

Master of Sports Science in Sports Physiology
Faculty of Sports Sciences
Rajiv Gandhi University



REGULATIONS
&
SYLLABUS

CHOICE BASED CREDIT SYSTEM

(From academic session 2020 onwards)

OBJECTIVE OF THE COURSE

One of the fundamental assumptions of the proposed curriculum is based on possibilities of independent thinking, ability to integrate and synthesize from a trans-disciplinary and multicultural perspective, to evolve a knowledge based system for preparing Sport Physiology Enthusiast of India who would contribute and participate effectively in the emergent world of Sport, with capacities to remain locally relevant and globally effective.

1. Student will not only confine to the knowledge base and theoretical foundations of the discipline of Sports Physiology. It will also attend to the pedagogical considerations emanating from experiential learning, research-driven problem solving and mentoring athlete.
2. Curriculum proposes to have a strong interface between regular as well as innovative teaching pedagogies.
3. Empower the students to inculcate specific job oriented skills, as well as building other behavioral skills and competencies to cater to the needs of athletes and coaches.
4. The curriculum intends to build some basic reflective, computational and communicative competencies in the students. In addition to these it also intends to hone the following competencies:
Development of critical thinking, Problem solving, Emotional intelligence, Analytical competence, Independent thinking, Cultural sensitivity, engaging in discovering self and inner potential to work with Athletes and coaches for performance enhancement
5. After completing this course student can go for further studies, works in Universities, Research and Development industry (Govt. or Private), Research Institutes, and Government Organization etc.

ELIGIBILITY CRITERIA

- A)** Academic Qualification: Bachelor's Degree in Sports Science / Physical Education and Sports / Physiology / Human physiology / Occupation Therapy / Physiotherapy / Biotechnology / Zoology / Microbiology / Biochemistry / Life Sciences / MBBS or equivalent thereto in 10+2+3 or 10+2+4 pattern from a recognized university with a minimum of 50% marks in aggregate of 55% marks in aggregate with 5% relaxation for (SC/ST).
- B)** Proficiency in Sports is desirable for the candidates who take up above mentioned courses, but he/ she must be medically fit and free from any deformities.
- C)** The pregnant women will not be permitted either for admission or to undergo the programme.
- D)** Admission shall be made on the basis of ranking for a total of 100 marks as given below:
- | | |
|------------------------|------------------|
| 1. General Awareness : | 30 marks |
| 2. Subject Knowledge : | 70 marks |
| Total Marks : | 100 Marks |

PROPOSED SCHEME OF EXAMINATION

SEMESTER I

Course Code	Course Name	Credit	Teaching Hours	Internal Marks	External Marks	Total Marks
PART- A (THEORY)						
MSCSP-CC:101	Fundamentals of Sports Physiology	4	64	20	80	100
MSCSP-CC:102	Cardio-Respiratory Concepts in Sports Physiology	4	64	20	80	100
MSCSP-CC:103	Musculoskeletal Adaptation in Sports Physiology	4	64	20	80	100
MSCSP-CC:104	Research Methods in Sports Science	4	64	20	80	100
Elective (choose any one)						
MSCSP-EC:101	Sports Training	4	64	20	80	100
MSCSP-EC:102	Project Work	4	64	20	80	100
TOTAL		20	320	100	400	500
PART- B (PRACTICAL)						
MSCSP-PC:101	Cardio-Respiratory Concepts in Sports Physiology	4	72	50	50	100
MSCSP-PC:102	Musculoskeletal Adaptation in Sports Physiology	4	72	50	50	100
		8	144	100	100	200
GRAND TOTAL		28	464	200	500	700

