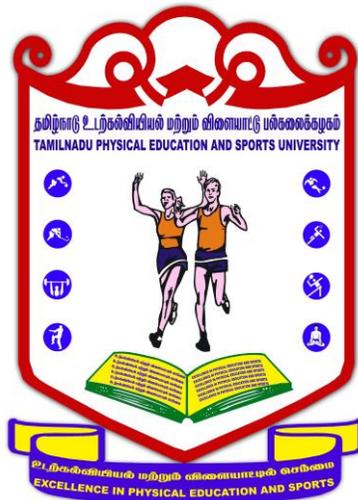


# TAMIL NADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY

CHENNAI-600 127



## MSc., SPORTS BIOMECHANICS AND KINESIOLOGY

**CBCS CURRICULUM – 2023-2024**

**TAMIL NADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY  
DEPT. OF EXERCISE PHYSIOLOGY AND BIOMECHANICS  
MELAKKOTTAIYUR POST  
CHENNAI - 600 127  
M.Sc., SPORTS BIOMECHANICS AND KINESIOLOGY  
(Two years Regular Programme)**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**DESCRIPTION OF THE DEPARTMENT**

The Department of Sports Biomechanics and Kinesiology has been offering the following programme:

1. BSc., Sports Biomechanics and Kinesiology (Regular Three Years Programme) since 2019-2020 academic year.
2. MSc., Sports Biomechanics and Kinesiology (Regular Two Years Programme) since 2008-2009 academic year.
3. PhD Sports Biomechanics and Kinesiology (Regular Three Years / Part time -4 years Programme) since 2015.

**VISION OF THE DEPARTMENT**

The Department of Sports Biomechanics and Kinesiology aims to produce skilled sports biomechanics and kinesiology professionals with holistic approach to promote and serve in the domains of sports performance analysis, human gait and posture, fitness and exercise prescription, strength and conditioning, sports science, biomechanics and kinesiology R&D, equipment design and development, ergonomics, rehabilitation, prehabilitation, clinical biomechanics, academics, research and consultancy services in biomechanics.

**OBJECTIVES OF SPORTS BIOMECHANICS AND KINESIOLOGY POST GRADUATE PROGRAMME:**

1. To gain knowledge on anatomy and physiology, kinesiology, biomechanics, motor skills, techniques of human movement and sports skills, research and statistics, and biomechanical instrumentation and measurement in 2D and 3D with inverse dynamics, EMG, force plate, Isokinetic Dynamometry etc.,
2. To apply the principles of mechanics on the human movement and sports skills to enhance the performance and reduce the risk of injury.
3. To analyse the sports skill technique/performance qualitatively and quantitatively using the biomechanical instrumentation and measurement.
4. To gain knowledge in the area of gait analysis and analyse the normal gait and pathological gait.

5. To assess the human body posture and prescribe corrective exercise to correct postural deviations.
6. To create a platform for students to engage in sports biomechanics research and pursue higher research degrees.
7. To produce an efficient sports biomechanist to work in research laboratories, sports academies, national teams, and faculty in academic institutions.
8. To produce sports performance analyst to work with sports teams/sports clubs/research labs as sports performance analyst.
9. To initiate the skill acquisition in data analytics, simulation and modelling, equipment design and development and industrial collaboration in sports.

## **REGULATIONS:**

The MSc Programme was started in 2008. The CBCS for the two years M.Sc. Degree programme was implemented from the academic year 2009-2010 revised in 2018-19. The Choice Based Credit System (CBCS) and Learning Based Outcome Curriculum Framework (LBOCF) is implemented from the year 2023-2024.

### **1. ELIGIBILITY FOR ADMISSION:**

A Candidate shall be admitted to the degree of Master of Science in **SPORTS BIOMECHANICS AND KINESIOLOGY** only if he/she produces satisfactory evidence to the effect that he/she has successfully completed **ANY SCIENCE / PHYSICAL EDUCATION / ENGINEERING / PHYSIOTHERAPY DEGREE (UG) OR ITS EQUIVALENT** recognized by the syndicate of this university. The total strength of the programme is 20.

### **2. COURSE OF STUDY:**

The normal duration of the M.Sc., Programme shall be 4 semesters (Two Academic Years). Maximum duration of the course of the course is 4 years.

### **3. SEMESTERS:**

An Academic year is apportioned into two semesters.

Odd Semester - July to November

Even Semester - December to April

In each semester, the courses are taught for **18 weeks** with each week having **5 working days and 6 hours a day (30 hours a week)**. For Co-curricular activities and thesis, the candidates will be working extra hours in lab, library and pertaining field of study. **There shall be not less than 90 working days** which shall comprise **540 teaching / Practical Activity clock hours for each semester**.

#### 4. CHOICE BASED CREDIT SYSTEM (CBCS) AND LEARNING BASED OUTCOME CUURICULUM FRAMEWORK (LBOCF)

The CBCS and LBOCF in M.Sc., programme would have the following 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
<b>Core course</b>	12	12	12	12	48
<b>Elective (Discipline Specific)</b>	03	03	03	03	12
<b>Generic Elective (GE)</b>	03	03	-	-	06
<b>Core - Practicum</b>	04	04	04	04	16
<b>Ability Enhancement Course (AECC)</b>	02	-	02	-	04
<b>Skill Enhancement Course</b>	-	02	-	-	02
<b>Thesis with Viva-Voce</b>	-	-	-	06	06
<b>Cocurricular Activity / Internship</b>	02	02	02	-	06
<b>Grand Total</b>	<b>26</b>	<b>26</b>	<b>23</b>	<b>25</b>	<b>100</b>

	Core CGPA	Credits details	Total Credits
<b>PART-I</b>	1. Core Theory	12 core papers x 4 credits	48 credits
	2. Department Specific Electives	4 DSE papers x 3credits	12 credits
	3. Generic Electives	2 GE papers x 3 credits	06 credits
	4. Thesis	1 x 6 credits	06 credits
<b>PART- II</b>	5. Core practical	8 Core practical x 2 credits	16 credits
<b>Non- CGPA</b>			
<b>PART-III A</b>	<b>Ability Enhancement Course (AEC) - 04 credits</b>		
	1. Communication skills	02 credits	02 credits
	2. Personality development	02 credits	02 credits
	<b>Skill Enhancement Course (SEC) - 02 credits</b>		
	3. Microsoft office skills	02 credits	02 credits
<b>PART-III B</b>	<b>Co –Curricular Activities - 06 credits</b>		
	1. SWACHH BHARAT	02 credits	02 credits
	2. MOOC	02 credits	02 credits
	3. Internship	02 credits	02 credits
<b>Total Credits</b>			<b>100 credits</b>

**CGPA- CUMULATIVE GRADE POINT AVERAGE:** A CGPA credit course has been classified into the five components and enlisted in part I and part II. The marks earned in the CGPA courses will be calculated for overall percentage of marks.

**NON- CGPA:** The students can earn additional credits by the way of choosing non-CGPA compulsory credit course such as ability enhancement courses, skill enhancement courses and co-curricular activities enlisted in part-III. The marks scored in the NON-CGPA courses will not be accounted in overall percentage calculation.

#### 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., Sports Biomechanics and Kinesiology (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.

<b>SEMESTER</b>	<b>CREDITS</b>	<b>TOTAL MARKS</b>
I	26	800
II	26	800
III	23	800
IV	25	700
<b>Grant Total</b>	<b>100</b>	<b>3100</b>

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:

<b>Components of Internal Evaluation of Theory</b>	<b>Marks</b>
Internal Test - I	5
Internal Test - II	5
Model Examination	10
Assignments /Seminars /quizzes etc.,	5
<b>Total</b>	<b>25</b>

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

Components of Internal Evaluation of practicum	Marks
Lab Experiment	05
Lab Performance	05
Viva Voce	05
Lab Record	10
<b>Total</b>	<b>25</b>

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 12.5 marks out of 25 (internal - 50% of 25 marks). In practical minimum passing standard will be 50% for the external exam and internal assessment for each practical course (75/25).

## 6 ATTENDANCE

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

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

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

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

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

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

6.10 **A student cannot claim condonation as his right and the condonation is at the discretion of the Head of the Department. A student can avail condonation / carry over only once during his course of study.**

## 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
Part-A (MCQ)	10	10	1	10
Part B Short notes (100 words)	5	5	2	10
Part C (Explanation 250 words)	5 out of 8	5	5	25
Part D (Discussion – 500 words)	3 out of 5	3	10	30
<b>Total Marks</b>				<b>75</b>

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	05
Viva-voce	05
Lab Record	05
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	90-100
A+	Excellent	9.0	80-89
A	Very Good	8.0	70-79
B+	Good	8.0	60-69
B	Above Average	7.0	50-59
RA	Reappear	6.0	Below 50
AB	Absent	N.A	ABSENT

## 9. INTERNSHIP AND FIELD TRAINING

Internship and field training is an important component of Sports Biomechanics and Kinesiology that provides students with the opportunity to gain applied practical experience in the field of Sports Biomechanics and Kinesiology. 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 Tamil Nadu (SDAT) coaching Centres / Sports Authority of India (Various coaching Centres of SAI) / Government Medical College/ Private Medical College and Hospitals other sporting centers 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 and proposal should be submitted in third Semester and candidate will work for one semester 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.

