B.Sc. Sports Sciences

Semester – III

19BSSC301 : ESSENTIALS OF SPORTS BIOMECHANICS

Description:

This biomechanics component of this module investigates the mechanical principles required to produce movement. It analyses both internal and external forces with respect to the human body and its environment, with a view to applying various mechanical principles to optimise human performance

Learning Objectives:

- To understand the fundamental concepts of mechanics applicable to the study of human motion
- To demonstrate knowledge of the scientific approach to the study of human movement
- To understand the limitations imposed by physical laws on human motion
- To discuss the optimization of human performance through application of mechanical principles.
- To conduct basic analyses of human motion

Contribution to course aims and graduate attributes:

The biomechanics component provides students with an understanding of the physical laws that govern motion and forms the theoretical basis for subsequent applied biomechanical analyses of human movement. This knowledge is integral to the quantitative empirical approach to solving biomechanical problems in human movement science.

UNIT-I

Concepts in biomechanics

- What Is Biomechanics?
- What Are the Goals of Sport and Exercise Biomechanics?
- The History of Sport Biomechanics

Planes of movement and axes of rotation:

- what is planes
- types of planes
- how to correlate with joint motion planes
- what is axis
- types of axis
- how to function with movement planes

UNIT-II

Fundamental and derived quantities, vectors and scalars

Definition and explanation with examples

- work
- speed
- power
- energy
- vectors
- scalars
- energy-work relationship

- vector component
- Equilibrium or Changing Motion
- What are forces?
- Classification of forces and friction
- Addition of forces: force composition resolution of forces
- Static & dynamic equilibrium

Unit III:

Kinematics

A. Linear Kinematics

- Describing Objects in Linear Motion
- Motion
- Linear Kinematics
- Uniform Acceleration and Projectile Motion

B. Angular Kinematics

- Describing Objects in Angular Motion
- Angular Position and Displacement
- Angular and Linear Displacement
- Angular Velocity
- Angular and Linear Velocity
- Angular Acceleration
- Angular and Linear Acceleration
- Anatomical System for Describing Limb

Unit IV:

Linear Kinetics

- Explaining the causes of linear motion
- Newton's first law of motion: law of inertia
- Conservation of momentum
- Newton's second law of motion: law of acceleration
- Impulse and momentum
- Newton's third law of motion: law of action-reaction
- Newton's law of universal gravitation

Unit V:

Angular Kinetics

- Explaining the Causes of Angular Motion
- Angular Inertia
- Angular Momentum
- Angular Interpretation of Newton's First Law of Motion
- Angular Interpretation of Newton's Second Law of Motion
- Angular Impulse and Angular Momentum
- Angular Interpretation of Newton's third law
- Levers, types, and comparison with human joint
- Centre of gravity, line of gravity and mass determination
- Segmental kinetics
- Kinetic chain concepts
- Torques and Moments of Force
- Maintaining Equilibrium or Changing Angular Motion
- What Are Torques?
- Forces and Torques in Equilibrium

Recommended/Suggested Textbooks:

- Carmine Clemente. Gray's Anatomy of the Human Body. (30th Edition).
- Peter McGinnis. Biomechanics of Sport and Exercise. (2nd Edition).

19BSSC302 : BASICS IN EXERCISE PHYSIOLOGY

Learning Objectives

This module is the core of exercise physiology. The essence of this module is for the student to understand the physiological responses of the systems to exercise in order to uphold homeostasis and life.

UNIT I CARDIOVASCULAR RESPONSE AND REGULATION DURING EXERCISE & RECOVERY

- **Overview of cardiac anatomy and coronary circulation**.
  - Structure and properties of cardiac muscle
  - Special features of coronary circulation
  - Cardiac metabolism
  - Myocardial oxygen demand
- **Electrical activity of the heart**
  - Conducting system of the heart
  - Pacemaker potentials
- **Physiology of cardiac pump**
- **Cardiovascular regulatory mechanisms.**
  - Neural control of cardiovascular system
  - Hormonal control of cardiovascular system
  - Local regulation in the blood vessel
  - Cardiac response to acute exercise.
  - Cardiac response to short term sub maximal aerobic exercise
  - Cardiac response to incremental aerobic exercise
  - Cardiac response to static exercise
  - Cardiac response to dynamic resistance exercise
  - Exercising after cardiac transplantation
- **Blood pressure response to acute exercise**
  - Blood pressure response to resistance exercise
  - Blood pressure response to aerobic exercise
  - Blood pressure response to graded exercise
  - Blood pressure changes on recovery.
  - Effect of exercise on blood flow distribution
- **CVS response to exercise in special groups**
  - Upper body vs lower body aerobic exercise
  - Sex differences during aerobic exercise
  - Responses of children to aerobic exercise
  - Response of elderly to aerobic exercise
  - Sex difference in response to static exercise

- Cardiovascular responses to static exercise in older adults.