SEMESTER II

Course Code	Course Name	Credit	Teaching Hours	Internal Marks	External Marks	Total Marks
PART- A (THEORY)						
MSCSP-CC:201	Applied Sports Physiology	4	64	20	80	100
MSCSP-CC:202	Sports and Exercise Physiology	4	64	20	80	100
MSCSP-CC:203	Physiological Support of Athletes	4	64	20	80	100
MSCSP-CC:204	Applied Statistics in Sports Science	4	64	20	80	100
Elective (choose any one)						
MSCSP-EC:201	Applied Technology in Sports Physiology	4	64	20	80	100
MSCSP-EC:202	Exercise Psychology	4	64	20	80	100
TOTAL		20	320	100	400	500
PART- B (PRACTICAL)						
MSCSP-PC:201	Applied Sports Physiology	4	72	50	50	100
MSCSP-PC:202	Physiological Support of Athletes	4	72	50	50	100
		8	144	100	100	200
GRAND TOTAL		28	464	200	500	700

SEMESTER III

Course Code	Course Name	Credit	Teaching Hours	Internal Marks	External Marks	Total Marks
PART- A (THEORY)						
MSCSP-CC:301	Sports Genetics and Talent Identification	4	64	20	80	100
MSCSP-CC:302	Physiological Assessments in Sports	4	64	20	80	100
MSCSP-CC:303	Environmental Sports Physiology	4	64	20	80	100
MSCSP-RC:304	Thesis (Synopsis Presentation and Data Collection)	4	64	20	80	100
Elective (choose any one)						
MSCSP-EC:301	Sports and Exercise Immunology	4	64	20	80	100
MSCSP-EC:302	Sports Biomechanics	4	64	20	80	100
TOTAL		20	320	100	400	500
PART- B (PRACTICAL)						
MSCSP-PC:301	Sports Genetics and Talent Identification	4	72	50	50	100
MSCSP-PC:302	Physiological Assessments in Sports	4	72	50	50	100
		8	144	100	100	200
GRAND TOTAL		28	464	200	500	700

SEMESTER IV

Course Code	Course Name	Credit	Teaching Hours	Internal Marks	External Marks	Total Marks
PART- A (THEORY)						
MSCSP-CC:401	Clinical Sports Physiology	4	64	20	80	100
MSCSP-CC:402	Nutrition and Sports Performance	4	64	20	80	100
MSCSP-CC:403	Sports Ergonomics and Ergogenic Aids	4	64	20	80	100
MSCSP-RC:404	Thesis (Submission)	4	64	20	80	100
Elective (choose any one)						
MSCSP-EC:401	Sports Injuries, Physiotherapy and Rehabilitation	4	64	20	80	100
MSCSP-EC:402	Sports Physiology and Gender	4	64	20	80	100
TOTAL		20	320	100	400	500
PART- B (PRACTICAL)						
MSCSP-PC:401	Clinical Sports Physiology	4	72	50	50	100
MSCSP-PC:402	Nutrition and Sports Performance	4	72	50	50	100
		8	144	100	100	200
GRAND TOTAL		28	464	200	500	700

CUMULATIVE CHART

SEMESTERS	Assessment Pattern			Teaching Hours		Total Credits
	Internal Marks	External Marks	Total Marks	Theory Hours	Practical Hours	
I	200	500	700	320	144	28
II	200	500	700	320	144	28
III	200	500	700	320	144	28
IV	200	500	700	320	144	28
GRAND TOTAL	800	2000	2800	1280	576	112

Detailed Syllabus for Two-year M. Sc. Course in Sports Physiology

Faculty of Sports Science
RGU, Rono Hills, Doimukh

1st Semester

MSCSP-CC: 101- Fundamentals of Sports Physiology

Learning Objectives: To learn the changes in human body systems due to exercise and sporting activities in an integrated manner. The subject also provides and gains knowledge about sports training.

Learning Outcome: Students will be ready to study effect of exercise and sports in detail and in application perspective. Students will also be able to measure the changes and interpret them in the context of sports.