## **11. CO CURRICULAR ACTIVITIES:**

### **1. SWACHH BHARAT**

A student has to serve for 15 days in village and produce a report signed by village administration officer to acquire the two credits.

### **2. MOOC**

A student has to enroll the listed MOOC course and submit the completion certificate to the department to acquire the two credits.

### **3. INTERNSHIP**

A student has to attend the internship programme for a period of two weeks in the summer vacation of first year. He/she will be visiting the established sports biomechanics laboratories to gain hands on experience and submit the internship report in the department at the start of third semester to acquire two credits.

## PROGRAMME OUTCOMES (POs):

After successful completion of three-year degree program in Sports Biomechanics and Kinesiology should be able to:

<b>PO1</b>	Demonstrate and an understanding of major concepts in all disciplines of Sports biomechanics and Kinesiology
<b>PO2</b>	Solve the problem and also think methodically, independently and draw a logical conclusion. Employ critical thinking and the scientific knowledge to design, carry out, record, demonstrate, plan, and analyze.
<b>PO3</b>	The graduates will display professional and ethical behavior. The graduates will be able to communicate professionally.
<b>PO4</b>	Create an awareness of the impact of Sports biomechanics and Kinesiology on the environment, society, and development outside the scientific community.
<b>PO5</b>	After completion of graduation, they would be able to apply the acquired concepts and principles to study different branches of Sports biomechanics and Kinesiology in their future career. When a student pursues for postgraduate studies, he or she can make use of all the applications, field or laboratory which he or she has gained knowledge. This B.Sc. Programme will also help students to enhance their employability for jobs in different sectors.

### PROGRAM SPECIFIC OUTCOMES (PSOs):

<b>PSO1</b>	Identify and list out common structure and functions of various systems of human body and movement patterns.
<b>PSO2</b>	Understanding and analyse the human movement (Kinesiology) in Qualitative and quantitative method
<b>PSO3</b>	Understanding the basic concepts of biomechanics, mathematics in biomechanics and computer applications
<b>PSO4</b>	Identification of key performance indicators in each sport and sports performance analysis
<b>PSO5</b>	Understanding Sports talent identification, kinanthropometry, posture and gait
<b>PSO6</b>	Understanding and analyzing kinematics and kinetics of human movement through 3D motion capture, EMG, Force plate, IKD
<b>PSO7</b>	Understanding Sports talent Identification and Sports performance analysis and reporting
<b>PSO8</b>	Learn to use the advanced tools in biomechanics and identification of strength and weakness of athlete and prescription of remedial measures.
<b>PSO9</b>	Gaining hands on experience in collecting valid data and writing scientific research papers
<b>PSO10</b>	Design a sports specific periodization for performance enhancement and recovery from injury

Semester - I							
Part –I	Course Code	Name of the Course	Lecture	Credit	Internal	External	Total
Core Theory	23PD1CT 101	Applied Anatomy and Physiology	4	4	25	75	100
	23PD1CT 102	Physics for Biomechanics	4	4	25	75	100
	23PD1CT 103	Test, Measurement and Evaluation	4	4	25	75	100
DSE (Student will choose any one course from the pool of subject offered by department)	23PD1DSE101	Foundations of fitness, exercise prescription, strength and conditioning	3	3	25	75	100
	23PD1DSE102	Psychology of Sports Performance					
	23PD1DSE 103	Sports Physiology and Ergogenic aids					
	23PD1DSE 104	Biomechanics of Yoga					
Generic Elective	Student will choose any one course from the pool of subject offered by other department		3	3	25	75	100
Part –II Core Practical	23PD1CP101	Anatomy and physiology practicum	4	2	25	75	100
	23PD1CP102	Test, Measurement and Evaluation	4	2	25	75	100
<b>Total</b>	<b>CGPA</b>		<b>26</b>	<b>22 C</b>			<b>700</b>
Part – III A NON CGPA	Ability Enhancement Course (AEC) 23PD1 AEC001	Communicative skills	2	2	25	75	100
PART – III B NON CGPA	Co-curricular / Extension Activities	SWACHH BHARAT	-	2	-	-	-
<b>Grand Total</b>			<b>28</b>	<b>26 C</b>			<b>800</b>

Semester-II							
Part -I	Course Code	Name of the Course	Lecture	Credit	Internal	External	Total
Core Theory	23PD1CT201	Kinesiology	4	4	25	75	100
	23PD1CT202	Basic biomechanics	4	4	25	75	100
	23PD1CT203	Human gait, Posture and Corrective exercise	4	4	25	75	100
DSE (Student will choose any one course from the pool of subject offered by department)	23PD1DSE 201	Mathematics in Biomechanics	3	3	25	75	100
	23PD1DSE 202	Modeling and Simulation					
	23PD1DSE 203	Kinanthropometry and Podiatry					
	23PD1DSE 204	Sports Technology					
Generic Elective	Student will choose any one course from the pool of subject offered by other department		3	3	25	75	100
Part –II Core Practical	23PD1CP201	Kinesiology	4	2	25	75	100
	23PD1CP202	Basic Biomechanics	4	2	25	75	100
<b>Total</b>			<b>26</b>	<b>22 C</b>			<b>700</b>
Part – III A NON CGPA	Skill Enhancement Course (SEC) 23PD1SEC001	Microsoft office skills	2	2	25	75	100
PART III B NON CGPA	Co-curricular / Extension Activities	MOOC - Python	-	2	-	-	-
<b>Grand Total</b>			<b>28</b>	<b>26 C</b>			<b>800</b>

Semester – III							
Part -I	Course Code	Name of the Course	Lecture	Credit	Internal	External	Total
Core Theory	23PD1CT 301	Applied Biomechanics	4	4	25	75	100
	23PD1CT 302	Mechanics of Track and field events	4	4	25	75	100
	23PD1CT 303	Research Methods and Statistical Process in Sports sciences	4	4	25	75	100
DSE (Student will choose any one course from the pool of subject offered by department)	23PD1DSE101	Foundations of fitness, exercise prescription, strength and conditioning	3	3	25	75	100
	23PD1DSE102	Psychology of Sports Performance					
	23PD1DSE 103	Sports Physiology and Ergogenic aids					
	23PD1DSE 104	Biomechanics of Yoga					
Part –II Core Practical	23PD1CP301	Applied Biomechanics	4	2	25	75	100
	23PD1CP302	Track and field events Practicum	4	2	25	75	100
<b>Total (CGPA)</b>			<b>22</b>	<b>19 C</b>			<b>700</b>
<b>PART-III A NON CGPA</b>	Ability Enhancement Course (AEC) 23PD1AEC002	Personality Development	2	2 C	25	75	100
<b>PART-III B NON CGPA</b>	Co-curricular / Extension activities	Internship	-	2 C	-	-	-
<b>Grand Total</b>			<b>24</b>	<b>23 C</b>			<b>800</b>

S.NO	PRACTICAL	CONTENT
1	Applied Biomechanics	1. 3D mocap
		2. EMG / Force Plate
		3. Isokinetic dynamometry
2	Track and field events	1. Sprints (100m/200m/400m)
		2. Hurdles (100m/110m/400m)
		3. Middle distance (800m/1500m)/ Long distance (5k/10k)
		4. Shot put / Discus / Javelin / Hammer throw
		5. High Jump / Pole vault

**Semester – IV**

Part -I	Course Code	Name of the Course	Lecture	Credit	Internal	External	Total
<b>Core Theory</b>	23PD1CT 401	Mechanics Sports and games -I	4	4	25	75	100
	23PD1CT 402	Mechanics of Sports and Games skills – II	4	4	25	75	100
	23PD1CT 403	Sports Performance Analysis	4	4	25	75	100
<b>DSE (Student will choose any one course from the pool of subject offered by department)</b>	23PD1DSE 201	Mathematics in Biomechanics	3	3	25	75	100
	23PD1DSE 202	Modeling and Simulation					
	23PD1DSE203	Kinanthropometry and Podiatry					
	23PD1DSE 204	Sports Technology					
<b>Thesis</b>			0	6	25	75	100
<b>Part –II Core Practical</b>	23PD1CP 401	Field events - Practicum	4	2	25	75	100
	23PD1CP 402	Sports and games -II	4	2	25	75	100
<b>Total</b>	<b>CGPA</b>		23	<b>25 C</b>	-	-	<b>700</b>

S.NO	PRACTICAL	CONTENT
1	<b>Sports and Games - I</b>	1. Badminton / Tennis / Table tennis
		2. Basketball / Volleyball / Kabaddi
		3. Hockey / Football / Cricket
2	<b>Sports and games - II</b>	4. Boxing / Fencing / Wrestling
		5. Gymnastics / Weight Lifting / Swimming
		6. Golf / Squash / Archery

### **DEPARTMENT SPECIFIC ELECTIVES:**

A student can choose any one of the department specific electives subject enlisted in the odd semester and even semester according to his/her choice.

