, (2011), Essentials of Exercise Physiology-4th ed, Lippincott Williams & Wilkins, a Wolters Kluwer business, Philadelphia.
3. Scott K. Powers, Edward T. Howley, (2018), Exercise Physiology: Theory and Application to Fitness and Performance, Tenth Edition, McGraw-Hill Education, 2 Penn Plaza, New York.
4. Edward T. Howley and Dixie L. Thompson, (2012), Fitness professional's handbook - 6th ed, Human Kinetics, Champaign, United States.
5. Werner W. K. Hoeger, Sharon A. Hoeger, Cherie I. Hoeger, Amber L. Fawson, (2018), Principles and Labs for Fitness & Wellness, Fourteenth Edition, Cengage Learning, 20 Channel Center Street, Boston, United States of America.
6. Barbara A. Bushman, (2017), complete guide to fitness & health. | American College of Sports Medicine's complete guide to fitness and health, Second edition, Champaign, IL: Human Kinetics, United States.
7. Vivian H. Heyward, Ann L. Gibson, (2014), Advanced fitness assessment and exercise prescription - Seventh edition, Champaign, IL: Human Kinetics, United States.
8. Jared W. Coburn and Moh H. Malek, editors, (2012), NSCA's essentials of personal training - 2nd ed, Champaign, IL: Human Kinetics, United States of America.
9. Sharon A. Plowman, (2003), Exercise Physiology for Health, Fitness, and Performance - Second Edition, Pearson Education, Inc.

Course Outcomes

On successful completion of the course, the students should be able to:

CO 1	To understand the bioenergetics, biologic work in human organs and energy systems in the body.
CO 2	To understand the metabolic adaptations to anaerobic, aerobic training and their role in the body.
CO 3	Apply the concept and structure, functions of muscle and mechanism of muscle Contraction.
CO 4	Anlyse the Neuromuscular Transmission, Muscle Hypertrophy and Muscle Atrophy
CO 5	To understand and acquire the Neuromuscular Adaptations to Resistance Training

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strong 3 ; M-Medium 2 ; L-Low 1**

SEMESTER- I

COURSE CODE – 23PC1CT102

CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY

Learning Objectives:

1. Explain types of circulations - coronary arteries- valves of the heart and chambers of heart for physiological adaptations to physical activity and exercise
2. Discuss the mechanism of bioelectricity and cardiac mechanics
3. Explain practice procedures of Cardiac electro physiology.
4. Understand the concept of cardiac adaptations in response to aerobic training
5. Understand the concept of Functional anatomy of the Bronchopulmonary system
6. Explain practice procedures and mechanism of inspiration and expiration
7. Understand the concept of lung volumes and capacities
8. Explain practice procedures of Lung function test

UNII - I - Basic Cardiac Anatomy: Definition, Structure and functions of Heart – size shape and location of heart – types of circulations - coronary arteries- valves of the heart – chambers of heart-cardiac physiology concepts — conducting system of the heart — cardiac cycle — redistribution of blood – heart rate variability – importance of sleeping on heart rate. Blood distribution during rest and exercise

UNII - II – Electrocardiogram: Definition, Cardio dynamics – Cardiac electro physiology and mechanics-action potential cardiac output – blood pressure –Factors affecting stroke volume – factors affecting cardiac output – measuring blood pressure – blood pressure and venous return. Cardiac adaptations in response to aerobic training. Cardiac tissue and bioelectricity – cardiac mechanics.

UNII - III Functional anatomy of the Bronchopulmonary system: Definition and Anatomy of the respiratory system — Internal and external respiration — respiration — mechanism of inspiration and expiration - alveolar ventilation – Dead space – diffusion and transport of gasses – lung volumes and capacities– O₂ – Haemoglobin – Dissociation curve in difference circumstances- Response of the Respiratory System to Exercise-Respiratory Training Adaptations..

UNII – IV Cardiovascular Responses to Exercise: Cardiovascular Responses to Aerobic Exercise - Cardiovascular Responses to Static Exercise - Male-Female Cardiovascular Differences during Exercise - Cardiovascular Responses of Children and Adolescents to Exercise - Cardiovascular Responses of Older Adults to Exercise – Hypertrophy of heart due to

short term and long term exercise on short distance and long distance runners -Cardiovascular Adaptations to Aerobic Endurance Training - Cardiovascular Adaptations to Dynamic Resistance Training.

UNII – V Cardiopulmonary Measurements: Definition, Blood Pressure Responses to Exercise- Accurate Blood Pressure Checks- Measurement of Heart Rate- Rating of Perceived Exertion - cardiorespiratory endurance test – laboratory tests– direct Method Assessment O₂ and CO₂ through gas analyser by using standard protocol and indirect Method - Harvard step test –field test- 12 minutes run and walk test – Queens college Step test, Beep test and YO -YO Test - Lung function test.

Reference Books:

1. Jack H. Wilmore and David L. Costill, (1994), Physiology of sport and exercise, Human Kinetics, Champaign, United States.
2. Victor L. Katch, William D. McArdle, Frank I. Katch, (2011), Essentials of Exercise Physiology-4th ed, Lippincott Williams & Wilkins, a Wolters Kluwer business, Philadelphia.
3. Scott K. Powers, Edward T. Howley, (2018), Exercise Physiology: Theory and Application to Fitness and Performance, Tenth Edition, McGraw-Hill Education, 2 Penn Plaza, New York.
4. Irwin S. Techlin JS. Cardipulmonary physical therapy: a guide to practice. St. Louis, Mo, Mosby Co., 2004.2.
5. William D.Mcardle, Frank I. Katch, Victor L. Katch, (2005), “Essentials of exercise physiology”, Lippincott Williams and Wilkins.
6. Mcardle, William D, Frank I. Katch, Victor L. Katch, (2005) “Essentials of Exercise Physiology”, Philadelphia: Lea and Febiger.
7. G. Gregory Haff, Charles Dumke, (2019). Laboratory manual for exercise physiology / Second Edition, Human Kinetics, P.O. Box 5076, Champaign, IL, USA.
8. Sharon A. Plowman, Denise L. Smith.(2014), Exercise physiology for health, fitness, and performance - 4th ed. Lippincott Williams & Wilkins, a Wolters Kluwer business, 2001 Market Street, Philadelphia.

Course Outcomes

On successful completion of the course, the students should be able to:

CO No	Course outcomes
CO 1	To understand the types of circulations, structure valves, and chambers of the heart.
CO 2	Analyze the Electrocardiogram – Cardio dynamics, Cardiac electrophysiology, and mechanics.
CO 3	To understand the structure, and functions of lungs and the mechanism of inspiration and
CO 4	Describe the Cardiorespiratory system and respiratory adaptation to training
CO 5	To understand the Cardiorespiratory assessment test direct and indirect methods

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

*S-Strong 3 ; M-Medium 2 ; L-Low 1

SEMESTER- I

COURSE CODE – 23PC1CT103 ADVANCED HUMAN NUTRITION

Learning Objectives:

1. To recognize the properties and composition of macronutrients
2. To understand the digestion and absorption of macronutrients and the role of macronutrients in metabolism, energy, production, control and distribution
3. To identify factors affecting intake, utilization and micro exertion of micronutrients and be aware of macro and micro nutrient research.

UNIT-I Carbohydrate: Definition, composition, structural features of CHO- structure of Aldoses and ketoses , classification- monosaccharides and its classification based on structure, disaccharides, oligosaccharides and polysaccharides- structure of starch and Inulin - functions of carbohydrates in the body, food sources, digestion and mechanism of absorption – monosaccharide transport and cellular uptake- Glucose transport – Secondary active transport-maintenance of blood glucose level- Glycemic response , Glycaemic index, glycaemic load - Dietary fiber - Definition, types, sources, RDA, physiological effects of dietary fiber. Carbohydrates of physiological significance - Therapeutic use of glucose, sucrose, galactose, fructose, Carbohydrate awareness, and lifestyle diseases.

UNIT – II Protein: Definition, structural elements of protein, Classification- based on structure, based on composition, based on functions, functions, Food sources, Requirements and RDA. Catalyst – messenger proteins – importance of protein messenger- Immuno protectors- protein transporters- Buffer- fluid balance- Digestion and absorption and metabolism of proteins. Amino acids- classification of amino acids- essential and nonessential – complete and incomplete proteins - Toxic proteins in foods of vegetable and animal origin and processing and cooking methods for detoxification. Nitrogen Balance- Positive and Negative

UNIT – III Lipids: Definition, structure of a fat, wax, steroid, glycerophospholipids – sphingophospholipid – sphingoglycolipid - Classification of lipids - simple, compound and derived lipids- saturated and unsaturated fatty acid – structure and functions of fatty acid – Lipoproteins – CM, VLDL, LDL, IDL HDL – importance of Lipoproteins - properties of lipoprotein – derived lipids – cholesterol function – cholesterol level- lipid profile test- Lipid digestion and absorption and transport of lipids - Composition and function of serum lipoproteins, Storage of lipids- Adipose tissue – structure of White adipose tissue(WAT) & Brown adipose tissue(BAT) –

sources – Nutritional significance of fatty acids – SFA, MUFA, PUFA functions and deficiency - Nutritional Requirements and dietary guidelines.

UNIT – IV Vitamins – Definition, 13 essential vitamins – structure- classification – Fat Soluble: Vitamin A, E, K and D and Water Soluble vitamins: Vitamin B complex and Vitamin C - sources – utilization – storage – excretion – functions – bioavailability –, deficiency, toxicity – absorption – transport - requirements and RDA - assessment of status and alteration in requirements in various clinical and metabolic disorders.

UNIT – V Minerals: Definition – Types - Macro and Micro minerals -, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders.

Reference Books:

1. Betsy B. Holli Judith A. Beto, Krause's Food & the Nutrition Care Process, 13th edition, Saunders Elsevier, 2011.
2. Maurice Edward Shils, Moshe Shike, Lippincott Williams & Wilkins, Modern Nutrition in Health and Disease, Mc Graw Hill, 2006.
3. Martha H. Stipanuk, Biochemical, Physiological, and Molecular Aspects of Human, 2012.
4. Krause's Food & the Nutrition Care Process (Krause's Food & Nutrition Therapy), 13ed, Mahan, 2011.
5. Sareen S. Gropper and Jack L. Smith (2009), Advanced Nutrition and Human Metabolism, Wadsworth, Cengage Learning, USA.
6. Heather Hedrick fink, Lisa A. Burgoon, Alan E. Mikesky, (2006), "Practical Application in Sports Nutrition", Jones and Bartlett.
7. Betsy B. Holli Judith A. Beto, Krause's Food & the Nutrition Care Process, 13th edition, Saunders Elsevier, 2011.
8. Maurice Edward Shils, Moshe Shike, Lippincott Williams & Wilkins, Modern Nutrition in Health and Disease, Mc Graw Hill, 2006.
9. McArdle William D. et.al. (2005) "Exercise Physiology, Nutrition and Human Performance", Philadelphia: lea and Febiger.
10. McArdle, William D., Katch, Frank I and Katch, Victor L (2005) "Exercise Physiology", Philadelphia, lea and Febiger.

Course Outcomes:

On successful completion of the course, the students should be able to:

CO1	Illustrate sources, requirements, role and deficiency of macro and micro nutrient
CO2	Explain beneficial effects of macro and micro nutrient on human health.
CO3	Application of Various training methods of Altitude training.
CO4	Explain the functions, deficiency or toxicity of macro and micronutrients
CO5	Evaluate the role of macronutrients, micronutrients in health and disease.

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SKILL ENHANCEMENT COURSE SEC -I

23PC1SE101	CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY PRACTICUM - I
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Each student is expected to practice measurement on 15 volunteers and determine Pre and Post Training/Exercise variation (To be carried out as project and on sports persons).

1. Measurement of heart rate various sites during rest and after exercise
2. Blood Pressure Measurements during and after exercise.
3. Electrocardiogram (ECG) Test
4. Heart rate response recording during sporting activities. At least three different sports are to be covered by each student.
5. VO₂ Max Measurements by Queens' step college Steps Test.
6. VO₂ Max Measurements by Astrand-Rhyming Step Test.
7. Harvard Step Test
8. Cooper 1.5-Mile Run/Walk Test
9. Cooper 12-Minute Run/Walk Test
10. Rockport Fitness Walking Test
11. Yo-Yo Intermittent Recovery Test
12. Determination of Physiological adaptation with training through Submaximal Exercise on Treadmill / Bicycle ergometer.
13. Determination of Physiological adaptation with training through Maximal Exercise on Treadmill / Bicycle ergometer.
14. Lung volumes and capacities Test.
15. Rating of Perceived Exertion
16. VO₂Max Assessment by Direct Method

SEMESTER- I

ABILITY ENHANCEMENT COURSE (AEC)-I

COURSE CODE – 23PC1AE101

COMMUNICATION SKILL

Learning Objectives:

1. To impart advanced training in standard pronunciation, word stress and intonation
2. To train students in the correct use of English in a formal way
3. To improve the learners' vocabulary by familiarizing them with the ways of word formation
4. To develop communication skills by providing theoretical knowledge of the mechanism of effective communication
5. Speak English with an unaffected accent using stress and intonation
6. Use acceptable English in academic writing
7. Use English language in a more meaningful way with an enriched word power
8. Communicate in a professional way using various communication strategies

Unit – I- Communication Skills: Role of communication in Present Days- Importance of Communication - Communication Barriers - Types of Communications: Verbal communication: Oral -Story telling- Crucial conversation – Face to Face Communication- Telephone communication, Aral- Listening and Hearing, Non - Verbal Communication: Facial Expressions- Body Language-Posture- Eye Contact, Written Communication: Journals- E-Mails- Blogs - Text Messages, Visual Communications: Signs- Symbols- Pictures.