UNIT-I: INTRODUCTION

- 1.1 Cells, Tissues, Organs and System Organization
- 1.2 Physiology, Exercise Physiology and Sports Physiology;
- 1.3 Scope of Sports Physiology;
- 1.4 Importance of study Sports Physiology in the field of sports and physical education;
- 1.5 Application in Competitive sports, Recreation sports, Medical rehabilitation

UNIT-II: HUMAN SYSTEM

- 2.1 Muscular System: Structure and Types of muscles;
 - 2.1.1 Anatomy of muscle fiber; Muscle fibers; types and characteristics;
 - 2.1.2 Muscle hypertrophy and atrophy; Muscle tone and fatigue.
- 2.2 Nervous System: Classification of nervous system (Central and peripheral);
 - 2.2.1 Structure and Function of neuron;
 - 2.2.2. Ion channels; Role of action potential in neuron transmission;
 - 2.2.3 Neurotransmitters and drug abuse.
- 2.3 Endocrine System: Different endocrine glands and their hormones; Major functions;
 - 2.3.1 Mode of action mechanism and regulation
 - 2.3.2 Endocrine Response to Exercise and Training

UNIT-III:

- 3.1 Cardiovascular System: Anatomy of heart and blood vessels;
 - 3.1.1 Conduction system in heart; Normal electrocardiogram; Systemic,
 - 3.1.2 Coronary and Pulmonary circulation;
 - 3.1.3 Cardiac cycle; Cardiac output and Blood Pressure
- 3.2 Respiratory system: Anatomy of respiratory system; Upper and lower respiratory tract;
 - 3.2.1 External, Internal and Cellular respiration;
 - 3.2.2 Pulmonary ventilation; Principles of gaseous exchange – diffusion of oxygen and carbon dioxide from respiratory membrane;
 - 3.2.3 Transport of oxygen and carbon dioxide in the blood and body fluids.
 - 3.2.4 Regulation of respiration: Chemical control; Peripheral chemo receptors in the regulation of respiration.

UNIT-IV:

- 4.1 Digestive System: Organs of Gastrointestinal Tract and their major functions
 - 4.1.1 Digestion and Metabolism
 - 4.1.2 Exercise and Gastrointestinal Function
- 4.2 Excretory System; Anatomy; Function
 - 4.2.1 Renal circulation; Auto regulation of the circulation; structural and functional unit
 - 4.2.2 Urine formation; Body fluid compartments and its regulation

- 4.2.3 Intracellular and extracellular body compartments; Constituents of extracellular fluids and osmotic regulation
- 4.2.4 Regulation of acid base balance; Respiratory & renal mechanism; Clinical abnormalities of acid base balance
- 4.2.5 Renal Response to Exercise and Training

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005). Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.

MSCSP-CC: 102- Cardio-Respiratory Concepts in Sports Physiology

Learning objectives: Understanding the cardio-respiratory system responses to athletes in sports activities and adaptation into the training.

Learning outcome: Capable of application of cardio-respiratory training to the training periodization in a systematic ways according to the athletes capabilities and contribute to enhance sports performance.

UNIT-I: CARDIOVASCULAR SYSTEM

- 1.1 Structure and function of cardiovascular system.
- 1.2 Cardiac Output
 - 1.2.1 Measurement of Cardiac output; Factor effecting cardiac output
 - 1.2.2 Regulation of cardiac output
- 1.3 Blood and Blood Vessels
 - 1.3.1 Composition of Blood
 - 1.3.2 Physiology of Blood vessels
 - 1.3.3 Fluid Exchange across blood vessels
 - 1.3.4 Bohr effect, Haldane effect, Chloride shift, cardiovascular drift

UNIT-II: EFFECT OF SPORTS ACTIVITIES ON CARDIOVASCULAR SYSTEM

- 2.1 Cardiac output during rest, exercise and sports
- 2.2 Cardiovascular adaptations to exercise and sports
 - 2.2.1 Response to dynamic resistance and Endurance training.
- 2.3 Sports activities and Blood Pressure
 - 2.3.1 Blood Pressure and its maintenance (During and After Sports Activities)
 - 2.3.2 Effect of sports activities on Blood Pressure (Immediate and Long Term)
 - 2.3.3 Effect of Sports activities on systolic and diastolic blood pressure