Sl. No	Odd Semester DSE		Sl. No	Even Semester DSE	
	Course code	Course name		Course code	Course name
1.	23PD1DSE101	Foundations of fitness, exercise prescription, strength and conditioning	1.	23PD1DSE 201	Mathematics in Biomechanics
2.	23PD1DSE102	Psychology of Sports Performance	2.	23PD1DSE 202	Modeling and Simulation
3.	23PD1DSE 103	Sports Physiology and Ergogenic aids	3.	23PD1DSE 203	Kinanthropometry and Podiatry
4.	23PD1DSE 104	Biomechanics of Yoga	4.	23PD1DSE 204	Sports Technology

### **GENERIC ELECTIVE:**

The Department of sports biomechanics and kinesiology offers one generic elective subject each in odd semester and even semester for the students of other departments.

Sl. No	Odd Semester DSE			Even Semester DSE	
	Course code	Course name		Course code	Course name
1.	23PD1GE 101	Human gait and posture		23PD1GE 201	Sports Biomechanics

**COURSE CODE: 23PD1CT101**  
**APPLIED ANATOMY AND PHYSIOLOGY**

**Learning Objectives**

1. To impart knowledge on structure and functions of different organs
2. Learn the integrated functioning of cells, tissues, organs and systems
3. To introduce the interrelationship between nutritional science and physiological functions

**UNIT-I Cell Biology:** Introduction to human anatomy, Anatomical terms, language of anatomy, levels of organization, various organ systems. Cell: Definition, structure and function. Cell division: Mitosis and Meiosis. Tissues: Definition, classification and function- Epithelial tissue, Connective tissue, Muscle tissue and Nervous tissue-Body Membranes.

**UNIT-II- Blood:** Definition and Functions- Composition of blood – Types and Functions of blood cell –Red Blood Cells (RBC) -Hemoglobin, White Blood Cells (WBC)- Types of White Blood Cells – platelets and Plasma. Blood Grouping and Typing. Blood Clotting - Definition and Mechanism.

**UNIT-III –Bones:** Histology and Physiology of Bones -A brief introduction to bones, joints, ligaments and muscles of the body-Structure and Functions of Skeletal System. Anatomical terms of bones - axial skeleton, appendicular skeleton. Bones of the upper limb, Bones of the lower limb, the vertebral column, the sternum, ribs and the skull. Types of Bones- Sex Differences in the Skeleton.

**UNIT-IV Cardiovascular System:** Position, Structure and Function of the heart. – Types of Blood Vessels: Arteries, Capillaries and Veins. Cardiac Cycle and Heart Sounds. Blood Flow - Arterial Pulse and Blood pressure – Definition, Procedure to measure and its values. Types of circulation: Systemic, Pulmonary, Coronary and Portal circulation. Lymphatic system- structure and function.

**UNIT-V Respiratory system:** Structure and Functions of Upper and Lower Respiratory System. Mechanism of breath inspiration and Expiration. Mechanism and Control of respiration., Gaseous exchange in lungs and tissues, Transport of oxygen and carbon dioxide.

**Reference Books:**

1. Jason LaPres, Beth Kersten and Yong Tang, (2016), Gunstream's Anatomy & Physiology: With Integrated Study Guide, Sixth Edition, McGraw-Hill Education, 2 Penn Plaza, New York, NY 10121.
2. Cinnamon L. Van Putte, Jennifer L. Regan & Andrew F. Russo, (2017), Seeley's Anatomy & Physiology, Eleventh Edition, McGraw-Hill Education, 2 Penn Plaza, New York, NY 10121.
3. Clancy, John & Andrew J.McVicar (1995), "Physiology & Anatomy – A Homeostatic Approach", London: Edward Arnold, A Division of holder head line PLC.
4. Guyton, A.C. (1979) Physiology of the Human Body. 5th ed. Saunders College of Publishing, Philadelphia.

### E-Learning resources:

1. <https://www.youtube.com/watch?v=jFKCXLiNx&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=11>
2. <https://www.youtube.com/watch?v=9KOZ2pr7yTE&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=3>
3. [https://www.youtube.com/watch?v=EFGvb6\\_tuoA&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=5](https://www.youtube.com/watch?v=EFGvb6_tuoA&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=5)
4. <https://www.youtube.com/watch?v=hXNtcxfdd3E&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=17>
5. [https://www.youtube.com/watch?v=R\\_8lx3Nt0OM&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=16](https://www.youtube.com/watch?v=R_8lx3Nt0OM&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=16)
6. <https://www.youtube.com/watch?v=OsrrNDid7XU&list=PLyj7LvLOVR9pnvfF2TmRLXZ5NkyzIE8tl&index=19>

### Course Outcomes

CO No	Course outcomes
CO 1	Identify the major levels of organization, major components of each organ and define the relationship between anatomy and physiology
CO 2	Describe the composition of different blood groups and their role in the body.
CO 3	Identify the classification of bones and joint movements
CO 4	Identify the structure and label the parts of respiratory system. Lung volumes and Capacities
CO 5	Illustrate the Structure and Function of the heart.

**Mapping with Programme Outcomes:**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>
<b>CO 1</b>	S	L	M	S	M
<b>CO 2</b>	S	M	L	S	M
<b>CO 3</b>	S	M	M	S	S
<b>CO 4</b>	S	M	M	S	M
<b>CO 5</b>	S	S	M	S	S

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

**COURSE CODE: 23PD1CT102**  
**PHYSICS FOR BIOMECHANICS**

**Learning Objectives**

1. To learn about fundamentals of physics and SI Units
2. To learn the laws of motion and projectiles
3. To learn about optics and acoustics
4. To learn about fluid dynamics and electricity and semi-conductors

**Unit – I**

**Units and Measurement:** Branches in Physics - Role of Physics in Sports and Biological System - SI Base Quantities and Units - Fundamental and Derived Quantities and their Units - Measurement of different quantities - Accuracy and Precision - Error Analysis - Significant and round off – Dimensional Analysis - Application of Unit and Measurements in sports.

**Unit -II**

**Laws of Physics and Motion:** Rest and Motion - Displacement and Distance - Velocity and Acceleration - Momentum – Force and Reaction - Moment, Torque and Couple - Free Fall and Vertical upward motion – Projectile Motion (Horizontal Projectile and Angular Projectile) - Circular Motion - Inertia and mass - Angular velocity and Acceleration - Kinematic of circular motion - Application of Laws of Motion and application of projectile motion in ball sports. Work, power and energy.

**Unit III**

**Optics and Acoustic:** Law of Reflection - Types of the lens - Laws of Refraction - Types of Mirror- Prism - Snell's Law- Refractive Index - Human Eye - Working Principle of Optic Fibre - Hygen's Principle - Coherent and Incoherent - Nature of Sound - Difference between Sound and Light - Types of Wave - Echo - Noise cancellation Technique -

Application of optics in binocular, Range finder in golf and archery sight - Application of acoustic in Sport indoor stadium or hall.

#### **Unit IV**

**Applied Fluid Dynamics and Solid Mechanic:** Fluid Dynamics Terminology - Types of Fluids - Viscosity effect based on Temperature - U-Tube manometer - Pascal Law - Bernoulli's principle - Drag and Lift - Types of Material - Stress and Strain - Hooks Law - Types of Stress and Strain - Factor of Safety - Types of Modulus. Role of Fluid Dynamics in water sports - Role of Aerodynamics in Cycling - Role of Solid Mechanics in Sports Helmet and Pole Vault.

#### **Unit V**

**Electricity and Semiconductors:** Basic Electricity Terminology - Circuit - Series and Parallel Connection - Power - Heating effect - of Current- Energy Consumption - AC and DC Current - Types of Battery - Semiconductor - Energy Level - P and N Type - Doping - Types of diodes - Application of Semiconductor.

#### **Reference**

1. John D. Cutnell and Kenneth W. Johnson, Introduction to Physics, Wiley, 10th Edition.
2. H C Sharma, Concept Physics: Part I, 2016 Edition.
3. H C Sharma, Concept Physics: Part II, 2016 Edition

## Course Outcomes

CO No	Course outcomes
CO 1	Describe the fundamentals of physics and SI units
CO 2	Evaluate the role of the Laws of motion
CO 3	Evaluate the role of projectiles
CO 4	Describe the optics and acoustics
CO 5	Identify the importance of electricity and semi-conductors

### 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

**COURSE CODE: 23PD1CE103**  
**TEST, MEASUREMENT AND EVALUATION**

**Learning Objectives**

1. To understand the importance of test, measurement and evaluation in sports
2. To acquire skills to construct norms, assess health and skill related fitness tests.
3. To learn and acquire the skills to conduct sports specific skill tests

**Unit I**

**Test, measurement and evaluation:** Definition and meaning of test, measurement and evaluation in Sports - Need and importance of test, measurement and evaluation in Sports science - Interrelationship between test, measurement and evaluation - Different types of testing procedure in sports - Factors affecting test, measurement and evaluation - Criteria for Test Selection– Scientific Authenticity - Meaning, definition and establishing Validity, Reliability, Objectivity, Norms–Administrative Considerations - Construction of physical fitness test, knowledge test, skill tests.