Unit – II- Components of Communication – Context - Encoder- Encoding - Message - Medium - Receiver – Feedback- Level of Communication – Intrapersonal – Intrapersonal- Group and Public communication, Characteristics of Communication, Memorandum: Purpose- Format- Business Memo and Agenda, Basic Skills for Communications- Listening- Speaking- Reading and Writing.

Unit – III- Interview Skills: Preparing for Interview- -Personal interview - Technical interview - Group Discussion- Body language- Pronunciation- Speaking - Presentation skills: Preparation – The Subject – The Audience – The place- The time- Length of Talk and Structure of Presentation.

Unit – IV- Phonetics: Elements of English Language – Phonology- Morphology – Lexis – Syntax- Grammar, The Different Speech Organs and Their Role- The Individual Sounds- Vowel- Pure

Vowel- Semi Vowel- Diphthongs- Classification of Diphthongs - Monotones- Consonants- Manner of Articulation- Place of Articulation.

Unit – V- Strong and weak Forms of Words- Stress- Word Stress- Primary Stress- Secondary Stress- Sentence Stress, Rhyme and Rhythm- Rhythm- Intonation- Raise - Fall - Raise Fall intonation.

Reference Books

1. Second Edition of “Communication Skills” Published by Carrier Skill Library.
2. Effective Communication Skills – A Book of MTD Training.
3. The Language Sound of Language by Michael Dobrovolsky and Francis katamba.

Course Outcomes

On successful completion of the course, the students should be able to:

CO1	Understand and acquire knowledge on basic skills for communications
CO2	Explain the basic concepts of Speak English with an unaffected accent using stress and intonation
CO3	Describe the application of various interview skills.
CO4	Analyse the elements of English language
CO5	Explain the strong and weak forms of words

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- II

SEMESTER- II

COURSE CODE – 23PC1CT201 ENVIRONMENTAL EXERCISE PHYSIOLOGY

Learning Objectives:

1. The course focuses on learning about the various forms of environmental stress and how the resulting human organism responds physiologically to them.
2. Students will study how physical performance is affected by environmental stress such as heat, cold and high altitude and underwater environments.

Learning outcomes:

1. Students who successfully complete the paper will develop an understanding of the physiological adaptations that have evolved them to survive, adapt, participate and to train in various sports activities.

Unit – I Different Terms In Environmental Physiology: Definition of Environmental Physiology , Homeostasis - Functions of Homeostasis – Definition of thermoregulation - Goal of Thermoregulation - metabolism –heat stress-- Fundamental principles involved in thermoregulation – Conduction – Convection - Radiation – Evaporation – Hypothalamus and heat losing mechanism- Homeostasis and Temperature Control- role of endocrine glands in regulating body temperature – temperature regulation during exercise .

Unit – II Hot And Cold Climate: Definition of Acclimatization , Acclimation , Adaptation - Acclimatization to heat – Acclimatization to heat exposure – the heat equation – heat training – heat related illness – How to beat the heat – heat stress – signs and symptoms of mild and moderate stress – contributing factors of heat stress – dehydration and symptoms of dehydration – Heat Exhaustion - signs and symptoms of heat exhaustion- Algorithm for management of heat stroke and heat exhaustion- heat cramps- causes of heat cramps – Heat stroke - Heat stress injuries – precaution to be taken to avoid heat illness – safety consideration to prevent heat injuries. Temperature regulation in cold environment – acclimatization to cold – fine motor activity – facilitation of metabolic heat production - precaution to be taken in cold environment.

Unit – III Altitude: Definition of Barometric pressure, High Altitude – different Altitudes – Different Air Pressure (PSI) at different Altitudes – Oxygen levels at altitude - The environmental differences between High altitude and sea level – immediate physiological changes at high altitude - Acclimatization - in respiratory system – in cardiovascular system – long term adaptation - time of acclimatization – acute and chronic mountain sickness - the importance of training at altitude- aerobic process – anaerobic process – Exercise and sports

performance at Altitude –Altitude training – Intermittent Hypoxic Training – Altitude exposure technique – Live High- Train High , Live Low- Train High , Live High Train Low – Artificial Training - Hypoxic training methods for improving endurance exercise performance

Unit – IV Under Water Environment: Definition of underwater environment - Marine Eco System - underwater pressure - General characteristics of underwater environment— SCUBA diving – Different depth at sea level and Atmosphere – Nitrogen Narcosis – Oxygen Toxicity – Carbon dioxide Toxicity – Nitrogen and Volume of Nitrogen at Different levels – Decompression Sickness – Bends, compressed air sickness , Caissons disease , Divers Paralysis and Dysbarism - treatment - Nitrogen Elimination and Decompression - PADI Dive table - physiology of underwater diving – physiological response to water immersion –exposure – breath hold limitations – Ambient pressure changes – breathing under pressure .

Unit – V Factors affecting physiological performance: Environmental factors in exercise and sports performance skeletal system – muscular system –cardiovascular system – respiratory system –Bio-energetic system – lactate tolerance – maximum aerobic capacity – hormonal difference.

Reference Books:

1. Stephen S. Cheung., (2010), Advanced environmental exercise physiology , United States: Human Kinetics, P.O. Box 5076 Champaign, IL 61825-5076
2. William D. Mcardle, Frank I. Katch, Victor L. Katch, (2005), “Essentials of exercise physiology “, Lippincott Williams and Wilkins.
3. Victor L. Katch, Frank. I. K atch, William D. Mcardle, (2003), “Essentials of exercise physiology “, Williams and Wilkins.
4. Lorry G. Shaver (1981) “Essentials of exercise physiology” Delhi: SurjeethPuplications.
5. William E.Garrett J.R., Donald T. Kirendall, (2000), Exercise and sports science”, Lippincott Williams and Wilkins.
6. McArdle William D. (1998) “Essentials of exercise physiology” Malveern, Pennsylvania: Lea and Febiger.
7. Roger M. Enoka, (2002), “Neuromechanics of human movement”, Human Kinetics. P.O. Box 5076 Champaign, IL, United States.

Course Outcomes

On successful completion of the course, the students should be able to:

CO1	Understand the basic concepts of Thermoregulation and role of endocrine glands in regulating body temperature
CO2	Understand the essential and environmental features and requirements of hot and cold climate
CO3	Application of Various training methods of Altitude training.
CO4	Analyse the physiological response of under water, SCUBA Diving, Decompression Sickness.
CO5	Understand acquire deep insight into Factors Affecting Performance, factors influencing body temperature and common cold injuries.

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- II

COURSE CODE – 23PC1CT202 EXERCISE AND SPORTS NUTRITION

Learning Objectives:

1. To impart knowledge on sports specific nutrition and hydration guidelines- in power/strength, weight class-combat and racket sport athletes.
2. To help students understand the role of ergogenic aids- their dose, safety and efficacy to enhance sports performance.
3. To enable the students to understand the characteristics, physiology and body composition needs of different power/strength sports.

Unit I: Sports nutrition: Definition of Nutrition, Sports Nutrition- Principles of Sports Nutrition - Basic training and nutrition principles - Basic nutrition standards and guidelines - Basic sports nutrition guidelines. Measuring nutritional status of athletes: Clinical and research perspectives - Dietary measurement - Techniques for measuring dietary intakes: Diet records- 24-hour recall- Food frequency questionnaires- Diet history- Clinical examination and medical history- Biochemical analysis- Anthropometric assessment

Unit II: Carbohydrates as a Source of Energy for Exercise: Use of Muscle Glycogen - Use of blood glucose - Muscle Glycogen -Time Course of Glycogen Depletion- Carbohydrate Loading – Super compensation - Carbohydrate Ingestion during Exercise-Carbohydrate Intake at Rest- Practical Measures for Glycogen Modulation. Fat Reserves: Fat as Fuel for Muscle - Fatty Acid Uptake by Muscle-Strategies to improve Fatty Acid Oxidation-Physical Training-Medium Chain Triacylglycerol (MCT) Ingestion. Protein Reserves: Plasma Proteins/Amino Acids- Muscle Protein- Visceral Protein- Protein Intake.

Unit III: Biology of protein and amino acid requirements: Body protein mass-Protein synthesis, degradation, and turnover- Protein Utilization in Athletic Performance- Protein requirements for Endurance Athletes - Protein requirements for Strength Athletes – Protein essential and in recovery from exercise - Benefits and Risks of a High-Protein Diet-Nitrogen Balance.

Unit IV: Dietary Planning Adapted to Different Sports: Nutrition for Running events: Fuelling and hydration strategy for running -Core menu plans for running events. Nutrition for Jumping and Throwing Events: Fuelling and hydration strategy and Core menu plans for Jumping and Throwing events - Nutrition for Swimming: Fuelling and hydration strategy for swimming- Preparing for a competition- Core menu plans for swimming. Nutrition for Cycling: Fuelling and

hydration strategy for Cycling- Nutrition for Team and Racket Sports: Fuelling and hydration strategy for team and racket sports- Core menu plan for team and racket sports

Unit V: Nutrient Timing and Recovery Nutrition: Eating before training -Eating during training- Recovery nutrition-Nutrition, exercise and immunity. Composition of Body Fluids: Intracellular Fluid - Extracellular Fluid - Fluid guidelines - Fluid need before exercise - Fluid need during exercise - Fluid need after exercise, Dehydration, Rehydration - Effects of dehydration and overhydration - Heat cramps, Sports drinks - Types of sports drinks - Energy drinks, Fluid and Electrolyte balance before, during and after training- Strategies to delay fatigue- Effects of hyperthermia and dehydration on performance.

Reference Books:

1. Heather Hedrick fink, Lisa A.Burgoon, Alan E.Mikesky, (2006), "Practical Application in Sports Nutrition", Jones and Bartlett.
2. Janice Thompson, Melinda Manore, (2005), "Nutrition: An Applied Approach", Pearson.
3. Robert E.C.Wildman, Barry S. Miller, (2004), "Sports and Fitness Nutrition", Thomson.
4. William D.Mcardle, Frank I.Katch, Victor L.Katch, (2000), "Essentials of Exercise Physiology", Lippincott Williams and Wilkins.
5. McArdle William D. et.al. (2005) "Exercise Physiology, Nutrition and Human Performance", Philadelphia: lea and Febiger.
6. Fred Brouns& Cerestar Cargill (2002) Essentials of sports nutrition.-2nd ed, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
7. Louise Burke, Vicki Deakin,(2011), Clinical sports nutrition -4th ed, McGraw-Hill Australia Pty Ltd Level 2, 82 Waterloo Road, North Ryde NSW.
8. Dan Benardot ,(2006), Advanced sports nutrition, Human Kinetics,P.O. Box 5076 Champaign, United States of America.

Course Outcomes

On successful completion of the course, the students should be able to:

CO1	Understand the basic concepts and analyze the different methods for assessing nutritional status
CO2	Identifying the requirement of carbohydrate and fat diet before, during, and after training
CO3	Understand the biology of protein and amino acid requirements before, during, and after training
CO4	Applying and developing a fuelling and hydration strategy for Adapting to different sports
CO5	Understand the composition of body fluids and fluid needs before exercise, fluid needs during exercise, fluid needs after exercise

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- II

COURSE CODE – 23PC1CT203

RESEARCH METHODOLOGY

Learning Objective:

1. Learning research methodology will be able to understand and comprehend the basics in research and applying them in Exercise Physiology and Nutrition
2. Providing researchers with a framework for designing, conducting, and analyzing research.
3. Formulating a research problem review of related literature, and drafting the research problem and its ethical considerations.

Unit I-Introduction: Definition of research – Meaning, Need, Important of research in Exercise Physiology and Nutrition, Qualities of good research, classification of research – Basic Research, Action Research, Applied Research, Philosophical Research, and Historical Research.

Unit II-Methods of Research: Experimental Research – Comparative and Analytical Research – Descriptive Research Methods–Need,Importance and Tools of Survey, Case Study, Interview Technique.

Unit III-Research Design: Experimental Design – Single Group Design – Reverse Group Design, Repeated Measures Design – Static Group Design, Equated Group Design, Random Group Design, Rotated Group Design, Static Group - Comparison Design.

Unit IV-Concept of Sampling: Sampling - Need For Sampling; Advantages – Disadvantages; Determining the Sample Size;Types of Sampling-Probability Sampling Method,Non-Probability Sampling Method,Random Sampling Design- Simple Random Sampling; Complex Random Sampling Design - Stratified Sampling-Proportionate Sampling-Cluster Sampling-MultistageSampling, Systematic Sampling, Sequential Sampling.

Unit V-Resarch proposal and Research Report: Research format, Research proposal, Style of writing research, Objectives of the Study , The significance of the problem, Hypothesis, Delimitations, Limitations Review of Related Literature, Methodology, Results and Discussions, Method of writing Abstract

References Book:

1. Author's Guide: "Research Methods Applied to Health Physical Education and Recreation", Washington, D.C., 1991.
2. Best J.W., "Research in Education", Prentice Hall, New Delhi 1982.
3. Clarke H. David, "Research Processes in Physical Education, Recreation and Health", Prentice Hall Inc, Englewood Cliffs, New Jersey, 1985.
4. Kamlesh M.L., "Methodology of Research in Physical Education and Recreation", AHPER, Washington D.C., 1973.

Course Outcomes

On successful completion of the course, the students should be able to:

CO1	Understand the basic concepts of Research and criteria of selecting a research problem
CO2	Choosing the appropriate research methodology include quantitative research, Qualitative Research Methodology, mixed-method research, experimental research, and case study research
CO3	Select the appropriate research design required for a particular research problem
CO4	Develop the ability to find out sampling size and sampling methods while working on a research project work.
CO5	Develop the ability to prepare the research project.