UNIT-III: RESPIRATORY SYSTEM AND SPORTS

- 3.1 Structure of Respiratory System
- 3.2 Mechanism of Breathing; Pulmonary Ventilation and Pulmonary Diffusion
- 3.3 Measurement of Lung Volumes
- 3.4 Transport of Oxygen and Carbon dioxide
- 3.5 Gas Exchanges at the working muscles
- 3.6 Aerobic and Anaerobic Power

UNIT-IV: EFFECT OF SPORTS ACTIVITIES ON RESPIRATORY SYSTEM

- 4.1 Respiratory regulation of Acid-base balance
- 4.2 Regulation of respiration during rest and exercise
- 4.3 Respiratory adaptation to sports and training
 - 4.3.1 Response to dynamic resistance and endurance training
- 4.4 Determining respiratory system and sports
- 4.5 Sports and Pollution

Suggested Books:

- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA
- Victor F. Froelicher, Jonathan Myers (2006) Exercise and the heart. Elsevier Inc.
- K. Wasserman, J Hansen, D Sue, W Stringer, B Whipp, (2004) Principles of Exercise Testing and Interpretation, 4th edn.. Lippincott Williams & Wilkins, Philadelphia, USA.
- Christopher Bell (2008). Cardiovascular Physiology in Exercise and Sport; 1st Edition.; Churchill Livingstone
- Michael G. Levitzky (2013). Pulmonary Physiology, 8th Edition; Lange. The McGraw-Hill Companies.
- Denise L. Smith and Bo Fernhall (2011). Advanced cardiovascular exercise physiology. Human Kinetics

MSCSP-CC: 103: Musculoskeletal Adaptation in Sports Physiology

Learning Objectives: To provide the knowledge of musculoskeletal system and process of adaptation of load by the athletes during sports activities.

Learning Outcome: Enables the students to gain an overall understanding of human body functioning during exercise and sports activities and thus provide appropriate nutrition/fuel.

UNIT-I: SKELETAL SYSTEM

- 1.1 Concept and functions
- 1.2 Bone Growth and Sports
- 1.3 Factors Influencing Bone Health
 - 1.3.1 Age Related Changes in Bones
 - 1.3.2 Growth of Peak Bones Mass
- 1.4 Skeletal Adaptation to Sports Training

UNIT-II: THE MUSCULAR SYSTEM

- 2.1 Concepts of Muscles, its characteristics
- 2.2 Classification and functions
- 2.3 Structure of Skeletal Muscles
 - 2.3.1 Microscopic structure of muscle fiber
 - 2.3.2 Molecular structure of the Myofilaments
- 2.4 Contractions of Muscles fiber
 - 2.4.1 The Sliding Filament Theory of muscle
 - 2.4.2 Excitation-Contraction Coupling

UNIT-III: NEUROMUSCULAR ASPECT OF MUSCLES CONTRACTION

- 3.1 Neuro-muscular Junction
- 3.2 Neural Control of Muscle Contraction
 - 3.2.1 Nerve Impulse; Motor Unit and all-or-none law
- 3.3 Reciprocal Inhibition of Muscular Movement
- 3.4 Concept of Proprioception
 - 3.4.1 Muscles spindle and Golgi Tendon Organs
 - 3.4.2 Proprioceptors and related reflexes

UNIT- IV: MUSCULAR ADAPTATION OF SPORTS AND TRAINING

- 4.1 Muscular Force Production
 - 4.1.1 Tension versus Load
 - 4.1.2 Classification of Muscle Contraction
 - 4.1.3 Muscles forces Developments
- 4.2 Muscular Fatigue and Soreness
 - 4.2.1 Muscular Fatigue
 - 4.2.2 Types of Activity and Muscular Fatigue
 - 4.2.3 Muscles Soreness
- 4.3 Neuromuscular Adaptation to Resistance Training
 - 4.3.1 Muscles Function
 - 4.3.2 Muscles size and structure
 - 4.3.3 Neural Adaptations
 - 4.3.4 Hormonal Adaptations
- 4.4 Neuromuscular Adaptations to Detraining