**Unit-II**

**Motor Fitness :**Meaning and Definition of Motor Fitness- Test for Motor Fitness; Oregon Motor Fitness Test (Separately for boys and girls) – Motor Ability; Barrow Motor Ability Test– Newton Motor Ability Test–Muscular Fitness–Kraus Weber Minimum Muscular Fitness Test - Physical Fitness Tests - AAHPERD Health Related Fitness Battery (revised in 1984) - ACSM Health Related Physical Fitness Test, Roger’s Physical Fitness Index. Motor Educability Tests: Metheny- Johnson motor educability test.

**Unit-III**

**Anthropometry and Physiological testing:** Anthropometric Measurements: Method of Measuring Height: Standing Height, Sitting Height. Method of measuring Circumference: -

Arm, Waist, Hip, Thigh. Method of Measuring Skin folds: Triceps, Sub scapular, Suprailiac. **Physiological Testing:** Treadmill test -cycle tests – Tests of Anaerobic Capacity and Anaerobic power – Lactic acid test – Hydration measurement.

#### **Unit-IV**

**Fitness tests:** Cardiorespiratory endurance test: distance test, step test and time test - speed tests- explosive power- agility - reaction time - static and dynamic balance tests – Coordination – strength and strength endurance – flexibility test – Questionnaires.

#### **Unit-V**

**Specific Sports Skill Test:** **Badminton:** Miller Wall Volley Test. **Basketball:** Johnson Basketball Test, Harrison Basketball Ability Test. **Cricket:** Sutcliff Cricket test. **Hockey:** Friedel Field Hockey Test, Harban's Hockey Test, **Volleyball:** Russel Lange Volleyball Test, Brady Volleyball Test. **Football:** Johnson Soccer Test, Mc-Donald Volley Soccer Test. **Tennis:** Dyer Tennis Test. **Handball:** Cornish Handball Test.

#### **Reference:**

1. **ACSM's Health/Fitness Facility Standards and Guidelines**, New York: Human, Kinetics, 1992.
2. **ACSM's Health related Physical Fitness Assessment manual**, Lippin Cott, 2008.
3. Michael Boyle. **Functional Training for Sports**. Human Kinetics, 2004.
4. Clake, H. Harrison. **Application of Measurement to Health and Physical Education, New Jersey:** Prentice Hall Inc. 1976.
5. Jensen, Clayne, R & Cynthia C. Hirst. **Measurement in Physical Education and Athletics**, MacMillan Publishing co., Inc New York, 1982
6. Juan Carlos. **Functional Training. Human Kinetics**. 2016.

7. Arnold G. Nelson & Jouko Kokkonen, **Stretching anatomy**. Human Kinetics. 2007.
8. Edmund O. Acevedo and Michael A. Starks. **Exercise Testing and Prescription lab Manual**, USA: Human Kinetics Publishers, 2003.
9. Claudio Gil Soares de Araujo. **Flexi test**, USA: Human Kinetics Publishers, 2004.
10. Thomas and Roger. **Essentials of strength training and conditioning**, 3<sup>rd</sup> edition, Human Kinetics, 2008.
11. Hoffman, J. (2006). **Norms for Fitness, Performance, and Health**. Human Kinetics. USA
12. Tomchuk, D. (2011). **Companion Guide to Measurement and Evaluation for Kinesiology**. Jones & Bartlett Learning. London U
13. Johnson, J. (2012). **Postural Assessment**. Human Kinetics. USA
14. Miller, T. (2012) **NSCA's Guide to Tests and Assessments** United States, Human Kinetics

### Course Outcomes

CO No	Course outcomes
CO 1	Learn the importance of test, measurement and evaluation in sports
CO 2	Understand the norms and criteria of constructing a standard test and learn about test Batteries
CO 3	Acquire the skills to test the anthropometry and physiological tests
CO 4	Acquire the skills to measure health related and skill related fitness tests
CO 5	To acquire the skills to conduct sports specific fitness tests

**Mapping with Programme Outcomes:**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>
<b>CO 1</b>	S	L	M	S	M
<b>CO 2</b>	S	M	L	S	M
<b>CO 3</b>	S	M	M	S	S
<b>CO 4</b>	S	M	M	S	M
<b>CO 5</b>	S	S	M	S	S

**COURSE CODE 23PD1CT201  
KINESIOLOGY**

**Learning Objectives:**

1. To make students understand the in foundations of kinesiology.
2. To make them aware about the fundamental movement of human body.
3. To make them learn the role and functions of muscles.
4. To enable them to learn the exercise program to strengthen and stretch the muscles.

To make them to acquire a strong foundation in kinesiology.

**Unit-I**

Kinesiology, meaning, history, scope and importance- muscle fiber architecture- uni-joint, two joint and multi joint muscles factors affecting muscular force generation; force velocity relationship, length tension relationship, electromechanical delay - functional role of skeletal muscles- planes and axis – fundamental movements of joints – role of muscles.

**Unit-II**

Structure of shoulder joint and shoulder girdle - origin, insertion and action of shoulder joint muscles and shoulder girdle muscles- - common injuries of the shoulder- Exercise program to stretch and strengthen the shoulder joint muscles. Structure of elbow joint- and wrist joint - Origin, insertion and action of elbow joint and wrist joint muscles- common injuries of elbow and wrist- Observation, palpation, and manual muscle testing - Range of motion assessment and joint mobility. Exercise program to stretch and strengthen the elbow joint and wrist joint muscles.

### **Unit-III**

Structure of pelvic girdle and hip joint - Origin, insertion and action of pelvic girdle and hip joint muscles- common injuries of hip joint - Observation, palpation, and manual muscle testing - Range of motion assessment and joint mobility. Exercise program to stretch and strengthen the pelvic girdle and hip joint muscles.

### **Unit-IV**

Structure of knee joint and ankle joint - Origin, insertion and action of knee and ankle joint muscles- common injuries of knee and ankle - Observation, palpation, and manual muscle testing - Range of motion assessment and joint mobility. Exercise program to stretch and strengthen the knee and ankle joint muscles joint muscles

### **Unit-V**

Structure of spinal column - Origin, insertion and action of spinal column muscles- Common injuries of spinal column-Exercise program to stretch and strengthen the spinal column muscles joint muscles. Observation, palpation, and manual muscle testing - Range of motion assessment and joint mobility. Kinesiological analysis of fundamental movements.

### **Reference:**

1. Kathryn Lutgens et al. **Kinesiology (Scientific Basis of Human Motion)**, Brown and Bench mark, 1992.
2. Robert Frost. **Applied Kinesiology**. Berkeley.2002.
3. Christy Cael. **Functional anatomy**, Lippincott.2010.
4. Joseph.E. Muscolino. **The Muscular System Manual (3<sup>rd</sup> edition)**. Elsevier, 2010.
5. Pamela K Lavange & Synthia C. Norkin. **Joint structure & function**. F.A. Davis company, 2005.
6. Donald A. Newmann. **Kinesiology of Musculoskeletal System**. Mosby.
7. Bernard Kingston. **Understanding muscles**. Chapman & Hall

8. Susan J. Hall, **Basic Biomechanics**, McGraw Hill Education, 2004.
9. Lynn S. Lippert. Clinical kinesiology and anatomy (4<sup>th</sup> edition). F.A. Davis Company. 2006.
10. Roger Bartlett, **Introduction to Sports Biomechanics Analyzing Human Movement Patterns**, Routledge, 2007.

### Course Outcomes

CO No	Course outcomes
CO 1	Describe the basic kinesiological concepts
CO 2	Understand the joints movements
CO 3	To learn about origin and insertion of muscles
CO 4	Describe the basic analysis of fundamental movements
CO 5	Identify the importance stretch and strengthening program in various joint muscles

### 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

**COURSE CODE: 23PD1CT202**  
**BASIC BIOMECHANICS**

**Learning objectives:**

1. To enable the students to learn the basic concept of biomechanics.
2. To make the students to understand kinematic and kinetic concept of human movement.
3. To equip the students to learn the principle of aerodynamic and hydrodynamics.
4. To enable the students to acquire the skills of qualitative and quantitative of human movement.

**Unit-I**

**Biomechanics** – Sports Biomechanics- branches of biomechanics; statics, dynamics, kinematics, kinetics-Definition - Meaning - Scope - Need and importance of Biomechanics - Historical development of Sports Biomechanics - Scholarly societies-International Journal of sports Biomechanics-International society of Biomechanics-American society of biomechanics-Canadian society of biomechanics-European society of biomechanics-AAPHERD-ACSM-Journals in Biomechanics.

**Unit-II**

**Kinematic concepts for analyzing human movement** - Kinematics; linear and angular kinematics- distance, displacement, speed, velocity and acceleration-forms of motion, linear motion, angular motion and general motion- tools for measuring kinematic quantities- common units of kinematic quantities. Kinetic concepts for analyzing human movement- Inertia, mass, force, net force, centre of gravity, weight, pressure, volume, density, specific weight, torque, impulse- common units of kinetic quantities- mechanical loads on the human body; compression, tension and shear force- mechanical stress' torsion, bending and combined loads- scalar, vector, composition and resolution, graphic solutions of vector problems- trigonometric solutions of vector problems- tools for measuring kinetic quantities.