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

*S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1

SKILL ENHANCEMENT COURSE SEC -II

23PC1SE201	EXERCISE AND SPORTS NUTRITION PRACTICUM - II
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Each student is expected to practice measurement on 15 volunteers and determine Pre and Post Training/Exercise variation (To be carried out as project and on sports persons).

1. Assessment of Nutritional status using various method:
 - i. Diet records-
 - ii. 24-hour recall
 - iii. Food frequency questionnaires
 - iv. Diet history
 - v. Clinical examination
2. Anthropometric assessment:
 - i. Body Mass,
 - ii. Stature,
 - iii. Body Mass Index,
 - iv. Using Girth/Circumference to Estimate % BF,
 - v. Waist-Hip Ratio (WHR)
3. Body composition analysis
 - i. Skinfold calliper.
 - ii. Bioelectrical impedance
4. RDA Calculation for Macro nutrition.
5. Core menu and Planning Diet for different Sports.
6. Assessment of Fluid balance
7. Preparation of Sports Drinks

SEMESTER- II

ABILITY ENHANCEMENT COURSE (AEC)-II

COURSE CODE – 23PC1AE201

COMPUTER APPLICATION IN EXERCISE PHYSIOLOGY AND NUTRITION

Learning Objectives:

1. To learn data collection methods and computer use
1. Importance of computers, Basics of scientific computing, Algorithms and Flowcharts
2. Data acquisition and data processing; Modeling (mathematical, IT based, biomechanical, physiological) and Simulation (interactive, animation etc.)
3. Practice of literature search and review writing
4. Prepare diagram/figures using computer software-MS Excel, MS Word, MS PowerPoint
5. Use of analysis system

Unit-I- Definition of Computers – Types of Computers – Microcomputer – Mini Computers, Mainframe Computers and Super Computers – Binary number system – Bits and Bytes – Hardware Input – Output – The arithmetic / Logic Unit – Control Unit. Computer Memory – Auxiliary Storage. The Punched Card – Magnetic & Tape – Disk oriented data entry system; Out-put devices.

Unit-II- MS-Word – Creating documents – Formatting, Editing, Deleting, Background and copying, Spelling check and Thesaurus – Ms-Excel-Opening – Saving – Editing File – Basic Mathematical Problems – Addition, Subtraction, Multiplication, Division – Ms Power Point – Opening – Creating Saving – Deleting Slides / Templates – Slide Show – Important Feature of Power point Presentation.

Unit-III- Background online designing - Scanning – Animation - slide sounds, Impact and non-impact printers-mobile devices to assess physiological parameters, Internet explorer – Different types of connections – Modem types - Network types, types of internet communications - e-mail - Text chatting - video chatting and calling.

Unit-IV- Benefits and uses of biochips, heart rate monitor for team sports and individual events - Monitoring of 24h ECG - Caloric expenditure- workload- blood pressure – Circadian rhythms – methods of record sleeping stages- physiological monitoring devices.

Unit-V- Role of computer in Exercise Physiology and Research- Assessment of Physiological parameters – Latest computer technology – Software involving interpreting variables in exercise physiology – Role of Nutrition software to boost the human longevity.

PRACTICUM

Each student shall practice, various software available in Exercise Physiology and nutrition and to determine the Pre and Post Training/Exercise data.

Reference Books:

1. Abraham Silberchatz, Henry F. Korth and S.Sundarshan, (2002), “Data Z Base System concepts”, 4th Edition, McGraw Hill.
2. Michael Halvorson, Michael.J Young. Microsoft Office XP Inside Out (paperback), Microsoft press.
3. ITL Education Solutions Limited, (2005),” Introduction to Information Technology”, Pearson Education (India).

Course Outcomes

On successful completion of the course, the students should be able to:

CO1	Understand the basic concepts of computers and different types of computer
CO2	Understand the essentials of MS-Word, MS-Excel and MS-power point presentation
CO3	Application of Various software in online and asses physiological parameters.
CO4	Analyse the physiological response of with help of computer
CO5	Understand acquire deep insight into Software involving interpreting variables in exercise physiology.

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- III

SEMESTER- III

COURSE CODE – 23PC1CT401 CLINICAL EXERCISE PHYSIOLOGY- I

Learning Objectives:

Upon successful completion of this course, students will be able to:

1. Understand the epidemiology and Prevalence of diseases, disorders, and conditions with special attention to cardiovascular, metabolic pulmonary, orthopedic, immunological, and neurological conditions.
2. To understand the physiology, pathophysiology and complications related to clinical diseases, disorders, and conditions.
3. To understand the clinical signs, symptoms and risk factors, diagnostic and laboratory evaluations graded exercise testing, and treatment.

Unit – I Stroke: Definition of stroke and Clinical Exercise Physiology - Epidemiology and Pathophysiology- Risk Factors for Stroke - Functional Consequences of Stroke - Comorbidity, Secondary Conditions, and Associated Conditions - Acute Responses to Exercise - Exercise Testing and Screening Criteria- Exercise Prescription. **Cerebral Palsy: Definition of Cerebral Palsy** - Epidemiology and Pathophysiology - Physical Examination - Exercise Testing- Exercise Prescription.

Unit –II Spinal Cord Dysfunction: Definition of Spinal cord, Dysfunction - - Epidemiology and Pathophysiology: Spinal Cord Injury- Spina Bifida - Acute Responses to Exercise- Exercise Testing: Aerobic Exercise Test Protocols - Fitness Testing- Functional Testing - Exercise Prescription. **Low back pain (LBP) : Definition of Low back pain (LBP)** - Epidemiology - Risk Factors - Types - Problems - Pain - Neurobiological Factors and Pain- Functional Assessment- Exercise for Acute Low Back Pain - Exercise for Chronic Low Back Pain.

UNIT – III Arthritis: Definition of arthritis Osteoarthritis, Rheumatoid Arthritis, and Fibromyalgia - Epidemiology and Pathophysiology - Common Signs and Symptoms - Clinical Exercise Physiology - Physical Examination- Exercise Prescription and Programming. **Osteopenia and Osteoporosis** - Definition of **Osteopenia and Osteoporosis** -Classification of Osteoporosis – Prevalence: Epidemiology and Pathophysiology - Bone Physiology - Risk Factors for Osteoporosis - Physical Examination - Diagnostic Techniques - Exercise, Fitness, and Functional Testing - Exercise Prescription - Dietary Modifications and Calcium Supplements.

UNIT - IV Hematologic Disorders: Definition of Hematology, anemia Epidemiology and Pathophysiology- The Role of Iron - Causes of Iron Deficiency - Prevalence of Iron Deficiency in Athletes - Effect of Anemia on Exercise Performance - Effect of Reduced Iron Status without Anemia on Exercise Performance - Iron Supplements - Dietary Prescription and Counselling- Exercise Prescription. **Cancer:** Definition of. Cancer - Pathophysiology - Epidemiology - Etiology and Risk Factors - Common Signs and Symptoms - Screening and Diagnosis - Effects of Cancer/Treatments on Physical Functioning and Health - Exercise Prescription and Programming

UNIT – V Renal Diseases: Definition of disease, renal disease Etiology of Renal Disease- Classification of Renal Disease - Dietary Treatment of Renal Disease-Dialysis - Diet during Dialysis-Diet after Kidney Transplant - Dietary Treatment of Renal Stones - Exercise Testing - Exercise Prescription. **Gastrointestinal Problems-**Dyspepsia-Esophagitis - Hiatal Hernia - Peptic Ulcers - Diverticulosis/Diverticulitis-Inflammatory Bowel Disease-Cirrhosis –Hepatitis – Pancreatitis – Residue - Controlled Diets - High-Fiber Diet - Low-Residue Diet.

Reference Books:

1. ACSM, (2010), ACSM's Resources for Clinical Exercise Physiology Musculoskeletal, Neuromuscular, Neoplastic, Immunologic, and Hematologic Conditions-Second Edition, Lippincott Williams & Wilkins, 530 Walnut Street, Philadelphia.
2. Louise Burke, Vicki Deakin, (2010), Clinical sports nutrition-4th ed, McGraw-Hill Australia Pty Ltd, Level 2, 82 Waterloo Road, North Ryde NSW.
3. ACSM, (2009), ACSM's Guidelines for Exercise Testing and Prescription- 8th ed, Lippincott Williams & Wilkins, 530 Walnut Street, Philadelphia.
4. Jack H. Wilmore and David L. Costill, (1994), Physiology of sport and exercise, Human Kinetics, Champaign, United States.
5. Victor L. Katch, William D. McArdle, Frank I. Katch, (2011), Essentials of Exercise Physiology-4th ed, Lippincott Williams & Wilkins, a Wolters Kluwer business, Philadelphia.
6. Scott K. Powers, Edward T. Howley, (2018), Exercise Physiology: Theory and Application to Fitness and Performance, Tenth Edition, McGraw-Hill Education, 2 Penn Plaza, New York.
7. Barbara Bushman, (2017), ACSM's complete guide to fitness & health, Second edition. | Champaign, IL: Human Kinetics, United States.
8. Micheal A. Clark, Scott C. Lucett, Erin McGill, Ian Montel, and Brian Sutton, (2018) NASM Essentials Of Personal Fitness Training, Jones & Bartlett Learning, 5 Wall Street, Burlington.

Course Outcomes:

On successful completion of the course, the students should be able to:

CO1	Understand the exercise responses to the disease and related diet, the prescription of exercise specific to the disease, and the benefits of physical activity and exercise training on the disease.
CO2	Evaluation of the Contribution of Exercise Testing to diagnosis and Prognosis for different Chronic and Acute Conditions
CO3	Application of exercise prescription for arthritis, osteopenia and osteoporosis
CO4	Understand acquire deep insight into effect of anemia on exercise performance
CO5	Understand acquire deep insight into exercise and dietary treatment of renal disease

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- III

COURSE CODE – 23PC1CT302 NEUROPHYSIOLOGY

Learning Objectives:

1. Explain process degeneration and regeneration of neurons
2. Discuss the mechanism of Ascending and Descending tracts of spinal cord
3. Explain procedures of Higher function of Brain.
4. Understand the influence of exercise on sleep
5. Understand the concept of Hypothalamus and body's Homeostasis
6. Explain practice procedures and mechanism of inspiration and expiration
7. Understand the concept of lung volumes and capacities
8. Explain practice procedures of Lung function test

UNIT – I - Definition of Neurophysiology – structure and functions of neuron – degeneration and regeneration – receptors – reflex – Action potential – Depolarization – Repolarization – Synapse- Synaptic transmission – Neurotransmitters. Cutaneous and deep visceral sensation – Ascending and Descending tracts of spinal cord- Motor unit – organization of motor and sensory functions of CNS and Spinal cord.

UNIT – II- Functions of Brain stem – cerebellum – Basal Ganglia - Hypothalamus – Thalamus- cerebral cortex. Higher function of Brain – Arousal – sleep , learning memory, speech – EEG – conditioned reflex – neural basis for instinctual and Behavior emotion – control of posture – equilibrium – muscle tone. Effects of exercise on sleep- arousal – learning- memory- action potentials.

UNIT – III Diencephalon function – Hypothalamus and body's Homeostasis- the control of body temperature – appetite – defecation – micturition - heart rate-Sleeping- arterial Blood Pressure – Anterolateral system conducting afferent pain and temperature interacts with the thalamus.

UNIT - IV

Brain imaging techniques – CT (Computerised Tomography) – MRI (Magnetic Resonance Image) - Use of CT and MRI for identifying deep brain structure, acute pain, hemorrhage, tumors, and edema. Effect of Exercise on Nervous System.

NIT – V - Neural Adaptation to Exercise Training - Nerve Cells - Neural Communication - Higher Brain Centers - Descending Corticospinal Tracts - Motor Units Recruitment - Electromyographic Changes - Firing Rate – Synchronization - Inhibitory Mechanisms - Neural Adaptation to Running - Neural Adaptation to Concurrent Training- Exercise Enhances Brain Health.

Reference Books

1. Johnson and WU. Foundations of Cellular Neurophysiology.
2. Hille, Ionic Channels of Excitable Membranes, 3rd edition, Sinauer Associates, Inc.
3. Levitan and Kaczmarek, The neuron, Oxford University press.
4. William D. McArdle, Frank I. Katch, Victor L. Katch, (2005), "Essentials of exercise physiology", Lippincott Williams and Wilkins.

Course outcome:

On successful completion of the course, the students should be able to:

CO1	Describe the degeneration and regeneration and spinal tracts.
CO2	Describe the Higher functions of Brain
CO3	Explain the Hypothalamus and body's Homeostasis
CO4	Classify different types of Brain imaging techniques
CO5	Describe the Exercise pattern for nervous systems

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- III

COURSE CODE – 23PC1CT303 STATISTICS IN EXERCISE PHYSIOLOGY

Learning Objectives:

After completing this subject we will be able to understand about

1. The basic concepts of statistics, need of statistics and central tendency & dispersion,
2. Sampling, hypothesis testing, data analysis using descriptive statistics.
3. How to analysis the problem using SPSS software.

UNIT - I Basic Definitions and Measures of Central Tendency: Meaning, Definition and Importance: Raw Score, Class Intervals -Continuous and Discrete Series, Construction of Frequency Tables, Measures of Central Tendency: Mean Median and Mode - Meaning, Definition, Importance, Advantages and Disadvantages. Calculation of Mean, Median and Mode.

UNIT - II Measures of Variability- Range, Quartile Deviation, Mean/Average Deviation, Standard Deviation-Meaning, Definition and use. The Normal Curve: Meaning, Principles, Laws, Properties and Uses. Divergence from Normality-Skewness and Kurtosis. Scoring Scales- Sigma scale, Z Scale, T Scale.

UNIT - III Correlation- Pearson Product Moment Correlation, Spearman Rank Order Correlation, Phi Correlation, Biserial Correlation Partial and Multiple Correlation. Regression Lines.