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to

- Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005) Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
 - Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
 - Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
 - C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
 - Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England
 - Roy J. Shephard and Henry S. Miller, Jr. (1999) Exercise and the Heart in Health and Disease. Marcel Dekker
 - Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA
 - McArdle, W.D., Katch, F.I., Katch, V.L. (2006) Essentials of Exercise Physiology. Lippincott Williams and Wilkins, USA.
 - Christopher B. Cooper and Thomas W. Storer (2004) Exercise testing and interpretation- A practical approach. Cambridge University Press.
 - Denise L. Smith and Bo Fernhall (2011). Advanced cardiovascular exercise physiology. Human Kinetics
 - ACSM's Guidelines for Exercise Testing and Prescription, 8th ed., Lippincott
 - Wilmore, J., Costill, D., and Kenney, W. (2008). Physiology of Sport and Exercise, 4th ed., Human Kinetics,
 - Astrand, P, et al. (2003). Textbook of Work Physiology, 4th ed., Human Kinetics,

MSCSP-CC: 104: Research Methodology in Sports Science

Learning Objectives: To learn methodology of carrying out scientific research

Learning Outcome: Student will be able to generate new research topic, plan and execute research

UNIT- I: INTRODUCTION

- 1.1 Basic concept of Research,
 - 1.1.1 Types of Research
 - 1.1.2 Steps of Research
- 1.2 Hypothesis: Meaning, Basis, Types, Testing of hypothesis-
 - 1.2.1 Type I Error, Type II Error, One Tailed Test and Two Tailed Test.
- 1.3 Sampling: Population, Sample, Sampling Techniques-
 - 1.3.1 Probability Sampling and Non- Probability Sampling,
 - 1.3.2 Size of sample and Sampling Error.
- 1.4 Variables and its classification.

UNIT- II: LITERATURE AND RESEARCH TOOLS

- 2.1 Review of literature: Need, Purpose and Kinds
 - 2.1.1 Steps of Literature Review
 - 2.1.2 Sources and types
- 2.2 Identifying the Research Problem, Meaning and Formulation of Research
- 2.3 Research Tools: Characteristics, Types, Selection of appropriate tool
- 2.4 Construction and Standardization of tools-Reliability, Validity and Norms.

UNIT- III: EXPERIMENTAL DESIGNS AND ETHICAL ISSUES IN RESEARCH

- 3.1 Experimental Designs
- 3.2 Introduction: Plagiarism
 - 3.2.1 Areas of scientific dishonesty;
 - 3.2.2 Ethical issues regard copyright;
 - 3.2.3 Scientific Misconduct;
- 3.3 Human Subjects.

UNIT-IV: RESEARCH REPORT AND PROPOSAL

- 4.1 Research Report and proposal: Quality Proposal;
- 4.2 Salient features of Proposal
- 4.3 Basic guidelines of Research Report;
- 4.4 Parts of research Reports.
- 4.5 Thesis Format, Writing of abstract and Research Proposal

Suggested Books:

- Clark, D. H. & Clark, H. H. (1979). Research process in Physical Education, recreation & health. Englewood Cliffs: prentice Hall.
- Johnson, B. & Christensen, L. (2008). Education Research, Quantitative, Qualitative and Mixed Approaches. (3rd ed.). Sage Publication: England.
- Sprinthall, R. C. (1997). Basic statistical Analysis. (5th ed.). USA: Allyn & Bacon
- Thomas, J. R. & Nelson, J. K. (2001). Research Methods in Physical Education, (4th ed.). USA: Human Kinetics.
- Bose N.M.,(2005) *Research Methodology* . Sher Niwas Publication, Jaipur, India.
- Gay R.L., Airasian Peter,(1996) *Educational Research*, Merrill, Prentice Hall.
- *Recreation and Health* ,Prentice Hall Inc. Englewood Cliffs, New Jersey.
- Silverman David,(2000)*Doing Qualitative Research*, (Saye Publication, New Delhi.
- Verma,J.P. and Ghufuran,M.(2012).*Statistics for Psychology: A comprehensive Text*. Tata McGraw Hill Education, New Delhi.