### **Unit-III**

**Linear kinematics of human movement** - Linear kinematics- kinematics of projectile motion; horizontal and vertical components, influence of gravity, influence of air resistance- factors affecting projectile trajectory; projection angle, projection speed, relative height of release, optimum projection conditions, analysing projectile motion, equations of constant acceleration. Angular kinematics of human movement - Angular kinematics- measuring angles-relative and absolute angle-tools for measuring body angles- instant centre of rotation- angular kinematic relationship-; angular distance and displacement, angular speed and velocity, angular acceleration- relationship between linear and angular motion; linear and angular displacement, linear and angular velocity, linear and angular acceleration.

### **Unit-IV**

**Linear kinetics of human movement** - Newton laws; Law of inertia, law of acceleration and law of acceleration- law of gravitation- mechanical behaviour of bodies in contact; friction, static friction, kinetic friction, coefficient of friction- momentum – impulse- impact- coefficient of restitution- work, power and energy relationship- conservation of mechanical energy- principle of work and energy. Equilibrium and human movement - Torque, moment arm, couple, resultant joint torque, levers; types of levers, anatomical and mechanical levers- equations of static equilibrium- equations of dynamic equilibrium, centre of gravity and location of centre of gravity, location of human body centre of gravity; reaction board, segmental method- stability and balance. Angular kinetics of human movement - Resistance to angular acceleration; moment of inertia, determining moment of inertia, human body moment of inertia- angular momentum; conservation of angular momentum, transfer of angular momentum, change in angular momentum, angular analogues of Newton laws of motion- centripetal force and centrifugal force.

### **Unit-III**

**Linear kinematics of human movement** - Linear kinematics- kinematics of projectile motion; horizontal and vertical components, influence of gravity, influence of air resistance- factors affecting projectile trajectory; projection angle, projection speed, relative height of release, optimum projection conditions, analysing projectile motion, equations of constant acceleration. Angular kinematics of human movement - Angular kinematics- measuring angles-relative and absolute angle-tools for measuring body angles- instant centre of rotation- angular kinematic relationship-; angular distance and displacement, angular speed and velocity, angular acceleration- relationship between linear and angular motion; linear and angular displacement, linear and angular velocity, linear and angular acceleration.

### **Unit-IV**

**Linear kinetics of human movement** - Newton laws; Law of inertia, law of acceleration and law of acceleration- law of gravitation- mechanical behaviour of bodies in contact; friction, static friction, kinetic friction, coefficient of friction- momentum – impulse- impact- coefficient of restitution- work, power and energy relationship- conservation of mechanical energy- principle of work and energy. Equilibrium and human movement - Torque, moment arm, couple, resultant joint torque, levers; types of levers, anatomical and mechanical levers- equations of static equilibrium- equations of dynamic equilibrium, centre of gravity and location of centre of gravity, location of human body centre of gravity; reaction board, segmental method- stability and balance. Angular kinetics of human movement - Resistance to angular acceleration; moment of inertia, determining moment of inertia, human body moment of inertia- angular momentum; conservation of angular momentum, transfer of angular momentum, change in angular momentum, angular analogues of Newton laws of motion- centripetal force and centrifugal force.

## Unit-V

**Human movement in a fluid medium :** The nature of fluids; fluid, relative motion, relative velocity, laminar and turbulent flow, fluid properties- buoyancy; characteristics of buoyant force, Archimedes's principle, centre of volume, floatation- drag, coefficient of drag, skin friction, surface drag, viscous drag, form drag, profile drag, pressure drag, wave drag- lift force, coefficient of lift, foil, Bernoulli principle, angle of attack, lift drag ration- Magnus effect- Propulsion in fluid medium, propulsive drag theory, propulsive lift theory, vortex generation and stroke technique. Basic mathematic and related skills - Negative numbers, exponents, square roots, order of operations, use of a calculator, percentages, simple algebra, measuring angles, trigonometric functions, common units of measurement, anthropometric measurements for the human body.

### Reference Books:

1. Paul Grimshaw et al. Sports & Exercise Biomechanics, Taylor & Francis Group, (2007).
2. Susan J. Hall, Basic Biomechanics, McGraw Hill Education, 2004.
3. Peter McGinnis Biomechanics of Sport and Exercise, Human Kinetics, 2005.
4. Kathryn Lutgens et al. Kinesiology (Scientific Basis of Human Motion), Brown and Benchmark, 1992.
5. Roger Bartlett. Introduction to Sports Biomechanics Analyzing Human Movement Patterns, Routledge, 2007.
6. Roger Bartlett. Introduction to Sports Biomechanics, Spon Press, 1997
7. Knudson Duane V. Fundamentals of biomechanics, Springer, 2007.
8. Tomothy et al. Applied anatomy and biomechanics in sport (2nd edition), Human Kinetics, 2009
9. Steven T. McCaw. Biomechanics for dummies, John Wiley, 2014.
10. Anthony J. Blazeovich. Sports Biomechanics (2nd edition), Bloomsbury,

1. 2012. Web links:

1. -<http://www.sportsbiomech.com/aboutsportsbiomech.php>

2. [www.isb.com](http://www.isb.com)

3. [www.clinbiomech.com](http://www.clinbiomech.com)

### Course Outcomes

CO No	Course outcomes
CO 1	Describe the basic biomechanics concepts
CO 2	Understand the kinematics and kinetics
CO 3	To learn about fluid mechanics
CO 4	Describe the basic linear and angular kinematics
CO 5	Identify the importance basic mathematics in biomechanics

### 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

**COURSE CODE: 23PD1CT203**  
**HUMAN GAIT, POSTURE AND CORRECTIVE EXERCISE**

**Learning objectives:**

1. Know the basic parameters of human gait
2. Characterize normal human gait
3. Know the methods of gait analysis and assessment
4. Sketch the normal ranges of motion of the various joints during a gait cycle.
5. Describe various types of pathological gait.
6. Identify causes and compensation mechanisms for pathological gait.
7. Describe measurements used in analysis of human movement.
8. Understanding human posture, deformities and corrective exercise .

**Unit-I**

**Fundamentals of gait** - Meaning of gait, gait cycle divisions, Rancho Los Amigos gait terminology. **Gait parameters** - Temporal variables - stance time, single limb and double support time, swing time, stride and step time, cadence, speed. Spatial variables- stride length, step length and width, degree of toe out. Joint motion – Sagittal, frontal and Transverse plane joint angles. **Functional sub divisions of gait cycle** - Passenger unit, locomotor unit. Locomotor functions – Propulsion, stance stability, shock absorption, energy conservation.

**Unit-II**

**Normal gait** – Ankle foot complex – motion, muscle control and functional interpretation. Knee - motion, muscle control and functional interpretation. Hip - motion, muscle control and functional interpretation. Head, trunk, and pelvis - motion, muscle control and functional interpretation. Arm - motion, muscle control and functional interpretation. Total limb function- initial contact, loading response, mid stance, terminal stance, pre-swing, initial swing, mid swing, terminal swing.

### Unit-III

**Pathological gait** - Pathological mechanisms – deformity, muscle weakness, sensory loss, pain, spasticity. Abnormal gait - Structural impairment - leg length discrepancy, increased Q-angle, increased tibial torsion, increased pronation and supination of the foot. Functional impairment - Parkinson's gait, calcaneal gait, gluteus medius gait, gluteus maximus gait, antalgic gait, arthrogenic gait, ataxic gait, hemiplegic gait, scissors gait, foot drop gait, stiff knee gait, psosatic limp gait. Walking aids, types, prescription and indication.

### Unit – IV

**Kinematic methods of gait analysis** - Observational gait analysis - Motion analysis – Qualitative analysis – Quantitative analysis – 2-Dimensional analysis, 3-Dimensional analysis - Motion marker systems- sagittal, coronal and transverse plane landmarks. Electrogoniometers, Accelerometers. **Kinetic methods of gait analysis** – Electromyography – Ground reaction force and vector analysis – Instrumented walkways – Energy expenditure – normal walking speed, fast walking speed, and running.

### Unit- V

**Human Posture and corrective Exercise: Postural Assessment Techniques** - Overview of postural assessment methods - Observation, plumb lines, and grids in assessing alignment - Use of technology for objective posture analysis- Normal and Abnormal Postural Patterns - **Examination of ideal and neutral posture** - Identification of common postural deviations - Relationship between postural deviations and biomechanical factors - **Muscular Imbalances and Posture** - Understanding the role of muscles in maintaining posture - Imbalances between agonist and antagonist muscles - Muscle length-tension relationships and their effect on posture - **Corrective Exercise Techniques** - Strengthening weak muscles and inhibiting overactive muscles - Mobility and flexibility exercises for improving posture - Integrating stabilization exercises into a program.

**Reference Books:**

1. NihatOzkay&Margareta Nordin. **Fundamentals of Biomechanics: Equilibrium, Motion and Deformation**, Springer International Publisher, 2017.
2. MargaretaNordin& Victor Hirsch Frankel. **Basic Biomechanics of the Musculoskeletal System**, Lippincott Williams & Wilkins, 2001.
3. Arthur E. Chapman. **Biomechanical Analysis of Fundamental Human Movement**. Human Kinetics, 2008.
4. David A. winter. **Biomechanics and Motor Control of Human Movement (4<sup>th</sup> edition)**. John Wiley & sons, 2009
5. Jacquelin Perry. **Gait Analysis; Normal and Pathological functions (2<sup>nd</sup> edition)**. SLACK incorporated, 2010.
6. Michael Whittle. **Gait Analysis; An Introduction**, Butterworth-Heinemann, 2007.