UNIT - IV Testing of Hypothesis - Procedure, Types of Hypothesis, Level of Significance, One Tailed and Two Tailed Test, Degrees of Freedom, Test of Significance for Difference of Means- t Test -Independence and Dependence Test, Z-Test, One Way Analysis of Variance.

UNIT - V Non Parametric: Chi Square Test – Equal Occurrence Test, Independence of Attributes, Contingency Coefficient; Graphical Representation – Line Diagram, Bar Diagram- Multiple Bar Diagram, , Histogram, Frequency Polygon, Frequency Curve. Cumulative Frequency Polygon, Ogive, and Pie Diagram – introduction of SPSS Package.

Reference Books

1. Berg, "Essential of Research Methods in health Physical education", Lippincott William and Wilkins Publisher.
2. Rothstein, Anne L. (2006), "Research Design and Statistics for Physical Education, Englewood Cliffs, and New Jersey: prentice Hall Inc.
3. Blum, J.R., and Fattu, N.A. 1954. Nonparametric methods.Rev.Educ.Res. 24, 467-487.

4. Conover, W.J. Practical Nonparametric statistics, 2nd edition. New York; John wiley& sons, 1980.
5. Gibbons, J.D., and Chakraborti. S., Nonparametric Statistical Inference, 3d ed., New York, Marcel Dekker. 1992.
6. Clarke, David H. Clarke, Harrison H. Research Process in Physical education, New Jersey: Prentice Hall Inc.1984.
7. Jerry R. Thomas, Jack K. Nelson and Stephen J. Silverman., Research methods in Physical Activity (5th Ed), New York: Human Kinetics, 2005.
8. Kraft, Charles H. and Van Eeden. Constance A Nonparametric Introduction to Statistics. New York: Macmillian, 1968.
9. Owen, D.B. Handbook of Statiscal Tables. Reading, Mass; Addison- Wesley, 1962.
10. Siegel, Sidney. Nonparametric statistics for the behavioural Sciences. New York: McGraw-Hill, 1956.
11. VarmaJ.Prakash; Sports Statistics Copyright 2000 by Venus Publication.

COURSE OUTCOMES

On successful completion of the course, the students should be able to:

CO	Course Outcome
CO1	Understand the basic concepts of statistics, measure of central tendency, merits and demerits of central tendency.
CO2	Understand the essential measures of dispersion and checking the normality of the data
CO3	Measuring the relationship in the sample data using various correlation techniques.
CO4	Analyse the data using inferential statistical technique using estimation and testing of hypothesis.
CO5	Understand acquire deep insight into Non parametric statistics and Various types of Graphical Representation.

MAPPING WITH PROGRAMME OUTCOMES:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- III

COURSE CODE – 23PC1CT304 EXERCISE AND SPORTS FOR WOMEN

Course Objectives:

1. To understand the difference between male and female.
2. To understand physiology of menstruation, pregnancy, hormonal disorders and actions.
3. To apply and analyse the knowledge of hormonal actions, osteoporosis and its pathophysiology.

Unit I: Structural and Physiological differences between male and female: Body size, skeletal difference, Q - angle, strength difference, gender affects metabolism , Men and Women BMR formula, male and female predominant metabolic traits- Bone mass – Muscle mass difference after resistance training – Fat mass- Healthy body Composition, Body fat percentage for men and women age wise- Heart – Blood Volume – RBC- male and female respiratory system, male and female vocal cords difference – respiratory volumes and capacities difference – Difference in Gonadal hormones and Sports performance.

Unit-II Structure of the Uterus Menstruation: Definition of Menarche, Primary Amenorrhea, secondary, Dysfunctional Uterine Bleeding Amenorrhea, Menorrhagia, Metorrhagia, Oligomenorrhea, Anovulation/ anovulatory, Dysmenorrhea – Characteristics of normal menstruation – associated symptoms of menstruation- Menstrual cycle – Phases in menstrual cycle- hormones involved in menstrual cycle- Physiology of menstrual cycle – Exercise during menstrual cycles – Balance your menstrual cycle and fitness – Nutrition and training strategies during menstrual cycle - RED (Female athlete triad): Disordered eating , coaches role in recognizing disordered eating, Signs and symptoms of disordered eating- Amenorrhea – osteoporosis, Prevention strategies- menstrual cycle and Physical performance.

Unit III: Pregnancy: Gametes, formation of new individual- Definition of Pregnancy – Process of Fertilization- Fertilization and implantation – three types of embryo during the process of gastrulation - Physiological changes during pregnancy, Hematological changes, RBC and Hemoglobin, leucocytes and Immune system, Total Plasma Protein, Blood Coagulation Factor- Metabolic Changes, protein metabolism, carbohydrate metabolism, fat metabolism, Iron metabolism- Weight gain- Calcium metabolism and Locomotor system- changes in Respiratory system- Cardiovascular changes in heart, cardiac output, Blood pressure- Distribution of blood flow – Uterine Blood flow, Pulmonary blood flow, renal blood

flow- Changes in Urinary System- kidney, ureter, Bladder- Changes in Alimentary System- liver and gall bladder- Changes in Nervous system- Changes in Endocrine System- Placental hormone, pituitary hormone, Thyroid function- plasma volume Lactation — Process of Lactation, Physiology of Lactation- Pregnancy and Exercise- Indications and Contraindications to exercise during Pregnancy - Guidelines for exercise during and after pregnancy- Pregnancy and Nutrition

Unit- IV Causes of Endocrine disorders: Definition, Types of Endocrine Disorders - Adrenal insufficiency, Cushing's disease, Gigantism, Hyperthyroidism - Physiological changes during Peri menopause- Menopause and Post menopause , sources of estrogen at post menopause, Neurological effect of estrogen - Osteoporosis and its pathophysiology- The Potential Mechanisms of Exercise in the Prevention of Osteoporosis- Anemia, Iron deficiency anemia.

Unit V: Hormone Mechanism: Definition of hormone, General Principles of Hormone action, Mechanism of hormone action, Mode of hormone action, Four main types of receptors based on characteristics, Types of receptors- internal and external, hormones binding with receptors- Gonadal Hormones- Androgen, Estrogen, Progesteron - Women and weight training – hormonal responses to exercise - Mascularization due to exercise, Hormonal effects on fluid and electrolyte balance during exercise – aldosterone – renin- ADH - Doping and performance – women participation in contact and non-contact sports.

Reference Books:

1. Mary Lloyd Ireland, Aurelia Nattiv, (2002), —The Female Athlete, Saunders
2. Kate Woolf- May, Steve Bird, Polly Davey, Jane Fallows, (2006), Exercise Prescription Physiological Foundations, Churchill Livingstone.
3. William D.McArdle, Frank I.Katch, Victor L.Katch, (2000), —Essentials Of Exercise Physiology, Lippincott Williams and Wilkins
4. Victor L.Katch, Frank.I. Katch, William D.McArdle, (1996), —Exercise physiology, Williams and Wilkins.
5. William E.Garrett J.R., Donald T.Kirendall, (2000), —Exercise and sports science, Lippincott Williams and Wilkins.
6. Greg McLatchie, Mark Harries, Clyde Williams, John King, (2003), —ABC of sports medicine, BMJ Books
7. Barbara Bushman, J.C.Young (2005), Action Plan for Menopause, Human Kinetics.
8. Peter J.Maud and Carl Foster (1995), Physiological Assessment of Human Fitness, Champaign, IL: Human Kinetics.

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Understand the basic concepts of male and female characteristics
CO2	Understand the physiology of menstruation and Phases of menstruation.
CO3	Application of knowledge about pregnancy and physiological changes during pregnancy.
CO4	Analyse the Causes and types of Endocrine disorders and analyse osteoporosis and its pathophysiology.
CO5	Understand acquire the knowledge of General Principles , Mechanism and Mode of hormone action, Hormonal effects on fluid and electrolyte balance during exercise

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SKILL ENHANCEMENT COURSE – SEC- III

23PC1SE301	CLINICAL EXERCISE PHYSIOLOGY PRACTICUM - III
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PRACTICUM

Each student is expected to practice measurement on 15 volunteers and determine Pre and Post Training/Exercise variation (To be carried out as project and on sports persons).

1. Estimation of Blood Profile
2. Measurement of blood hemoglobin (Hemometer)
3. Estimation of Hemoglobin, total Red Blood Cells and total White Blood Cells (demonstration only)
4. Measurement of Pain through visual analog scale (VAS)
5. Back Pain Functional Scale (BPFS)
6. Bone mineral density (BMD).
7. Bone density is measured with Dual-Energy X-ray Absorptiometry (DEXA)
8. Planning, Calculation of nutrient content, Preparation and Service of diets for:
 - i. Osteopenia and Osteoporosis
 - ii. Hematologic Disorders
 - iii. Cancer
 - iv. Renal Diseases
 - v. Gastrointestinal Problems
9. 6 mile briskwalk Test
10. Calculating a day's energy intake and energy expenditure and evaluating the state of energy balance.
11. To perform calorie calculation using Harris Benedict equation.

SEMESTER- III

ABILITY ENHANCEMENT COURSE (AEC)-III

COURSE CODE – 23PC1AE301

LIFE SKILLS MANAGEMENT

Unit I: Introduction: Soft Skills - Concepts and Definition- Need and importance of Soft Skills – Developing Soft Skills – Implications on Youth Development .

Unit II: Behavioral Skills : Attitude, Lateral Thinking , Emotional Intelligence, Leadership, Team Building and Interpersonal Skills.

Unit III Social Skills and Negotiation Skills: Self Awareness and Empathy , Influencing, - Effective Communication –Oral Presentation Skills – Interviewing – Delegating.

Unit IV: Thinking Skills: Critical Thinking and Creative Thinking – Problem Solving and Decision Making skills.

Unit V: Coping Skills : Coping with stress and Emotions – Conflict Resolution – Negotiating - Time and Stress Management Skills.

Reference Books

1. G. Ravindran, S P Benjamin, Elango and R. Arokiam (2007) - Success through Soft Skills, ICT
2. Kamin M (2013) Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. ISBN: 978-1-118-10037-0

Course Outcomes

On successful completion of the course, the students should be able to:

CO	Course Outcome
CO1	Understand the basic concepts, Need and importance of Soft Skills
CO2	Understand the essential of Behavioral Skills
CO3	Application of Various Social Skills and Negotiation Skills training.
CO4	Analyse the Thinking Skills
CO5	Understand acquire deep insight into Coping with stress and Emotions.

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- IV

SEMESTER- IV

COURSE CODE – 23PC1CT401

CLINICAL EXERCISE PHYSIOLOGY- II

Learning Objectives:

1. To understand the exercise and diet prescription for specific disease, disorder, and the benefits of diet, physical activity and exercise training on the disease.
2. To understand the Legal and Ethical Considerations of aerobic training, strength training and flexibility training and diet on specific disease, disorder.

UNIT – I overweight and obesity: Definition of overweight and obesity - Assessment of overweight and obesity- Etiology of Obesity - Health Problems Associated with Excessive Weight and Obesity -Prevalence of obesity - Factors that contribute to obesity - Physiological aspect of obesity -Types of obesity - Dietary Modification of obesity - Exercise Testing -Exercise prescription for obesity.

UNIT – II Diabetes Mellitus: Definition of Diabetes Mellitus – Prevalence of Diabetes Mellitus – Etiology of Diabetes Mellitus – Diabetes Prevention -Types of Diabetes Mellitus – Symptoms, Diagnosis, and Treatment of Diabetes - complications of Diabetes Mellitus – Healthy Approaches to Managing Diabetes -Exercise and Diabetic Diet prescription for Diabetes Mellitus.

UNIT – III Cardiovascular disease (CVD): Definition of Cardiovascular disease (CVD)-Types of Cardiovascular Disease - Pathophysiology of Coronary Artery Disease - Risk factors for Cardiovascular disease (CVD)- Sign and symptoms of Cardiovascular disease (CVD)- Cardiovascular Disease Prevention: Dietary Management - Exercise prescription for Cardiovascular disease (CVD).

UNIT – IV Hypertension: Definition of Hypertension - Pathophysiology of Hypertension-Prevalence of Hypertension - Risk factors for Hypertension - Regulation of blood pressure- Causes of Hypertension-Classification of hypertension - complications of Hypertension - Prevention of Hypertension: Dietary Management -Exercise prescription for Hypertension.

UNIT – V Pulmonary Diseases and Disorders: Definition of Pulmonary Diseases and Disorders - Restrictive Lung Diseases – Chronic Obstructive Pulmonary Disease: Chronic Bronchitis – Emphysema- Cystic Fibrosis- Asthma- Diagnosis and Causes - Prevention/Relief of Asthma- Exercise-Induced Asthma- Testing and Evaluation - Pulmonary Rehabilitation and Exercise Prescription.

Reference Books:

1. ACSM, (2010), ACSM's Resources for Clinical Exercise Physiology Musculoskeletal, Neuromuscular, Neoplastic, Immunologic, and Hematologic Conditions-Second Edition, Lippincott Williams & Wilkins, 530 Walnut Street, Philadelphia.
2. Louise Burke, Vicki Deakin, (2010), Clinical sports Nutrition-4th ed, McGraw-Hill Australia Pty Ltd, Level 2, 82 Waterloo Road, North Ryde NSW.
3. ACSM, (2009), ACSM's Guidelines for Exercise Testing and Prescription- 8th ed, Lippincott Williams & Wilkins, 530 Walnut Street, Philadelphia.
4. Jack H. Wilmore and David L. Costill, (1994), Physiology of sport and exercise, Human Kinetics, Champaign, United States.
5. Victor L. Katch, William D. McArdle, Frank I. Katch, (2011), Essentials of Exercise Physiology-4th ed, Lippincott Williams & Wilkins, a Wolters Kluwer business, Philadelphia.
6. Scott K. Powers, Edward T. Howley, (2018), Exercise Physiology: Theory and Application to Fitness and Performance, Tenth Edition, McGraw-Hill Education, 2 Penn Plaza, New York.
7. Barbara Bushman, (2017), ACSM's complete guide to fitness & health, Second edition. | Champaign, IL: Human Kinetics, United States.
8. Micheal A. Clark, Scott C. Lucett, Erin McGill, Ian Montel, and Brian Sutton, (2018) NASM Essentials Of Personal Fitness Training, Jones & Bartlett Learning, 5 Wall Street, Burlington.