❖ **Measurements of cardiac function**

- Measurement of cardiac output
- Electrocardiogram
- Measurement of blood pressure

UNIT II RESPIRATORY RESPONSE AND REGULATION DURING EXERCISE & RECOVERY

❖ **Physiology of ventilation**

- Mechanics of ventilation
- Dead space – definition, types and measurement
- Ventilation perfusion ratio

❖ **Review of lung volumes and capacities**

❖ **Physiology of gas exchange- O2 transport**

- Structure of respiratory membrane and factors influencing gaseous exchange
- Oxygen uptake, transport and delivery
- Oxygen dissociation curve

❖ **Physiology of gas exchange – CO2 transport**

- Uptake, transport and delivery of CO2
- Respiratory exchange ratio

❖ **Regulation of ventilation during exercise**

- Respiratory centres
- Neural regulation of ventilation
- Chemical regulation of ventilation

❖ **Influence of age and sex on respiration during exercise**

❖ **Physiology of lactate metabolism**

- Onset of blood lactate accumulation
- OBLA and endurance performance
- OBLA and racial differences

UNIT III HORMONAL AND IMMUNE RESPONSE DURING EXERCISE & RECOVERY

❖ **Hormonal changes due to exercise**

- Hormonal changes due to acute exercise
- Hormonal changes due to endurance and resistance training

❖ **Immune response to exercise**

❖ • Overview of functions of cellular immunity AND Overview of functions of humoral immunity

- Immune response to short to medium duration high intensity exercise
- Immune response to prolonged high intensity exercise
- Cytokine response to exercise
- Hormonal control of immune response to exercise

- Training adaptations in immune system

❖ **Delayed onset muscle soreness**

UNIT IV SKELETAL MUSCLE RESPONSE AND REGULATION DURING EXERCISE & RECOVERY

❖ Muscle contractility: Classification and structure of muscle fibre types. Fiber type diversity and adaptation to exercise

❖ Muscle contractility

- Properties of skeletal muscle
- Sarcotubular system
- Excitation and contraction coupling
- Molecular basis of muscle contraction.
- Exercise-induced muscle hypertrophy.
- Thermal changes during muscle contraction

❖ Energy providing pathways

- ATP-CP Anaerobic Energy Pathway
- Anaerobic Metabolism – Glycolysis
- Aerobic Metabolism
- Fat oxidation and biosynthesis

❖ Physiology of recovery after exercise

❖ Skeletal muscle biopsy analysis

NEUROMUSCULAR RESPONSE AND REGULATION DURING EXERCISE & RECOVERY

❖ Neuromuscular response and regulation during exercise and recovery

- Structure of neuromuscular junction.
- Process of neuromuscular transmission

❖ Metabolic Responses to Exercise

- Short-Term, Intense Exercise
- Prolonged Exercise
- Incremental Exercise

UNIT V

BODY FLUID RESPONSE AND REGULATION DURING EXERCISE AND RECOVERY

❖ Glomerular filtration rate and renal blood flow

❖ Effect of exercise on kidney

- Control of renal blood flow during exercise
- Urinary water and electrolyte excretion during exercise
- Exercise induced hyponatremia
- Exercise associated proteinuria
- Exercise associated hematuria

❖ Body fluid response during exercise and recovery

- ❖ Renal regulation of acid base balance during exercise
- ❖ Pulmonary regulation of acid base balance during exercise
- ❖ Mechanisms and regulation of sweating

UNIT VI

THE BRAIN AS A REGULATOR OF EXERCISE

- ❖ Concept of fatigue
    - Central vs peripheral fatigue
    - High and low frequency fatigue
    - Models of peripheral fatigue
    - Models of central fatigue
    - Central governor theory
- ❖ Central vs peripheral control of exercise

Learning outcomes

For all these below, the student needs to understand, define and describe:

- Respiratory response and regulation during exercise and recovery
- Cardiovascular response and regulation during exercise and recovery
- *Skeletal muscle response and regulation during exercise and recovery*
- Endocrine responses during exercise and recovery
- Body fluid response and regulation during exercise and recovery
- Immune responses to exercise and recovery
- The brain as a regulator of exercise

Recommended/Suggested Textbooks:

- George Brooks, Thomas Fahey, Kenneth Baldwin. Exercise Physiology: Human Bioenergetics and Its Applications. (4th Edition).
- Jack H. Wilmore, David L. Costill. Physiology of Sport and Exercise. (3rd Edition).

19BSSC303 : FUNDAMENTALS IN SPORTS PSYCHOLOGY

Learning objective: To examines various personality and social-psychological factors that underlie participation, adherence and performance in physical activity and sport.