**Course Outcomes**

CO No	Course outcomes
CO 1	Describe the basics of gait and its phases
CO 2	Understand the normal gait
CO 3	To learn about abnormal gait
CO 4	Describe the assessment methods of gait
CO 5	Identify the human posture, deviations and corrective 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

**COURSE CODE: 23PD1CT301**  
**APPLIED BIOMECHANICS**

**Learning Objectives:**

1. To familiarize the students with basic electronic devices.
2. To introduce the students the basic properties of high-speed cameras and calibrations.
3. To enhance their ability to assess and analyse human locomotion.
4. To provide students with a strong mechanical foundation to acquire the professional competence, knowledge and skills.
5. To study electromyography and force platform used for kinetic quantity measurement
6. To provide knowledge about advanced equipment and their significant practical applications in biomechanics.

**Unit-I**

Spots and exercise biomechanics- role and functions- research, scientific support services, education, consultancy- Analysis services; qualitative analysis, quantitative analysis- Procedures; Ethics, pre analysis preparation, detailed reporting. **Sensors and Transducers:** Principles of sensors and transducers in biomechanics - Types of sensors: force, pressure, strain, acceleration, etc. Calibration, accuracy, and reliability of sensors.

**Unit-II**

**Motion Capture and Analysis:** Overview of motion capture technologies - 2D and 3D mocap - Camera-based systems, marker placement, and data collection - Processing and interpretation of motion capture data- Marker less camera and procedures - Data Processing and Analysis. **Data acquisition systems and software tools** - Filtering, smoothing, and processing biomechanical data – IMU sensors and its uses in sports

### Unit-III

**Force and pressure measurement** - Force platform- piezoelectric and strain gauge technology - calibration- 2D and 3D force plates. Force Measurement and Analysis.

**Techniques for measuring ground reaction forces:** Instrumented treadmills, force plates, and load cells - Center of pressure analysis and force-time curves. **Pressure Measurement and Gait Analysis** - Applications of pressure sensors in biomechanics. Plantar pressure measurement, foot pressure distribution analysis - Role of pressure measurement in gait analysis.

### Unit-IV

**Surface electromyography-** equipment considerations- data collection procedures; electrode configuration, location and orientation, skin preparation, cross talk- sampling- processing, analyzing and presenting EMG- reporting an EMG study. **Isokinetic dynamometry-**Applications of isokinetic dynamometry- mechanical basis of isokinetic dynamometry measurements- isokinetic equipment considerations- isokinetic experimental and data collection procedures- processing, analyzing and presenting isokinetic data- reporting an isokinetic study. Eye tracker and its uses in sports

### Unit-V

**Instrumentation for Sports Performance Analysis:** Technologies for analyzing sports-specific movements - Use of wearable sensors, accelerometers, and GPS devices - Real-time feedback and performance enhancement. **Emerging Technologies in Biomechanical Instrumentation** - Overview of current trends and innovations - Wearable sensors, virtual reality, artificial intelligence- Implications for future biomechanical research and applications. **Prosthetics, Orthotics, and Assistive Devices:** Biomechanics in designing and fitting prosthetics and orthotics - Improving mobility and function through assistive devices - Case studies of innovative biomechanical solutions. **Biomechanics of Footwear:** Impact of footwear on gait, running, and jumping mechanics - Components of sports footwear: outsole, midsole, upper - Designing and selecting footwear for different sports disciplines

**Reference:**

1. Paul Grimshaw et al. **Sports & Exercise Biomechanics**, Taylor & Francis Group, 2007.
2. Susan J. Hall. **Basic Biomechanics**, McGraw Hill Education, 2004.
3. Peter McGinnis. **Biomechanics of Sport and Exercise**, Human Kinetics, 2005.
4. Kathryn Lutgens et al. **Kinesiology (Scientific Basis of Human Motion)**, Brown and Bench mark, 1992.
5. Roger Bartlett. **Introduction to Sports Biomechanics Analyzing Human Movement Patterns**, Routledge, 2007.
6. Knudson, Duane V. **Fundamentals of biomechanics**, Springer, 2007.
7. Vladimir, Medved. **Measurement of human locomotion**, CRC Press, 2001
8. John Mc Lester, & Peter St. Pierre, **Applied biomechanics**, Thompson, 2008.
9. Carl J. Payton & Roger M. Bartlett, **Biomechanical evaluation of movement in sports and exercise**, Routledge, 2008.
10. Roger Bartlett. **Introduction to Sports Biomechanics**, Spon Press, 1997

**Course Outcomes**

<b>CO No</b>	<b>Course outcomes</b>
<b>CO 1</b>	Describe the role of biomechanist
<b>CO 2</b>	Understand the methods of analyzing 2D and 3D motion in sports
<b>CO 3</b>	Acquire the skills of assessing force data in force plate and EMG
<b>CO 4</b>	Describe the assessment of Isokinetic Dynamometer procedures
<b>CO 5</b>	Identify the future directions of biomechanics and applications in sports

**Mapping with Programme Outcomes:**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>
<b>CO 1</b>	S	L	M	S	M
<b>CO 2</b>	S	M	L	S	M
<b>CO 3</b>	S	M	M	S	S
<b>CO 4</b>	S	M	M	S	M
<b>CO 5</b>	S	S	M	S	S

**COURSE CODE: 23PD1CT302**  
**MECHANICS OF TRACK AND FIELD EVENT**

**Learning objectives**

1. To equip the students to learn fundamental skills and techniques of track and field events.
2. To familiarize with mechanical principles involved in skills and technique track and field events.
3. To understand and conduct the qualitative and quantitative analysis in track and field events.
4. To acquire the skills of reviewing the current research studies.

**Unit-I**

**Track events** (Sprint - 100m, 200m and 400m) History, legends, world record, skills, technique, application of biomechanical principles, analysis of related research reviews, and analysis of current world and Olympic record holder's performance. Types of Crouch Start – Bunch start-Medium start-Elongated start - Running – Stride length - Take-off distance - Flight distance - Landing Distance - Stride Frequency - Action of leg - Supporting phase-Driving phase - Recovery phase - Action of arms -Action of trunk - Finish - Types of Finish - Start - Running – Finish- Spikes – Types of spikes - Starting block

**Unit-II**

**Hurdles (100m, 110m and 400m hurdles)**

History, legends, world record, technique, application of biomechanical principles, analysis of related research reviews, and analysis of current world and Olympic record holder's performance. Hurdles – High hurdles-Approach-take-off-Flight-Landing- Running between hurdles-Intermediate hurdles-Low hurdles.

### Unit-III

**Throws** (Shot-put, hammer, discus and javelin) History, legends, world record, technique, application of biomechanical principles, analysis of related research reviews, and analysis of current world and Olympic record holder's performance. **Shot-put** - Shot-put - O'Brien style-Initial stance-Glide-Delivery-Reverse - Rotation style- distance prior to release-Physique-Position-Distance after release-Height of release-Speed of release-Forces exerted -Angle of release –Air resistance - Advantages and Disadvantages of O'Brien and Rotation techniques. **Hammer** - Hammer Throw – Preliminary swing-The first turn-The second turn-The third turn-The delivery-Air resistance Speed of release-Angle of release-Height of release. **Discus** - Discus Throw – Initial stance –Preliminary swings-Transition-Turn-Delivery-reverse-Aerodynamic factors. **Javelin**-Javelin Throw - Types of Grip –Carry-Run – Transition, Throw, and RecoverySpeed, Angle, Height of release-Aerodynamic factors influencing flight- Advantages and Disadvantages of different Grips- Aerodynamic Javelin.

### Unit-IV

**Jumps** (Long jump, Triple jump, High jump and Pole vault) History, legends, world record, technique, application of biomechanical principles, analysis of related research reviews, and analysis of current world and Olympic record holder's performance. **Long Jump**-Hang style - Hitch Kick style - Approach run – Take-off -Flight in the Air - Landing – Take-off distance-Flight distance-Speed, angle, height of take off-air resistance-Advantages and Disadvantages of different styles. **Triple Jump** - Hop - Step and Jump- Approach Run – Take-off - Flight in the Air – Landing. **High jump**- straddle- fosbury flop- run up- take off- bar clearance- landing- height of take – off- physique – body composition at take off- flight height- vertical velocity at take off-clearance height- body position at peak- **pole vault**-carry- take off- clearance- landing-take off- swing height- clearance height- kinetic energy at take off- strain energy at take off- work done during ascent- mechanical energy losses - kinetic energy- usage and advantage of fiberglass- analysis of recent world pole vaulters.

## **Unit-V**

**Middle and Long Distance and Relays** (800m, 1500m, 5000m, 10000m , and 4x100m and 4x400m)

History, legends, world record, technique, application of biomechanical principles, analysis of related research reviews, and analysis of current world and Olympic record holder's performance.