Course Outcomes (COs)

By the end of the course, the student will be able to

CO1	To understand the epidemiology and prevention related to clinical disorders conditions with special attention to metabolic conditions.
CO2	To understand the clinical considerations including signs, symptoms and risk factors, diagnostic and laboratory evaluations graded exercise testing, and treatment.
CO3	To understand the physiology, pathophysiology and complications related to these same important clinical diseases and conditions.
CO4	To understand the rehabilitation exercise considerations that need to be made with regard to these same conditions including the risks of exercise with disease, the exercise responses to the disease.
CO5	The prescription of exercise specific to the disease, and the benefits of physical activity and exercise training on the disease

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- IV

COURSE CODE – 23PC1CT402 ENDOCRINE PHYSIOLOGY

Learning Objective (LO):

By the end of the course, the student will be able to

1. Explain process Principles of Endocrinology
2. Discus the mechanism of Negative feedback loop and Positive feedback loop
3. Understand functions of Secretions of Anterior Pituitary.
4. Understand functions of Secretions of posterior Pituitary
5. Understand the concept of Functional anatomy of the thyroid gland
6. Explain about Adrenal gland -Adrenal Cortex and medulla
7. Understand the Islets of Langerhans, beta, alpha, delta cells

UNIT I: Meaning and Definition of Endocrinology- Endocrine and Exocrine Gland - Classes of Hormones, Cascades - Neuroendocrine interactions – Endocrine glands and endocrine tissues - Chemical classification of hormones and their synthesis – Types of Hormones and its Class - Regulation of hormone secretion. Negative feedback loop and Positive feedback loop- Cyclic variations of hormones secretion.

UNIT II: Hypothalamus and Pituitary – Secretions of Anterior Pituitary – Posterior pituitary hormones. Control and release of Tropic and Non hormones, hormones with direct effects on nonendocrine target tissues - Releasing and inhibitory hormones of the hypothalamus. Hypothalamus and Posterior Pituitary - Hormones of the posterior pituitary, Secretion and function of anti-diuretic hormone (ADH) and oxytocin - Signals generating stimuli for ADH (AVP) secretion - The major actions of ADH. Target cells, intracellular mechanism – Exercise adaptation on Pituitary glands

UNIT III: Thyroid Gland - Functional anatomy of the thyroid gland - thyroid hormones (TH).Role of thyroglobulin. - Transport of TH by the blood. – Peripheral metabolism of TH. – TH receptors and action of TH on target cells. – Role of TH in normal body growth and development of CNS. - Effect on basal metabolic rate. - Cardiovascular system. - Respiration - GIT. –nervous system. - Other endocrine glands. - Carbohydrate, lipid and protein metabolism. - Regulation of TH secretion and synthesis - Exercise adaptation on Thyroid glands

UNIT IV: Adrenal gland -Adrenal Cortex – Glucocorticoids. - Transport of glucocorticoids in blood. – Metabolic actions of cortisol, principal target tissues. Mineral corticoids. – Adrenal steroids with mineral corticoid activity. - Transport of aldosterone in the blood. - Target cells and

cellular mechanism of aldosterone action. - Effect of aldosterone in tubular epithelium of the kidney, on extracellular fluid volume, and blood pressure. - Regulation of aldosterone secretion. Renin-angiotensin system, plasma potassium and sodium levels, ACTH. Adrenal Medulla. - Catecholamines, functions of Catecholamines and storage. Mechanism of the secretion and degradation of catecholamines - Exercise adaptation on Thyroid glands

UNIT V: Pancreas. – Islets of Langerhans, beta, alpha, delta, and PP cells. Secretion of pancreatic hormones. Neural and hormonal control of insulin secretion. - Insulin receptor and mechanism of cellular action. – Effect of insulin on carbohydrate, lipid, and protein metabolism in the liver, muscle, and adipose tissue- glucagon. Secretion and action of glucagon, effect of glucagon, role on metabolic process. Gonadal hormones - types- secretions and its actions. Effects of exercise on gnadal hormones - Exercise adaptation on Pancreas.

Reference Books

1. Degroot LJ, Jameson JL (eds): Endocrinology, 5th ed. Philadelphia,Elsevier, 2006
2. Gereben B et al: Cellular and molecular basis of deiodinase-regulated thyroid hormone signaling. Endocr Rev 29:898, 2008
3. Golden SH et al: Clinical review: Prevalence and incidence of endocrine and metabolic disorders in the United States: A comprehensive review. J ClinEndocrinolMetab 94:1853, 2009
4. Hammes A et al: Role of endocytosis in cellular uptake of sex steroids. Cell 122:751, 2005

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Describe the Principles of Endocrinology.
CO2	Describe the functions of Anterior and posterior Pituitary
CO3	Thyroid Gland and its secretions and action
CO4	Classify different functions of adrenal cortex and medulla
CO5	Describe the Effect of insulin on carbohydrate, lipid, and protein metabolism

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- IV

COURSE CODE – 23PC1CT403

ERGOGENIC AIDS AND SPORTS PERFORMANCE

Learning Objectives

1. To understand the importance of supplements and ill effects of ergogenic aids
2. To apply the knowledge and to describe the ill effects of ergogenic aids to athletics
3. To educate the athletics about the use of doping substances will harm the important system and further will decline the performance.
4. To gain understanding of the various supplements and drugs used in sports and the nodal bodies for controlling doping

Unit: 1 Introduction to Ergogenic aids - History and development of Ergogenic aids - types of Ergogenic aids - World Anti-Doping Agency (WADA) and National Anti- Doping Agency (NADA) – International Olympic Committee (IOC) - Doping agency - Doping in sports - Blood Doping in sport – effects of blood doping - Erythropoietin – effects of exogenous administration of erythropoietin.

Unit: II Diuretics - Target organ for Diuretic Action - Narcotic Analgesics & Athletic performance - mechanism of Action - Non-steroidal Anti - inflammatory Drugs & Corticosteroids, Narcoleptics: Beta-Adrenergic Antagonists - Beta-Blockers – Ephedrine- Cocaine- Marijuana.

Unit: III Prohibited Performance enhancing Substances: Action and side effects of Anabolic Steroids - health risk of steroid abuse - Effects of Anabolic Steroids abuse - Action and side effects of Testosterone Precursors (Prohormones) - Action and side effects of Androstenedione - Action and side effects of Dehydroepiandrosterone (DHEA) - 19- nonandrostenedione and 19-norandrostenediol – Action and side effects of human Chorionic Gonadotropin (HCG) - Action and side effects of Human Growth Hormone - Amphetamines -Beta-2-Agonists.

Unit: IV Common Performance enhancing Substances: Definition of Dietary Supplements - Weight-Loss Supplements - Health Supplements - Potential Benefits, Risks, and Side Effects: Creatine - Branched chain amino acids (BCAA)- Whey and Casein- Arginine - Beta-alanine - Caffeine - Glycerol - Bicarbonate-antioxidants - Liquid meal supplements - Sports drinks- Sports Gels - Energy bars - Beetroot juice- Vitamin D.

Unit: V Supplements under consideration: Glutamine - Ribose - Colostrum - Beta-Hydroxy-Beta Methyl butyrate (HMB) - L-Carnitine – Chromium- Coenzyme Q10 - Ginseng – Pyruvate - Vitamin Supplement- Omega-3 fatty Acids - Medium-Chain Triglycerides – calcium - Iron Supplement- - Nitrate- Probiotics.

Reference Books

1. Michael S. Beatrice, Charles E. Yesalis, (2002), "Performance Enhancing Substances in Sport and Exercise", Human kinetics.
2. Melinda Manore, Janice Thompson, (2000), "Sport Nutrition for Health and Performance", Human kinetics.
3. Anita Bean,(2014), Food for Fitness, How to eat for maximum performance-4th edition, Bloomsbury Publishing Plc, 50 Bedford Square, London.
4. Cardwell, Glenn, (2012), Gold medal nutrition, Human Kinetics, P.O. Box 5076, Champaign, USA.
5. G. Gregory Haff, N. Travis Triplett, (2016), Essentials of strength training and conditioning / National Strength and Conditioning Association, Fourth edition. Human Kinetics, P.O. Box 5076, Champaign, USA.
6. Williams, Melvin H. | Rawson, Eric S. | Branch, J. David, (2017), Nutrition For Health, Fitness And Sport: Eleventh Edition, McGraw-Hill Education, 2 Penn Plaza, New York, USA.
7. Hayley Daries, (2012) Nutrition for Sport and Exercise- A Practical Guide, John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex,PO19 8SQ, UK

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Understand the evolution of ergogenic aids or drugs among athletes and government regulations
CO2	To understand the different types of metabolite and botanical ergogenic supplements
CO3	Understand the Prohibited Performance enhancing Substances
CO4	Understand the different types of Common Performance enhancing Substances
CO5	Understand the different types of micronutrient Supplements

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

SEMESTER- IV

COURSE CODE - 23PC1TH403

MASTER'S THESIS

Learning Objectives:

- To enable the students to develop skills and competencies for conducting rigorous, theoretically correct and practically relevant research in Exercise Physiology and Nutrition

Learning Outcome:

- By completing the Master's thesis, students will demonstrate their academic ability, i.e. their ability to think critically, write according to academic standards, and conduct independent research that is critical, methodical, and systematic.
- A student admitted to M.Sc. Exercise Physiology and Nutrition shall submit a thesis at the end of IV Semester and must submit his/her Synopsis and get it approved by the Head of Department on the recommendation of Department Research Committee (DRC).
- The beginning of the process of Thesis will start in the beginning of III Semester in form of preparation and submission of synopsis, facing and getting final approval from the DRC.
- The thesis must be submitted not less than one week before the beginning of the IV Semester end Examination.
- The candidate has to face the Viva-Voce examination conducted by DRC.

Structure of the Thesis:

1. Title Page
2. Certificate
3. Abstract (200-250 words)
4. Acknowledgements
5. Table of Contents
6. List of Figures, Tables, Illustrations,

Chapter 1: Introduction

Chapter 2: Review of Literature

Chapter 3: Methods

Chapter 4: Results and Discussion

Chapter 5: Summary and Conclusion

- References

SKILL ENHANCEMENT COURSE – SEC IV

23PC1SE301	CLINICAL EXERCISE PHYSIOLOGY- II PRACTICUM - IV
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Each student is expected to practice measurement on 15 volunteers and determine Pre and Post Training/Exercise variation (To be carried out as project and on sports persons).

1. Informed Consent
2. Medical History
3. Physical Activity Readiness Questionnaire (PAR-Q)
4. To measure Blood Pressure by using Sphygmomanometer
5. Estimation of mean arterial Blood Pressure
6. Lipid Profile Analyses
7. To measure vital capacity and total lung capacity using spirometer
8. Assess a Patient's Nutritional Status
9. Identify patients' nutritional problems and apply the most accurate treatments and diets in each case
10. Know food compositions, identify their utilities and add them to the diets of patients who need them
11. Identify the benefits of the Mediterranean diet, DASH diet
12. Planning, Calculation of nutrient content, Preparation and Service of diets for:
 - i. Overweight and obesity
 - ii. Diabetes Mellitus
 - iii. Hypertension
 - iv. Cardiovascular disease
13. To find WHR of minimum 20 subjects

ABILITY ENHANCEMENT COURSE (AEC) - IV
COURSE CODE – 23PC1AE401
YOGA EDUCATION

Learning objectives

Students will be able to:

1. The Students will acquire knowledge and understanding of YOGA.
2. Students become proficient in the knowledge, skill and practical of yoga and tactical efficiency, rules of the game and training related to yoga

UNIT I- Yoga: Meaning and Definition. Origin of Yoga, Historical development of yoga in India - Hatha yoga texts. Systems of Yoga: Karma yoga - Jnana yoga - Bhakthi yoga - Raja yoga. Eight limbs of yoga: Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana and Samadhi. International Yoga Day -Yogic Diet.

UNIT II- Schools of yoga - Effect of yoga on various systems of the body: Muscular system - Circulatory system - Endocrine system - Respiratory system - Nervous system - Digestive system - Yoga for Physical Fitness, Yoga for Health and Wellness. Yoga for Diseases.

UNIT III Loosening the joints - Suryanamaskar (Bihar school of yoga). Meaning of Asana Classification - differences between asanas and physical exercises - Techniques and benefits. Standing Asana: Vrksasana –Trikonasana - Padmahastasana. Seated Asanas: Siddhasana – Padmasana - Paschimottanasana. Inverted asanas: Sarvangasana - Halasana. Prone position: Mayurasana - Sirsasana. Back bend asanas: Bujangasana –Salabhasana – Dhanurasana - Ushtrasana. Supine position: Navasana, Suptavajrasana, Twisting: Vakrasana, Ardhamatsyendrasana, and Kuktasana.

UNIT IV Pranayama: Meaning and Definition – Concept of Pranayama – Nadis – Ida nadi – Pingala Nadi – Sushumna nadi – Controlling of breath: Puraka – Kumbhaka – Rechaka – Guidelines for practicing Pranayama – Benefits of Pranayama – Types of Pranayama: Nadi Suddhi – Nadi Shodhana – Surya Bhedana – Kapalabhati – Bhastrika – Sitkari – Sitali – Bhramari – Ujjayi. Bandhas: Meaning and Definition – Types: Jalandra – Uddiyana – Mula.