UNIT I

Review of psychology concepts

a. Historical and conceptual ideas
b. The peripheral and central nervous system
c. Brain structure and function
d. Perception

e. Memory
f. Decision-making
g. Information processing model
h. Skill acquisition and learning
i. Attitudes and attitude change

UNIT II

Personality and sport

a. Understanding personality structure
b. Measuring personality
c. Examining cognitive strategies and success

UNIT III

Motivation

a. Approaches to motivation
b. Building motivation
c. Developing realistic view

UNIT IV

Arousal stress and anxiety

a. Measuring arousal
b. Anxiety
c. Sources of stress & anxiety
d. Stress process

UNIT V

Aggression in sport

UNIT VI

Psychological factors that affect people in exercise environments

a. Reasons why people exercise
b. Reasons for not exercising
c. Determinants of exercise adherence
d. Influence of sport and exercise participation on psychological health and well-being
e. Addictive and unhealthy behaviour
f. Overtraining and burnout
g. Behaviour change models
h. Different psychological intervention strategies to enhance sport participation

Learning outcomes: At the completion of this module the students must be able to;

- Summarise the psychological theories and models from the area of sport and exercise psychology
- Demonstrate knowledge of personality and motivation and aggression in relation to sport and exercise

- Know the impact of arousal, stress and anxiety on sport performance
- Demonstrate knowledge of what competitive state anxiety is, and the factors that contribute to this state.
- Understand how group processes influence the individual and team functioning and performance.
- Understand how sport and exercise influence psychological health and well-being

Recommended/Suggested Textbooks:

- Robert S. Weinberg, Daniel Gould. Foundations of Sport and Exercise Psychology. (5th Edition).

19BSSC304 : INTRODUCTION TO SPORTS INJURIES

Objectives of module and outcomes

Many sports contain similar components of exercise (e.g. running, jumping), but vary with regards to the overall outcome of the sport (e.g. high jump vs. sprinting). It is rare that an individual know and understand all the sports, but in order to aid the athlete/coach/sport doctor/nutritionist, it is essential for the student to be familiar with the injuries associated with the codes. The sports scientist should be aware of serious injuries which demand cessation of sport or exercise or its modification thus. Focus should be given to prevention of injuries as part of training programmes. Finally, the most common injuries associated with a particular code will be highlighted.

UNIT I:

1. Basic concepts in injury: Tissues which can be injured (eg-bone, tendons)
2. Acute injuries: definitions, classification, grading
3. The inflammation process- 3 phases. Chronic and overuse injuries

UNIT II:

1. Introduction to pathophysiology of orthopaedic injury and healing
2. Referrals and professional ethics
3. Components of clinical assessment: Inspection, Palpation, Measurements, movements, etc

UNIT III:

Assessment and prevention of thorax, abdomen, spine and pelvis injuries

UNIT IV:

Assessment and and prevention of upper limb injuries

Shoulder – Elbow – Wrist – Hand

Assessment and and prevention of lower limb injuries

Hip – Thigh – Knee – Leg – Ankle - Foot

UNIT V: Gait cycle and retraining

What is gait re-training?

Purpose of gait re-training

Preparation and procedure for gait re-training?

With and without walking aids gait re-training?

Types of tools and procedure

Recommended/Suggested Textbooks:

- Brukner and Khan. Clinical Sports Medicine. 4th Ed.
- Natarajan's text book of orthopaedics and traumatology- seventh edition

19BSSE305 : BASICS OF RESEARCH METHODOLOGY

UNIT I:

Introduction to the Process of Conducting Research: Introduction, Steps in the Process of Research, Identifying a hypothesis and/or research problem, specifying a purpose,

UNIT II:

Research Designs, Creating research questions, Review of literature, Ethics of research and informed consent, Research proposal writing & Components of Research paper.

UNIT III:

Introduction to Qualitative, Quantitative and Mixed methods Research: Essence of Qualitative Data, Sampling, Collection Techniques, Biography.

UNIT IV:

Essence of Quantitative Data, Collection and Analysis Techniques, Choosing a good instrument, Interval and Ratio Scales, Validity and Reliability, Essence of Mixed Methods, Advantages, Design Components, Explanatory Mixed Methods Frameworks.

UNIT V:

Epidemiological Methods: Measuring disease frequency, Descriptive and analytical studies-observational and experimental studies and Biases in Epidemiological Studies

Text Books :

- Research Methods: Methods and Techniques by Kothari CR. New Age International Publishers- 2004
- Research Methodology: A step by Step Guide to Beginners by Ranjit Kumar. SAGE Publishers-2014.
- Research Methods by Pannerselvam R. PHI Learning Pvt Ltd-2013
- Becoming Quantitative Researchers- An Introduction by Glesne C. Pearson Publishers-2015
- Research Methods by Rajendra Kumar. APH Publishers-2008

19BSSP306 : MAJOR GAMES AND SPORTS - II

Dimensions of Play Field – Rules and Interpretation – Skills and techniques – tactics and strategies of the games and sports: tennis, tennikoit, ball badminton, football, hockey, handball, cricket and netball