### **Reference:**

1. The Sports Book (3rd Edition). D.K publishers.
2. Will Freeman. Track & Field Coaching Essentials. Human Kinetics. 2014.
3. Joseph. L. Rogers. USA Track & Field Coaching manual. Human Kinetics.2000.
4. Ed House Wright. Winning track & field for girls. Mountain Lion. 2010.
5. Tom Ecker. Basic Track & Field Biomechanics (4th edition). 2015
6. The Olympic and World Records book, Imagine Publishing, 2016.
7. James G. Hay, Biomechanics of Sports Technique, Prentice-Hall, 1993.

**COURSE CODE: 23PD1CT303**  
**RESEARCH METHODS AND STATISTICAL PROCESS IN SPORTS SCIENCES**

**Learning objectives:**

1. To equip students with a basic concepts of research.
2. To enable the students to learn the sampling techniques.
3. To enable students to chose the most appropriate research method / design to address a particular research question.
4. To equip the students to prepare a research proposal for grants.
5. To enable the students to prepare a research thesis/report/article for a journal.
6. To enable the students to learn the basic concepts of statistics.
7. To acquire the skills of parametric and non parametric statistical methods and apply the appropriate technique for a research data analysis.

**Unit-I**

Fundamentals of Research- Meaning and Definition of Research, Scope of Research in sports sciences, Qualities and Characteristics of Scientific Research - Criteria for locating and selecting a research problem - Delimitations and Limitations of a problem- Hypothesis and its formulation - Sampling- Sampling and Population, Sampling Techniques - Characteristics of a good sample - Sampling errors- Types of Research based on purpose – Basic research, Applied research, Action research – Types of research based on methods – Descriptive research, Experimental research.

**Unit-II**

Variables - Independent, Dependant, Extraneous and Intervening, Experimental, Control variables. Research design – Types of Research design – Single group design, Repeated measures design, Static group comparison, Random groups design, Post-test only random group design, Related groups design, Rotation group design, Quasi experimental design and Factorial design - Methods of Data Gathering and Sampling – Survey, Questionnaire, Interview, Case study, Observation, Opinionnaire.

### **UNIT-III**

Chapterization of Thesis / Dissertation - Front Materials, Body of thesis, Back materials, Method of Writing research proposal, Thesis / Dissertation - Method of writing abstract, full paper for presenting in a conference, publishing in journals, Mechanics of writing Research Report, APA referencing style, Plagiarism.

### **UNIT- IV**

Introduction to statistics types, classification and basic concepts of statistics – Levels of measurement - Measures of central tendency – Mean Median and Mode – Measures of variability - Range, Mean deviation Quartile Deviation and standard deviation. Introduction to Normal distribution – Normal curve – Characteristics of Normal Curve – Properties of Normal curve - Testing of Hypothesis: Hypothesis – Type I & II error Parametric and Non parametric statistic

### **UNIT- V**

Test of significance of a single Mean – Difference between two means for small and large sample tests – paired t – test for difference of mean. One way and two way analysis of variance – Post hoc tests - Scheffe's, Newman, Duncan, Tukey – Analysis of covariance. Pearson product moment correlation – Rank order correlation – Bi-serial Correlation-bhi coefficient - Detrahoric correlation- Partial and Multiple correlation – Chi square – contingency coefficient - SPSS Package – Introduction and application – creating, saving and opening a data file – Data entry and analysis of descriptive statistics, dependent and independent t-test, one way and two way ANOVA, ANCOVA, Repeated Measure and correlation – Naming the variables – editing the output file.

### **Reference:**

1. Clarke, David H. Clarke, Harrison H. Research Process in Physical Education, New Jersey: Prentice Hall Inc. 1984.
2. Jerry R. Thomas, Jack K. Nelson and Stephen J. Silverman., Research Methods in Physical Activity (5th Ed), New York: Human Kinetics. 2005.

4. John W. Best and James V. Kahn., Research in Education (9th Ed.), New Delhi: Prentice Hall of India Pvt. 2006.
5. Robertson .E Gordon D et al. Research Methods in Biomechanics. New York: Human Kinetics. 2004.
6. Darren George & Paul Mallery. IBM SPSS Statistics 23 step by step. Routledge. 2016.
7. Kathleen et al. An introduction to statistical analysis in research. Wiley. 2018.

**COURSE CODE: 23PD1CT401**  
**MECHANICAL ANALYSIS OF SPORTS AND GAMES – PART I**

**Learning objectives:**

1. To provide the acquaintance about the history of games, legends, skills and technique.
2. To recognize the mechanical principles involved in various skills of a game.
3. To acquire the skills with conducting research and evaluate the data on particular skill and technique in the relevant game.
4. To enable the students to learn to prepare standard biomechanical analysis report.

**Unit-I**

**Basketball and Handball**

History of the game, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - Basketball- Qualitative and Quantitative analysis Dribbling, types of passes - Chest pass - Overhead pass - Bounce pass - Baseball pass, Types of shooting-Set shot-Jump Shot-Layup shot. Handball - Dribbling-Passing- types of passing- Overhead pass- Types of shot –Jump shot - Playing surfaces-Types

**Unit-II**

**Volleyball and Kabaddi**

History of the game, legends, skills and technique, application of biomechanical principles, analysis of related research reviews- Volleyball- Qualitative and Quantitative analysis Serve, Types, Forearm pass Setting, Attack, Block, Floor defense - Kabaddi- offensive and defensive skills- match analysis.

**Unit-III**

**Tennis and Table tennis** :History of the game, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - Tennis- Qualitative and Quantitative analysis Service, types-

of service- Rally – fore hand rally-Back hand rally-offensive and defensive techniques – Tennis Rackets –Types- Playing surfaces- Table tennis- Qualitative and Quantitative analysis-Grip, Stance, Footwork, Forehand drive, Backhand drive, Backhand push, Forehand push, Serve, Return of serve, Basic strokes-Drive, Push, Block, Smash; Advance stroke – Loop, Chop, Flip and Lob.

#### **Unit-IV**

##### **Badminton and Squash**

History of the game, legends, skills and technique, application of biomechanical principles, analysis of related research reviews – Badminton - Qualitative and Quantitative analysis - grip, foot work, service and types; short, flick, high , drive - clears, drop shot, smash, drive, net play - Squash- Qualitative and Quantitative analysis, Racket Grip, Squash Swing (Forehand swing and back hand swing)

#### **Unit-V**

##### **Swimming**

History, legends, skills and technique, application of biomechanical principles, analysis of related research reviews-Swimming - Qualitative and Quantitative analysis – Free style, Front crawl, Butterfly, Breast stroke, and Back crawl.

##### **Reference:**

1. Hay, J. (1993). The Biomechanics of Sports Techniques, Benjamin Cummings.
2. Barth/Dietz. Learning swimming, Meyer & Meyer, 2002.
3. Cathy McGee, Coaching Basketball-Technical and Tactical skills, Human Kinetics, 2004.
4. Karen Palacios Jansen. Golf fitness. Taylor trade publishers, 2011.
5. Janusz Czerwinski & Frantisek Taborsky. Basic handball. European Handball Federation. 1997.
6. Renstrom. Hand book of Sports Medicine and Science Tennis. Blackwell science. 2002.
7. Philip Yarrow & Aiden Harrison. Squash steps to success (2nd edition). Human Kinetics. 2010.
8. Richard McAfee. Table tennis-Steps to success. Human Kinetics. 2009.
9. John Edwards. Badminton. Crow wood. 2014.

10. Brahm's. Badminton. Meyer & Meyer. 2009.
11. Barth/Nadman. Learning field hockey. Meyer & Meyer. 2005.
12. Robertson .E Gordon D et al. Research Methods in Biomechanics. New York: Human Kinetics. 2004.

**COURSE CODE: 23PD1CT402**  
**MECHANICS OF SPORTS AND GAMES – II**

**Learning Objectives:**

1. To enable the students to learn the basic skills and techniques of sports and games.
2. To learn and apply the mechanical principle on the technique of sports skill.
3. To understand the technique of qualitative and quantitative analysis.
4. To equip the students to carryout 3D analysis on sports skills and generate a valid report.

**Unit-I**

**Hockey and football**

History of the game, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - Hockey- Qualitative and Quantitative analysis – Dribbling- Pushing – Scooping-slap shot-Drag push and Drag flick- Hockey Sticks- Types of sticks- Playing surfaces - Football- Qualitative and Quantitative analysis - Kicking – instep kick-inside of the foot kick- passing-inside of the foot pass- Receiving -Throw in- Dribbling – Heading-Volle

**Unit-II**

**Cricket**

History of the game, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - Cricket- Qualitative and Quantitative analysis - batting: forward defense, backward defense, drives, cut, pull, and sweep - Bowling: Pace bowling, types and technique; medium pace, Spin bowling: types, leg spin, off spin and their improvisation – Fielding: catching, ground fielding, close and deep fielding- Wicket keeping.