UNIT V Meditation: Meaning and Definition – Concept of meditation – Types of meditation – Physiological benefits of meditation – yoga and competition – Principles of yogic Diet –

Integration of Yoga with modern education – yoga institutions in India and Abroad – General Yogic Schedule.

Text Book

1. George Feuerstein. (1975). Text Book of Yoga. London: Motilal Bansaridass Publishers (P) Ltd.
2. Gore. (1990). Anatomy and Physiology of Yogic Practices. Lonavala: Kanchan Prkashan.
3. Iyengar, B. K. S. (2000). Light on Yoga. New Delhi: Harper Collins Publishers.
4. Swami Satyananda Saraswathi. (1984). Kundalini and Tantra. Bihar: Yoga Publications Trust.
5. Swami Kuvalayananda. (1998). Asanas. Lonavla: Kaivalyadhama. Publication.

Course Outcome

After successful completion of the course the students will be able to

CO1	Understand the basic Concepts of Yoga
CO2.	Apply the principles of Yoga to live healthy and active life style.
CO3.	Promote the awareness of health through yoga
CO4.	Analyze the techniques and of body posture to bring out healthy change.
CO5.	Able to execute loosening exercise, Asanas and Pranayama.

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

*S-Strong 3 ; M-Medium 2 ; L-Low 1

**DISCIPLINE SPECIFIC ELECTIVE (DSE)
ODD SEMESTER I & III**

Subject Code	Name of the Paper
23PC1DSE001	Exercise and Nutritional Biochemistry
23PC1DSE002	Exercise Science and Functional Assessment
23PC1DSE003	Clinical Sports Nutrition
23PC1DSE004	Nutrition and Immune Function In Athletes

COURSE CODE – 23PC1CE001
EXERCISE AND SPORTS BIOCHEMISTRY

Learning Objectives:

1. To produce an advanced understanding of the core principles and topics of Biochemistry and their experimental basis and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of Lecture.
2. Demonstrate a thorough knowledge of experimental approaches to solving problems of a chemical nature and have an ability to extend that knowledge to the solution of new problems.
3. To demonstrate technical meaning of fundamental Laboratory Skill, use proper laboratory safety in practices and demonstrate proficiency in using computers to solve chemical problems

UNIT – I Sports Biochemistry: Definition and Importance. Composition of plasma. Energy and Calorie (Kilocalorie) - Definition .Free Energy- Definition and its units. Mitochondria- Structure and function. ATP, ADP, AMP and Creatine Phosphate-Definition and its formation and breakdown. Role of Oxygen in Energy metabolism. Catabolism and Anabolism— Definition and its Process.

UNIT – II- Role of Glucose in Carbohydrate Metabolism: Transport of Glucose through the Cell Membrane. Glycogenesis—the Process of Glycogen Formation. Glycogenolysis- Breakdown of Stored Glycogen. Role of Insulin, Epinephrine and Glucagon in glucose transport and metabolism. Glycolysis and the Formation of Pyruvic Acid. Citric Acid Cycle (Krebs cycle). ETS (Oxidative Phosphorylation). Anaerobic Glycolysis (Lactic acid System) Lactic metabolism (CORI Cycle). Pentose Phosphate Pathway (Phosphogluconate Pathway). Gluconeogenesis. Role of Carbohydrate (Breakdown of Glucose) In Energy Metabolism.

UNIT – III Lipid: Basic Chemical Structure of Triglycerides. Lipoproteins-Classification, Importance, Functions and normal values. Fat Deposit in adipocytes. Triglycerides for Energy. Hydrolysis of Triglycerides. Synthesis and Breakdown of Fatty acid and Triglycerides- Beta Oxidation of Fattyacids. Formation and Uses of Phospholipids. Formation and Uses of Cholesterol. Factors That Affect Plasma Cholesterol Concentration—Feedback Control of Body Cholesterol.

UNIT – IV- Basic Chemical Structure of Amino Acids: Transport and Storage of Amino Acids. Functional Roles of the Plasma Proteins. Essential and Nonessential Amino Acids. Use of

Proteins for Energy- Transamination.- Deamination, Urea Formation by the Liver and Oxidation of Deaminated Amino Acids Ketogenesis-Definition. Hormonal Regulation of Protein Metabolism. Effect of Starvation on Protein Degradation.

UNIT – V Acid-base balance: Causes of Alteration in Acid-Base Balance- Volatile acids and Non-volatile acids. Role of different Buffer System in Acid-Base Balance by acid-base Buffer System- Bicarbonate buffer system, Phosphate buffer system and Protein buffer system .Acid-Base Balance by Respiratory Mechanism - Regulation of Acid-Base Balance by Renal Mechanism.

Reference Books

1. Lorry G.Shaver(1981) “Essentials Of Exercise Physiology” Surjeeth Publications, Delhi
2. Mcardle (2000) “Essentials of Exercise Physiology” 3rd edition, lippincottwillams and Wilkins publisher.
3. Sharon, (2003) “Exercise Physiology for Health Fitness and Performance” LippincottWillams and Wilkins Publisher.
4. Clerk, D.H (1975.) “Exercise Physiology” Prentice – Hall, Inc., Englewood Cliffs, New Jersey.
5. Michael j.Gibney, Ian A. Macdonald and Helen M.Roche (2007), Nutrition *and Metabolism*. Publisher. Blackwell Science, Oxford. Pg 126-127,135, 137,277.

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Describe the Biochemistry their role in energy production during exercise
CO2	Explain the chemical structure and functions of carbohydrates.
CO3	Using the knowledge of lipid structure and function, explain how it plays a role in Signalling pathways
CO4	Describe the various levels of structural organisation of amino acids and the role of proteins in biological system
CO5	Applying the knowledge of acid base balance sequencing in research and diagnosis

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S

CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

COURSE CODE – 23PC1CE002

EXERCISE SCIENCE AND FUNCTIONAL ASSESSMENT

Course Objectives:

1. To feel comfortable selecting and performing appropriate fitness assessments, including all related equipment manipulation, calculations, conversions, data collection/summary, and interpretation of results.
2. To explain the anatomy, physiology, and biomechanics underlying various fitness assessments.

Learning Out Come:

1. To consider scope of practice when selecting fitness assessments and interpreting data from assessments.
2. To appreciate the historical development of modern fitness assessments, especially with regard to trends and technology.
3. To appreciate the value of the methods section of a scientific publication.
4. To appreciate how and why fitness assessments are used in various settings: fitness industry, sports, clinical, and even basic sciences.

UNIT – I Diagnostic testing: Pretesting Guidelines and procedure – Laboratory and Field testing – Cardiovascular and Pulmonary assessment – Treadmill and Ergometers – Metabolic measurement equipment – pulmonary function equipment – Electrocardiograph equipment – pulse oximeter – Blood pressure assessment.

UNIT – II Musculoskeletal Function assessment: Electromyography equipment – force platforms - Pressure Sensitive Insoles –Isokinetic Dynamometers. Magnetic Resonance Imaging – Magnetic Resonance Spectroscopy – Muscle Biopsy Equipment Computer Tomography – Isometric Strength Tests - Isometric Handgrip Strength Test-YMCA Bench Press Protocol.

UNIT – III Energy Balance Assessment: - Measuring energy intake – Measuring energy expenditure - Whole room indirect calorimeter – Double Labeled Water – other Assessment Instruments – Heart rate monitor – pedometer Accelerometers.

UNIT – IV Measuring Body Composition: Densitometry- Dual Energy x- ray Absorptiometry – Bio- Electrical Impedance – Skinfold assessments– Anthropometric measurements.

UNIT V Blood collection and analysis: General equipment – Common blood measures – routine check-up – haemoglobin- urine analysis- urea, uric acid and lipid profile- Blood Lactate Measurement at Rest - Lactate Analyzer Test - Blood Lactate after Anaerobic Exercise.

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Describe the Preliminary Health Evaluation
CO2	Understand the different methods of clinical assessment
CO3	Understand the different methods of assessment of components of Health Related physical fitness
CO4	Understand the different methods of assessment of different components of physical fitness
CO5	Understand the different methods of assessment of VO ₂ Max Test Protocol

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

COURSE CODE – 23PC1DSE003

CLINICAL SPORTS NUTRITION

Learning Objectives:

Focuses on the components of the fitness associated with optional health

1. Learners will explore the associations among physical activity, health and hypothetic disease, health screening, principles of assessment.
2. Describe and discuss the relationship between physical activity and health across the lifespan.
3. To understand the nutritional requirements and considerations for athletes with clinical conditions, special conditions and special dietary need

Unit I: Nutritional Genomics: Genetic Fundamentals - Genetics and Genomics: Nutritional Genomics, Nutrigenetics, and Nutrigenomics - Modes of Inheritance: Mendelian inheritance, mitochondrial inheritance, and epigenetic inheritance- Genetics and Nutrition Therapy- Nutrigenomic Influences on Health and Disease- Epigenetic Influences on Health and Disease- Nutritional Genomics and Chronic Disease.

Unit II: Disordered eating in athletes: Disordered eating categories/classifications- Prevalence of disordered eating among athletes- Etiology of disordered eating among athletes- Performance and health consequences disordered eating- Prevention of disordered eating among athletes- Management of disordered eating among athletes, Female Athlete Triad- Prevention and treatment of the Female Athlete Triad.

Unit III: Bone, exercise and nutrition: Definitions of sports osteopenia and osteoporosis- Exercise effect on bone in athletes and healthy people- Calcium intake and bone mineral changes at various life stages- Effect of calcium intake during childhood and adolescence on bone mineral density- Effect of calcium intake on BMD during the premenopausal years, early postmenopausal and later postmenopausal years on BMD- Effects of amenorrhea on bone mass- Stress fractures in athletes with menstrual disturbances.

Unit IV: Iron- Stages of iron depletion- Iron Depletion in Athletes- Sport Anaemia- Causes of iron deficiency in athletes- Assessment of iron status of an athlete: Serum ferritin- Serum transferrin- Red blood cell- Hemoglobin and haematocrit- Hcpidin- Clinical symptoms- Dietary intervention for iron depletion and iron deficiency.

Unit V: Gut Health : Definition of Gut Health – sign of poor Gut Health – signs of good Gut health – Gut Health and Its importance – Brain –Gut connection – Gut Health and Skin Health –

Gut microbiome – Gut Health and Depression – Gut Health and Emotional Wellbeing – Best Probiotics for Gut Health – Gut Health Diet – IBD , IBS – signs and symptoms – food to avoid.

Reference Book:

1. Louise Burke and Vicki Deakin, (2010), Clinical sports nutrition, 4th ed., McGraw-Hill Australia Pty Ltd

COURSE OUTCOME:

On successful completion of the course, the students should be able to:

CO1	Understand the Nutritional Genomics
CO2	Explain the Disordered eating in athletes
CO3	Understand the knowledge of Bone, exercise and nutrition
CO4	Describe the Sport Anaemia and Causes of iron deficiency in athletes
CO5	Applying the knowledge of nutritional requirements for athletes with Gut Health and Its Importance

MAPPING WITH PROGRAMME OUTCOMES:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

COURSE CODE – 23PC1DSE003

NUTRITION AND IMMUNE FUNCTION IN SPORTS AND EXERCISE

Course Objectives:

1. To know about the adequate intake of iron, zinc and vitamins for the maintenance of micronutrients.
2. To know about the athlete exercising in carbohydrate-depleted state and IMMUNE function.

Learning Objectives:

1. Students will apply the concept of nutritional intervention to immune system of the athlete in various sports.
2. They will also insist the athlete to maintain the IMMUNE system for better performance.

UNIT – I Immune system: Meaning and Definition of Immune system – Functions of the immune system- Components – Leukocytes – Definition and Types of Neutrophils – Eosinophils – Basophils – Monocytes - Lymphocytes - function and characteristic - Factors Affecting Immune Function.

UNIT – II Immune response – mechanism of general response – Clonal selection and immunological memory – cellular immune response –Humoral fluid response – Antigen – Antibody reactions – Complement – Disorders of the immune mechanism.

UNIT – III Effect of exercise on the immune system – Acute effect of exercise on immune function – Chronic effect of exercise on immune function – Guidelines for the athlete to reduce the risk of infection – nutritional counter and measures.

UNIT – IV Nutritional Manipulation - immune depression in athletes –nutritional influence on immune function in athletes – Role of carbohydrate, protein and fat in immune function – pre and post exercise.

UNIT – V- Immune function and nutrition of elite athletes -Nutritional influence – role of vitamins and minerals in immune function – Effect of Dietary deficiency and excess - Dietary Sources – RDA – Fluid Concentration.

Text Book

1. Asker Jeukendrup and Michael Gleeson (2004) "Sports nutrition" Human Kinetics, inc
2. Nieman, D.C., and B.K. Pederson (2000) "Nutrition and Exercise Immunology". CRC press: Boca Raton, FL.

Reference Book

Journal of sports sciences ISSN 0264 – 04147x online copyright 2004 Taylor & Francis Ltd

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	To understand the functions of the immune system and Factors Affecting Immune Function.
CO2	Analyzing the Disorders of the Immune Mechanism.
CO3	Gain knowledge on the Effect of Exercise on the immune system
CO4	Gain knowledge on the nutritional influence on immune function in athletes
CO5	Understand the Immune Function and Nutritional needs of athletes

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

*S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1

**DISCIPLINE SPECIFIC ELECTIVE (DSE)
EVEN SEMESTER II & IV**

Subject Code	Name of the Paper
PEN18DSE005	Strength Training and Conditioning for Fitness
PEN18DSE006	Exercise Rehabilitation and Injury Management
PEN18DSE007	Renal Physiology
PEN18DSE008	Training And Performance

COURSE CODE – UEN23CE005
STRENGTH AND CONDITIONING FOR FITNESS

Learning Objectives:

1. This is designed to give opportunity to participate in many different activities to learn the immediate and long term benefits of physical activity
2. To develop personal strength training programme.
3. To Interpret and apply scientific knowledge and literature relating to strength training.
4. Understand the importance of organizations admin distraction and leadership and their importance in the development of a safe and effective training programs.