**Unit-III**

**Boxing and fencing**

History, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - **Boxing**- Qualitative and Quantitative analysis- Foot work- a) Stand-up base base b) Cross footwork c) Circling; Punches - a) Jab b) Cross c) Hook -

d) Upper-cut; Blocks, parries and evasive techniques - a) Catch b) Side parry c) High front cover d) Low front cover e) Hook / side cover f) Shoulder roll g) Slip h) Duck i) Bob and weave - **Fencing**- Qualitative and Quantitative analysis- Lunge (attacking) - flunge (saber fencing) - Passata sotto (movement with a twist) - Parry (defensive move) - Counter attack (attack) - Riposte (counter attack) - Remise (series of attack) - Beat (attack) – Feint.

#### **Unit-IV**

##### **Gymnastics**

History, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - Men - Qualitative and Quantitative analysis -Floor exercise, parallel bar, horizontal bar, vaulting table. pommel horse and Roman rings – Women - Qualitative and Quantitative analysis -Uneven bars, Floor exercise, Balance beam and Vaulting table

#### **Unit-V**

##### **Golf and cycling**

History, legends, skills and technique, application of biomechanical principles, analysis of related research reviews - Golf - Qualitative and Quantitative analysis - carry-speed of release-Direction of Release-Height of release-Air resistance- The run-Putting- Techniques- Grip-Stance-The swingback swing-Down swing-Impact-Follow through - Cycling- analysis of velodrome and outdoor cycling events.

##### **Reference:**

1. Hay, J. (1993). The Biomechanics of Sports Techniques, Benjamin Cummings
2. Martin Toms. Routledge International book of gold science, Taylor & Francis, 2018.
3. Emeric Arius. Biomechanics of human motion (2nd edition). CRC Press. 2017.
4. Elaine Cheri. Fencing steps to success. Human Kinetics. 2002.
5. Gabi Amzaleg. Boxing technique. Create Space Independent Publishers. 2018.
6. Gary Blower. Boxing technique tactics skills. Crowood. 2012.
7. Rodrigo R. Bini & Felipe P. Carpes. Biomechanics of cycling. Springer.2014.
8. Robertson .E Gordon D et al. Research Methods in Biomechanics. New York: Human Kinetics. 2004.

## Course Outcomes

CO No	Course Outcomes
CO1	Describe the basics of research
CO2	Understand the methods of research
CO3	Acquire the skills of sampling and proposal writing
CO4	Describe the method of writing thesis
CO5	Identify the statistical methods and applications in 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
CO4	S	M	M	S	M
CO5	S	S	M	S	S

**COURSE CODE: 23PD1CT403**  
**SPORTS PERFORMANCE ANALYSIS**

**Learning Objectives:**

1. To make the students to learn the fundamental and advance strategies of performance analysis.
2. To enable the students to acquire the video capturing technique.
3. To make the students to learn and acquire the skills of using sports performance analysis software.
4. To enable the students to acquire the skills of sports performance analysis.
5. To enable the students to diagnose the strength and weakness of a player / team.
6. To create a platform for the students to choose sports perform analysis as a career.

**Unit-I**

Sports Performance analysis – meaning, need and importance of sports performance analysis, careers opportunities in sports performance analysis – purpose of sports performance analysis – match analysis, work rate analysis. Sports performance analysis methods and procedures.

**Unit-II**

Notational Analysis - Sport-specific notational systems; computerised notational analysis; notation in individual sports; notation in team sports; augmented feedback through videobased technologies; modelling of competitive sport; analysis of structures of sports informing performance indicators; flowcharts and presentation models of sports performance; reliability and validity of notational data; data processing; probability analysis; literature searching; critical evaluation of literature.

### **Unit-III**

Analysis of Sports Technique - Observation of movement; systematic models of qualitative technique analysis; deterministic models of technique analysis; principles of movement (position, orientation, velocity, acceleration, force production); quantitative analysis of performance; accepted 2D filming protocols; comparison to model proformas; assessment of reliability; justification of methods.

### **Unit – IV**

Kinematic methods of gait analysis - Observational gait analysis - Motion analysis – Qualitative analysis – Quantitative analysis – 2 Dimensional analysis, 3 Dimensional analysis - Motion marker systems- sagittal, coronal and transverse plane landmarks. Electrogoniometers, Accelerometers

### **Unit – V**

Kinetic methods of gait analysis – Electromyography – Ground reaction force and vector analysis – Instrumented walkways – Energy expenditure – normal walking speed, fast walking speed, and running.

### **Reference:**

1. NihatOzkay & Margareta Nordin. Fundamentals of Biomechanics: Equilibrium, Motion and Deformation, Springer International Publisher, 2017.
2. Margareta Nordin& Victor Hirsch Frankel. Basic Biomechanics of the Musculoskeletal System, Lippincott Williams & Wilkins, 2001.
3. Arthur E. Chapman. Biomechanical Analysis of Fundamental Human Movement. Human Kinetics, 2008.
4. David A. winter. Biomechanics and Motor Control of Human Movement (4th edition). John Wiley & Sons, 2009
5. Jacquelin Perry. Gait Analysis; Normal and Pathological functions (2nd edition). SLACK incorporated, 2010.
6. Michael Whittle. Gait Analysis; An Introduction, Butterworth-Heinemann, 2007.

## Course Outcomes

Co No	Course Outcomes
CO 1	Describe the basics of research
CO 2	Understand the methods of research
CO 3	Acquire the skills of sampling and proposal writing
CO 4	Describe the method of writing thesis
CO 5	Identify the statistical methods and applications in 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

**COURSE CODE: 23PD1DSE101**  
**FUNDAMENTALS OF FITNESS AND EXERCISE PRESCRIPTION**

**Learning Objectives**

1. To understand the importance of physical activity and health
2. To acquire skills to assess the cardiorespiratory fitness, muscle strength, body composition and flexibility components.
3. To design the exercise program for normal and special population

**Unit – I**

**Physical activity and health** – Health Benefits of physical activity - Domains of Physical Activity. Physical Activity Recommendations - Prevalence of Physical Activity - Benefits of Physical Activity and Chronic Disease. Benefits of Physical Activity and Chronic Disease - The Health Consequences of Physical Inactivity and Sedentary Behavior - Physical Inactivity- Sedentary Behavior - Preparticipation Screening, Fitness Assessment, and Interpretation - Preparticipation Health Screening - Risk Stratification for Those in Cardiac Rehabilitation and/or Medical Fitness Facilities.

**Unit -II**

**Cardiorespiratory Fitness Assessment**-Measuring Cardiorespiratory Fitness and the Maximal Oxygen Uptake-Contraindications to Exercise Testing - Maximal versus Submaximal Exercise Testing - Guidelines for Exercise Testing - Cardiorespiratory Test Sequence and Measurements - Procedures and Protocols for Maximal, Submaximal, and Field Exercise Tests - Field Tests for Cardiorespiratory Fitness Tests - Criterion-Referenced Standards versus Normative Data.

**Unit – III**

**Muscle Strength Assessment** - Dynamic Strength (Isotonic) - Muscular Endurance Strength - Isometric (Static) Strength–Handgrip Strength - Rate of Force Development - Isokinetic Strength Assessment - Functional Strength Assessments - Functional Movement-

Screen - Strength Evaluation. Body Composition Assessment - Rationale for Body Composition Assessment - Body Composition Models - Methodologies in Body Composition Assessment - Body Composition Assessment in Children and Adolescents - Body Fat Prediction Equation Selection - Interpretation of Body Fat Percentage Estimates.

#### **Unit-IV**

**Flexibility and Functional Movement Assessments** - Functional Movement Assessments - General Principles of Exercise Prescription - Exercise Prescription for All - Current FITT Recommendations from the American College of Sports Medicine - Aerobic Frequency - Aerobic Intensity- Aerobic Time (Duration) - Aerobic Type (Mode) - Aerobic Volume - Aerobic Progression - Resistance Components - Flexibility Components - Neuromotor Components - Setting Up a Program - Special Considerations across the Lifespan: Pregnancy, Children - and Youth, and Older Adults – Pregnancy - Preparticipation Health Screening, Medical History, and Physical Examination Exercise Testing Considerations Exercise Prescription and Progression Considerations - Children and Youth - Exercise Testing Considerations - Exercise Prescription and Progression Considerations Special Considerations and Physical Activity Recommendations for - Children and Youth - Older Adults - Exercise Prescription and Progression Considerations - Special Considerations for Exercise and Older Adults.

#### **Unit-V**

**Exercise Testing and Prescription for Special Populations** - Testing and Prescription for Special Populations Special Considerations for Cardiovascular Disease: Chronic Stable - Angina and Coronary Artery Bypass Graft Surgery - Graded Exercise Testing Considerations: Pretransplant - Graded Exercise Testing Considerations: Posttransplant - Special Considerations for Type 1 and Type 2 Diabetes Mellitus - Special Considerations for Metabolic Syndrome, Hypertension, and Dyslipidemia - Special Considerations for Chronic Obstructive Pulmonary Disease - Special Considerations for Asthma and Interstitial Lung Disease - Special Considerations for Weight Management - Special Considerations for Chronic Pain - Special Considerations for Cancer - Special Considerations for Bone Health and Osteoporosis - Special Considerations for Psychological Health - Special Considerations for Physical and Intellectual Disabilities.