UNIT – I Introduction to Wellness and Lifestyle Management : Definition and Meaning of Wellness - Dimensions of Wellness: Physical Wellness, Emotional Wellness, Mental Wellness, Social Wellness, Environmental Wellness, Occupational Wellness, and Spiritual Wellness – Wellness issues for diverse populations – Behaviours that contribute to wellness – Wellness and Health – Wellness and Physical Activity – Wellness through Life style management – Self-Planning for Healthy- Lifestyles Wellness in the digital age

UNIT II Introduction to Fitness and Lifestyle Management : Definition and Meaning of Fitness - Physical Activity and Exercise for Health and Fitness - Physical Activity and Exercise Recommendations for Promoting General Health, Fitness, and Weight Management- **Components of physical fitness : Health Related fitness components** - Cardiorespiratory endurance, Muscular strength, Muscular endurance, Flexibility, Body composition - **Skill (Neuromuscular) Related Components of Fitness** – Speed, Power, Agility, Balance, Coordination, Reaction and movement time.

UNIT – III Introduction Meaning and Definition of Strength training and conditioning- Brief History of Strength Training and Conditioning - Strength and Conditioning Today - Benefits of resistance training - **SAID Principle**: Mechanical specificity-Neuromuscular specificity-Metabolic specificity-Progressive Adaptations from Resistance Training: Stabilization-Muscular endurance- Muscular hypertrophy-Strength-Power-Resistance Training Program Design: Exercise Selection- Exercise order and Workout Structure-Intensity-Training Volume-Rest Intervals-Repetition Velocity-Frequency.

Unit IV Principles of Physical Training: FITT-VP principle - Physical activity pyramid - Designing Exercise Program - Guidelines for Training - ACSM Exercise Recommendations for Fitness Development in Healthy Adults - Health and fitness benefits of different amounts of physical activity and exercise - Choosing a Fitness Center. **Developing a Personal Fitness Plan**: Set Goals - Select Activities - Set a Target Frequency, Intensity, and Time (Duration) for M.Sc., Exercise Physiology and Nutrition – 2023-24

Each Activity - Set Up a System of Mini-Goals and Rewards - Include Lifestyle Physical Activity and Strategies to Reduce Sedentary Time in Your Program - Importance of Reducing Sedentary Time - Develop Tools for Monitoring Progress - Make a Commitment - Exercise Guidelines for Life Stages - Exercise Guidelines for People with Special Health Concerns

UNIT – V Warm-up and cool down: Definition of Warm-up and cool down - Physiology of Warming Up- Flexibility- Flexibility and Injury Prevention- Factors Affecting Flexibility- Types of Stretching: Static Stretching- Dynamic Stretching- Proprioceptive Neuromuscular Facilitation Stretching - Flexibility Training Guidelines - The Cool down

Reference Book

1. Micheal A. Clark, Scott C. Lucett, and Brian G. Sutton,(2012), NASM Essentials of Personal Fitness Training, Fourth Edition, Lippincott Williams & Wilkins, a Wolters Kluwer business, Two Commerce Square, 2001Market Street, Philadelphia, USA.
2. Nicholas Ratamess, (2012), ACSM’s Foundations of Strength Training and Conditioning, Lippincott Williams & Wilkins.
3. Thomas R. Baechle, and Roger W. Earl, (2008), Essentials of Strength Training and Conditioning, Human Kinetics, P.O. Box 5076, Champaign, USA.

Course Outcomes

After successful completion of the course the student will be able to

CO1	Explain the physiological basis for Strength training and conditioning
CO2.	Identify Competitive forms of Resistance Training
CO3.	Discuss appropriate SAID Principle for various age groups
CO4.	Discuss appropriate Cardiorespiratory Fitness for various age groups
CO5.	Demonstrate the skills plan and prepare appropriate and sustainable Warming Up and Flexibility various age groups

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

COURSE CODE – 23PC1DSE006
EXERCISE REHABILITATION AND INJURY MANAGEMENT

Learning Objective:

1. Understanding injuries and rehabilitation in sports
2. Concept of first aid, hydrotherapy, thermotherapy and different electrotherapeutic modalities.
3. Critically analyse current exercise guidelines, scientific papers and reviews to prescribe suitable exercise programmes for people with a variety of chronic conditions.
4. Critically analyse the relationship between physical activity and exercise on health outcomes in a diverse range of participant groups and appreciate the importance of equality.
5. Demonstrate a thorough understanding of the pathophysiology, symptoms, and diagnosis of a range of chronic conditions.
6. Demonstrate competency in assessing and monitoring the health and wellbeing of a client through appropriate evidence-based testing and exercise prescription/lifestyle intervention,
7. Demonstrating professionalism by practising key personal qualities such as compassion, empathy, flexibility, equality, diversity and understanding.
8. On successful completion of this module students will be able to comprehensively and systematically appraise the standard principles and stages of the rehabilitation process.
9. On successful completion of this module students will be able to comprehensively evaluate the composition of the rehabilitation team and how the individuals interact to allow the athlete to return to performance.
10. On successful completion of this module students will be able to comprehensively express how tissues respond to injury and how their recovery can be optimised through rehabilitation and training principles.

Unit I- Principles of Exercise Rehabilitation – Introduction - Physical Stress Theory - Mechanotransduction Hypothesis - Mobility and Stability – The Influence of pain on movement and motor control – Rehabilitation Considerations : Motor Skill Learning - Re-loading Rehabilitation - Generate a Needs Analysis - Building Chronic Capacity - Load Management : Identifying Load – Monitor Load – Progressing Load - Role of mental skills and confidence in exercising regularly - Barriers and motivators for exercise - Exercise participation and well-being - Counselling for exercise behaviour change - self-determination theory in exercise contexts - environment for exercise behaviour change – The rehabilitation team, and rehab planning - Current trends in research, critical assessment of research and future research directions

Unit II- Injury and Repair - Introduction to Injury of Traumatic Injury – Stages of Soft Tissue Repair : Inflammatory phase, Repair phase, Remodeling phase - Supporting Soft Tissue Repair - Injury Evaluation – Supporting Healing in the Inflammatory Phase – PRICE, POLICE Protocol - Supporting the Repair Phase - Supporting the Remodeling Phase - Introduction to Injury Prevention : Adapting tasks, Modifying environments, Building capacity, Restoring variation, Developing adaptability, Improving reactions.

Unit III-Exercise Rehabilitation for Non-Communicable (Chronic) Diseases : Non-Communicable Diseases - Global Incidence of NCDs - People at risk - Risk factors : Modifiable behavioural risk factors, Metabolic risk factors - Socioeconomic impact - Prevention and control - NCDs and Physical Inactivity - Physical Activity Interventions - Physical activity – a powerful investment in people, health, the economy and sustainability – Guiding principles for a population based approach to physical activity – A framework for action – Implementation of National policy and action plan – Introduction of policies that support physical activity - Reorient services and funding to prioritize physical activity - Develop partnerships for action.

Unit IV- Training for injury prevention: injury risk factors for team sports players: Intrinsic injury risk factors-Extrinsic injury risk factors- Specific Strength and Neuromuscular Training for Injury Prevention-Risk factors and injury mechanisms for common sites of injury in team sports: Ankle complex- Knee-Hip-Lumbar spine-Shoulder complex. Functional Biomechanics - Posture and Position - Anatomical Variation of Form and Technique - Movement Screens - Corrective Exercise - Positions of Ease of the Path of Least Resistance - Functional Evaluation - Complex Movement.

Unit V- Functional Program Design: Fundamental Principles of Training: Overload, Progression, Recovery, Variation, Periodization, Individualization - Client Appraisal: Goals, Activities of daily living, Painful movements and injury history, Attitudes, perceptions and beliefs regarding exercise - Functional Evaluation: Primary patterns, Secondary patterns, Travel patterns, Pain patterns - Functional Program Design: General warm-up, Dynamic stretch, Movement preparation, Main program, Cool-down - Pre-Session Appraisal (PSA) - Functional Platform. Pain Rehabilitation - Manage Emotion - Define Pain – Prevention of Pain - Engage Pain Patterns - Intelligent Variation in Rehabilitation – Corrective Exercise - Mapping Drills - Inhibition Exercises - Activation Exercises.

References Book:

1. Carolyn Kisner& Lynn Allen Colby, (2004) Therapeutic Exercise: Foundation & Techniques, New Delhi.

2. Freddie H. Fu, David A. Stone, (2001) *Sports Injuries: Mechanism, Prevention, Treatment*, Lippincott Williams & Wilkins.
3. Jayant Joshi, Prakash Kotwal; B.I. Churchill Livingstone (2008) *Essential of orthopedics & Applied Physiotherapy*, New Delhi.
4. Peggy A. Ouglum, (2001) *Therapeutic Exercise of Athletic Injuries*, Athletic Training Education Series.
5. Stevan Roy and Richard Irvin (2001) *Sports Medicine: Prevention, Evaluation, Management & Rehabilitation*; New Jersey.
6. Paul Gamble, (2010), *Strength and Conditioning for Team Sports*, Sport-specific physical preparation for high performance, Routledge, 270 Madison Avenue, New York.
7. Mueller MJ, Maluf KS. Tissue adaptation to physical stress: a proposed “Physical Stress Theory” to guide physical therapist practice, education, and research. *Physical therapy*. 2002 Apr 1; 82(4):383-403.
8. Stassen OM, Ristori T, Sahlgren CM. Notch in mechanotransduction—from molecular mechanosensitivity to tissue mechanostasis. *Journal of cell science*. 2020 Dec 15; 133(24):jcs250738.
9. Du H, Bartleson JM, Butenko S, Alonso V, Liu WF, Winer DA, Butte MJ. Tuning immunity through tissue mechanotransduction. *Nature Reviews Immunology*. 2022 Aug 16:1-5.
10. Khan KM, Scott A. Mechanotherapy: how physical therapists’ prescription of exercise promotes tissue repair. *British journal of sports medicine*. 2009 Apr; 43(4):247-52.
11. Frost HM. Wolff’s Law and bone’s structural adaptations to mechanical usage: an overview for clinicians. *The Angle Orthodontist*. 1994 Jun; 64(3):175-88.
12. Petty NJ. Principles of Exercise Rehabilitation. *Physical Examination, in Neuromusculoskeletal examination and assessment: a handbook for therapists*. Elsevier Health Sciences; 2011 Jan 27.
13. Gabbett TJ. The training—injury prevention paradox: should athletes be training smarter *and* harder? *British Journal of Sports Medicine* 2016; 50:273-80.

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Describe the Principles of Exercise Rehabilitation
CO2	Explain the different types of sports Injury and Repair.
CO3	Using the knowledge of Exercise Rehabilitation for Non-Communicable (Chronic) Diseases
CO4	Describe the various Training for injury prevention
CO5	Applying the Functional Program Design

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

COURSE CODE – 23PC1DSE007

RENAL PHYSIOLOGY

Learning Objectives

1. Describe the gross anatomy of the kidney and its coverings.
2. Trace the blood supply through the kidney
3. Describe the anatomy of a nephron
4. List several kidney functions that help maintain body homeostasis
5. Identify the nephron parts responsible for filtration, reabsorption, and secretion, and describe mechanisms underlying each of these functional processes.
6. Explain the role of aldosterone and of atrial natriuretic peptide in sodium and water balance
7. Describe the mechanisms responsible for the medullary osmotic gradient
8. Explain formation of dilute versus concentrated urine.

UNIT I: Physiological Anatomy of the Kidney-Structure of the kidney. Cortex.Medulla. – Nephron-functional unit of the kidney. Cortical and juxtamedullary nephrons. – Anatomy of the nephron. Glomerulus.Tubule. – Bowman's capsule. Proximal tubule.Loop of Henle.Distal tubule.Collecting duct. – Kidney blood vessels. Afferent and efferent arterioles.Peritubular capillary network.Vasa recta.Juxtaglomerular apparatus. - Principles of urine formation.

UNITE II: Glomerular Filtration. Glomerular filtration membrane. - Net filtration pressure. – Glomerular filtrate. Composition. Glomerular filtration rate. – Clearance. Definition. Calculation. Inulin clearance. Creatinine clearance. PAH clearance. – Renal plasma flow. Filtration fraction. – Physiological control of glomerular filtration and renal blood flow. Nervous regulation. Humoral regulation. Autoregulation. Tubuloglomerular feedback. Myogenic autoregulation.

UNIT III: Excretion of Water. Reabsorption of water in tubular segments. – Excreting excess water by forming a dilute urine. – Conserving water by excreting a concentrated urine. Obligatory urine volume. Osmotic stratification of renal medulla .Counter current multiplier system (loop of Henle).Role of distal tubule and collecting duct. Contribution of urea.Recirculation of urea. Counter current exchange system (vasa recta). - Mechanism of water reabsorption. Role of antidiuretic hormone (ADH).Diabetesinsipidus.–Water diuresis. Osmotic diuresis.

UNIT IV: Excretion of Sodium, Chloride, Potassium and Other Ions. Reabsorption of sodium in tubular segments. Mechanisms of sodium reabsorption. Reabsorption of sodium in late distal tubule and in collecting duct. Role of aldosterone. – Excretion of potassium. Reabsorption of potassium. Secretion of potassium. Principal cells. Intercalated cells.

Regulation of potassium secretion. Excretion of chloride. – Excretion of calcium. Regulation of calcium reabsorption. – Excretion of phosphate. - Excretion of magnesium.

UNIT V: Acid-Base Balance and Kidney. Plasmatic pH. Acidosis, alkalosis. Sources of hydrogenions.-Acid-base buffer systems. Bicarbonate buffer system - The role of kidney in the acid-base regulation. Secretion of hydrogen ions. Filtration and reabsorption of bicarbonate ions. Generation of new bicarbonate ions.–Renal response to acidosis. Tubular buffers. The role of ammonium ion and ammonia. Renal response to alkalosis. Respiratory acidosis and alkalosis. Metabolic acidosis and alkalosis. Micturition. Ureter Ureterorenal reflex. – Bladder. Detrusor muscle. Innervation of the bladder. Internal sphincter. External sphincter

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Describe the Physiological Anatomy of the Kidney
CO2	Explain the chemical structure and functions of carbohydrates.
CO3	Using the knowledge of lipid structure and function, explain how it plays a role in Signalling pathways
CO4	Describe the various levels of structural organisation of amino acids and the role of proteins in biological system
CO5	Applying the knowledge of acid base balance sequencing in research and diagnosis

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

*S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1

COURSE CODE – 23PC1DSE008
TRAINING AND PERFORMANCE

Learning Objectives

1. Provide opportunities to the graduates to learn the methods of training for performance.
2. To work with higher efficiency as Exercise Physiologist or Exercise Trainers.
3. To constructively apply the acquired scientific findings and methodological repertoire in practical training under various conditions.

UNIT – I Introduction to Training

Definition and meaning of training and Sports Training, importance of Sports Training - Training principles: over load, specificity, progression - reversibility – volume, Intensity, Frequency. Macro cycles - Mesocycles – Microcycles - Periodization- General Preparation phase (off-season), Specific preparation phase (preseason), Competitive phase (in-season), Transition phase (active rest) – Overtraining - Detraining - Retaining Exercise and Training as Stressors.

UNIT – II Competitive forms of Resistance Training: Definition of Strength- Factors Determining Strength- Types of Strength: Maximum Strength- Explosive Strength — Strength Endurance – Types of Muscle Contraction: Isotonic, Dynamic or Concentric Contraction- Isotonic, Dynamic or Eccentric, Contraction Advantages and Disadvantages of Isotonic Method- Isometric or Static Contraction, Advantages and Disadvantages of isometric Method- Isokinetic Contraction - Methods of Strength Development. Bodybuilding - Weightlifting - Powerlifting - Strength Competitions - Competitive Lifting Modes and Performance

UNIT – II Aerobic Training: Basic Physiology of Cardiorespiratory Endurance Exercise - The Cardiorespiratory System - The Cardiorespiratory System at Rest and During Exercise - Energy Production - Exercise and the Three Energy Systems - Benefits of Cardiorespiratory Endurance Exercise -Different Training Program for Aerobic Endurance. Long Slow Distance – Interval Training – Circuit Training – Fartlek High Intensity Interval. Factors Influence the Aerobic Performance- VO_2 Max - Lactate Threshold. Influence of Altitude and Resistance Training in Aerobic Performance.

UNIT – III Speed, Agility and Plyometric Training

Definition of Speed - Types of Speed - Acceleration, change of Direction, Reaction of Agility, Maximum Velocity or Speed, Speed Endurance Training- Methods to Increase the All Types of Speed - Physics of Sprinting, Change of Direction and Agility. Plyometrics - Physiology of Plyometric Exercise – Phases of Stretch Shortening Cycle- Components of Plyometric Training - Program Design for Plyometric –Plyometric Drills for Upper Body and Lower Body.

UNIT - IV Introduction to Core Training and Functional Training

Definition of Core Strength and Stability – Origin, Insertion and function of Rectus abdominis, Erector spinae group, External oblique, Internal oblique, Quadratus lumborum, Iliopsoas, Transverse abdominis, Multifidus muscles - Factors that Affect the Core-Benefits of a Strong Core -Training Core Strength- Core-Stabilization Training. Definition of Functional Training.

UNIT – V Age- and Sex-Related Differences

Definition of Strength- Factors Determining Strength- Types of Strength: Maximum Strength- Explosive Strength – Strength Endurance – Types of Muscle Contraction: Isotonic, Dynamic or Concentric Contraction- Isotonic, Dynamic or Eccentric, Contraction Advantages and Disadvantages of Isotonic Method- Isometric or Static Contraction, Advantages and Disadvantages of isometric Method- Isokinetic Contraction- Methods of Strength Development.

Reference Books

1. Scott K. Powers Edward T. Howley (2004) "Exercise Physiology- Theory and application to fitness and performance", Brown and Benchmark.
2. Diek, Frank W. (1978) "Sports training principles ", London: Lepus books.
3. Nieman, David C,"The Exercise Health Connection" Champaign L: Human kinetics.
4. Jack. H Wilmore and David L. Costill (2004) "Physiology of Sports and Exercise", Human kinetics.
5. Gregory Huff G and Travis Triplett, (2016), Essentials of Strength Training and Conditioning; Fourth Edition, National Strength and Conditioning Association, United States: Human Kinetics P.O. Box 5076, Champaign, IL.

Course Outcomes

After successful completion of the course the student will be able to

CO1	Explain the physiological basis General Training Principles
CO2.	Understand the aerobic training methods
CO3.	Discuss Training to improve Speed and Agility
CO4.	To understand Core Training and Functional Training
CO5.	Understand the Age and Gender differences and their Implications for Resistance Training

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strong 3 ; M-Medium 2 ; L-Low 1**

1. Assessment of Muscular Strength
 - i. 1-Repetition Maximum (RM) Bench Press Test
 - ii. 1-Repetition Maximum (RM) Leg Press Test
 - iii. Maximal Handgrip Strength Test
2. Assessment of Muscular Endurance
 - i. Pull-Up Tests
 - ii. Push-Up Tests
 - iii. Partial Curl-up Test
 - iv. Prone bridge (or plank).
 - v. Half-squat (or wall-sit).
3. Assessment of Muscular Power
 - i. Standing Long Jump Test
 - ii. Vertical Jump Test
 - iii. Single-Leg Triple Hop Test
 - iv. Forward Overhead Medicine Ball Throw Test
4. Assessment of Flexibility
 - i. Sit and Reach Test (Trunk Flexion).
 - ii. Back-Scratch Test
5. Assessment of Agility
 - i. T-Test
 - ii. Hexagon Test
 - iii. 5-10-5 Test (Pro agility or 20-yard shuttle run)
 - iv. Y-Shaped Reactive Agility Test
6. Assessment of Speed
 - i. Straight-Line Sprint
 - ii. Repeated Sprint Ability Test

GENERIC ELECTIVE (GE)

Subject code	Name of the Paper/ Components
PEN18GE001	Essentials of Exercise Physiology
PEN18GE002	Essentials of Sports Nutrition

COURSE CODE – 23PC1GE001
ESSENTIALS OF EXERCISE PHYSIOLOGY

Learning Objectives

1. Exercise Physiology is an evaluation of acute response and chronic adaptations of the body to the stresses of exercise.
2. Demonstrate the sound fundamental knowledge and understanding of the principles of Exercise physiology as they relate to responses and adaptations to physical activity and exercise.
3. To learn the changes in human body systems due to exercise in an integrated manner.

Unit- I- Definition of Exercise Physiology and Sports Physiology- Structure and functions of heart - cardiac cycle - Blood pressure - cardiac output - Heart Rate - Stroke volume - Acute Response to Cardiovascular Exercise – Physiological adaptation to training on Cardiovascular - Structure and Functions of respiratory system – mechanism of Breathing - Lung volumes and capacities - Respiratory Adaptations to Training.

Unit- II- Types of Muscles- Structure and functions of skeletal muscle - Muscles fiber types- Mechanism of Muscles contraction- Sliding filament theory- structure of Neuron - central neurons- brain and spinal cord-peripheral neurons - Automatic Ns- Motor unit- Action potential- depolarisation- Reflex are - proprioceptors- Physiological adaptation to training on Muscular and Neuron System.

Unit- III- Energy Metabolism - ATP- PC System - Glycolytic and Oxidative system- Oxygen debt and deficit- Aerobic and anaerobic training and their effects on Aerobic and Anaerobic System - Physiological Responses to Exercise in the Heat - Heat-Related Disorders- Physiological Responses to Exercise in the cold.

Unit- IV Endocrine Glands and Their Hormones: Pituitary gland Thyroid Gland - Parathyroid Glands - Adrenal Gland and Adrenal cortex and Pancreas - Physiological adaptation to training on Endocrine System - Menstrual Cycle- Physiological changes during pregnancy - Guidelines for Exercise during and after pregnancy.

Unit- V- Immunity- definition and classification- physiology of sleep- Cardiac rhythm- obesity- Exercise perception for obesity- Diabetes mellitus- Exercise Perception- Hyper tension- Exercise Perception- Coronary Heart Disease- Exercise Prescription- Pulmonary Disease- Exercise Prescription.

Reference Books

1. William D.Mcardle, Frank I.Katch, Victor L.Katch, (2005), "Essentials of exercise physiology", Lippincott Williams and Wilkins.
2. Victor L.Katch, Frank.I. Katch, William D.Mcardle, (2003), "Exercise physiology", Williams and Wilkins.
3. Lorry G.Shaver (1981) "Essentials of Exercise Physiology" Delhi: Surjeeth Publications.
4. William E.Garrett J.R., Donald T.Kirendall, (2000), "Exercise and sports science", Lippincott Williams and Wilkins.
5. McArdle William D. (1998) "Essentials of Exercise Physiology" Malveern, Pennsylvania: Lea and Febiger.
6. Berger Richard A. (2003) "Applied Exercise Physiology" United States of America, Lea and Febiger, Philadelphia.

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Demonstrate an understanding of the structure, function, cardiorespiratory system to include ventilation, gas transport and exchange and cardiac output during rest and exercise
CO2	Understand the concepts involved in Mechanism of Muscles contraction and Physiological adaptation to training on Muscular and Neuron System.
CO3	Using the knowledge Energy Metabolism, explain how it plays a role in aerobic and anaerobic sports
CO4	Describe the various Endocrine Glands and the role in biological system
CO5	Understand the concepts of Exercise Prescription for special population

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

COURSE CODE – 23PC1GE002
ESSENTIALS OF SPORTS NUTRITION

Learning Objectives:

1. It explores nutrition in the enhancement of health and fitness.
2. It includes the nutrient requirements of attainment and maintenance of health, disease prevention and sports performance
3. The appropriate use of dietary supplements, popular diets and causes and treatment of eating disorders and obesity will be studied.
4. Provide individual advice and guidance in the area of sports nutrition.
5. Design and run a group consultation for athletes about sports nutrition.
6. Develop knowledge on sports nutrition.

Unit- I- Sports Nutrition - Basic Sports Nutrition Guidelines- Principles of Good Eating: Variety-Balance- Moderation Assessment of Nutritional status- carbohydrate diets for training - carbohydrate Utilization during Exercise - Muscles and Liver Glycogen- carbohydrate loading- Glycemic Index- Carbohydrate intake before, during and after exercise- Carbohydrate Recommendations for Athletes.

Unit- II- Proteins and Amino Acids - Protein essential for before, during after Exercise- Protein Recommendations for Athletes - Lipids and Physical Activity- Athlete conditioning and metabolizing fat - Medium-Chain Triglycerides (MCTs) - Omega-3 fatty Acids - Fats as a Source of Energy during Exercise- Fat Recommendations for Athletes.

Unit- III- Nutrient Timing and Recovery Nutrition: Eating before training- Eating during training- Recovery nutrition- Phytonutrients- Antioxidants- Salt - Water Loss, Intake, Balance, and Imbalance- Hypohydration, euhydration, and hyperhydration- fluids and electrolytes consumed before, during, and after exercise- Energy drinks- Sports drinks guide.

Unit- IV- Nutritional need for Special population- Nutrition need for young and ageing athletes- Athletics with diabetes- Glucose monitoring during exercise- Preventing and managing Hypoglycemia- Physical activity for people type with II diabetes.

Unit- V- Dietary guideline for eating right- Food Plate - Functional food pyramid- Planning Diets for aerobic and anaerobic sports- Planning for vegetarian athlete and vegan athlete, overweight and obesity, Hyper tension, Coronary Heart Disease and Lung disease.

Reference Books

1. Sareen S. Gropper and Jack L. Smith (2009), Advanced Nutrition and Human Metabolism, Wadsworth, Cengage Learning, USA.
2. Heather Hedrick fink, Lisa A. Burgoon, Alan E. Mikesky, (2006), "Practical Application in Sports Nutrition", Jones and Bartlett.
3. McArdle William D. et.al. (2005) "Exercise Physiology, Nutrition and Human Performance", Philadelphia :lea and Febiger.
4. Mcardle, William D., Katch, Frank I and Katch, Victor L(2005) "Exercise Physiology", Philadelphia ,lea and Febiger.

Course Outcome:

On successful completion of the course, the students should be able to:

CO1	Describe contemporary dietary guidelines and demonstrate an ability to use these guidelines to provide general nutrition advice for achieving or maintaining a healthy body weigh and sports performance
CO2	Using the knowledge of Proteins , lipid and function, explain how it plays a role in maintain good health.
CO3	Describe how nutrition influences human development, exercise performance, recovery and physiological adaptations
CO4	Understand the Nutrition need for young and ageing athletics
CO5	Understand the Dietary guideline for eating right and Planning Diets for aerobic and anaerobic sports

Mapping With Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	L	M	S	M
CO 2	S	M	L	S	M
CO 3	S	M	M	S	S
CO 4	S	M	M	S	M
CO 5	S	S	M	S	S

***S-Strongly correlated 3 ; M- Moderately correlated 2 ; L-Low 1**

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