MSCSP-EC: 101- Sports Training

Learning Objectives: To learn the changes in human body systems due to exercise and sporting activities in an integrated manner. The subject also provides and gains knowledge about sports training.

Learning Outcome: Students will be ready to study effect of exercise in detail and in application perspective. Students will also be able to measure the changes and interpret them in the context of sports.

UNIT- I: INTRODUCTION

- 1.1 Sports training, definition aim and characteristics
- 1.2 Sports performance: Definition, model structure, factors, performance structure, performance capacity and training structure.
- 1.3 General principles of sports training
- 1.4 Means and methods of sports training.

UNIT- II: TRAINING LOAD

- 2.1 Training Load: Definition, Types of Load and Supercompensation
- 2.2 Principles of Load Adaptation
- 2.3 Over Load: Cause and Effect of Over Load
- 2.4 Judgment of Load

UNIT- III: COMPONENT OF SPORTS PERFORMANCE

- 3.1 Strength: Components and Factors of Strength
- 3.2 Speed: Components and Factors of Speed
- 3.3 Endurance: Components and Factors of Endurance
- 3.4 Flexibility: Components and Factors of Flexibility
- 3.5 Coordinative Abilities: Components and Factors of Coordinative Abilities
- 3.6 Technique, skill & style, skill acquisition process; Factors affecting technique and skill
- 3.7 Tactics nature of tactics and strategy, tactical action, tactical training

UNIT- IV: PLANNING (PERIODIZATION)

- 4.1 Training Session: Importance, types, structure, class organization and training session plan
- 4.2 Long term training process and its stages
- 4.3 Planning; definition principles of planning, formulation of a plan,
 - 4.3.1 Planning of Meso, Micro and Macro cycles
- 4.4 Competition: Importance and types of competitions, competition system and preparation

Suggested Books:

- Beachle, T.R.: Earle, R.W.: Essentials of strength training and conditioning, NSCA Publication, 2000.
- Bompa Tudor, O.: Theory and methodology of training : They key to athletic Performance, 1990.
- Harre, D.: Principles of Sports Training. Sportsverlag, Berlin, 1988.
- Kansal, D.K.: Test and measurement in sports and physical education, DVS Publication, New Delhi, 1996.
- Matweyev, L.P.: Fundamentals of Sports training, Publication Moscow, 1984.
- Michael Kent: The Oxford dictionary of sports sciences and medicine Oxford University Press, Inc., New York, 1994.
- Scholisch, M.: Circuit Training, Sportvertag, Berlin, 1988
- Singh, H.: Science of Sports Training. DVS Publication, New Delhi, 1991
- Singh, H.: Sports Training: General Theory and methods, NIS, Patiala, 1984.

MSCSP-EC:102	Project Work
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MSCSP-PC: 101: Cardio-Respiratory Concepts in Sports Physiology

Learning Objectives: To gain skill in measurement of various physiological responses due to exercise and sports activities.

Learning Outcome: Students will be able to measure the changes and interpret them in the context of sports.

Practical

1. Introduction to laboratory techniques- pipette, calculations, introduction to equipments, sterile techniques and lab safety.
2. Measurement of heart rate and blood pressure during and after exercise.
(Each student is expected to practice measurement on 50 volunteers and determine intra experimenter and inter-experimenter variation)
3. Heart rate response recording during sporting activities.
(To be carried out as project and on sports persons. At least three different sports are to be covered by each student)
4. Blood Pressure Measurements: Effects of Body Position, Dynamic Exercise and Isometric Contractions on BP
5. Cardio-pulmonary resuscitation practice on Human Mannequin
6. Aerobic power measurement using Queens' college test, Astrand- Rhyming test.
7. Target Aerobic Movement Test (Brockport).
8. Pulmonary Volume (Spirometry).
9. Pulmonary Function Testing: Lung Volumes and Capacities, Pulmonary Function
10. VO₂ Max (Laboratory and Field Method)
11. How to Use microscopes
12. Measurement of Biochemical Composition of Blood
13. Measurement of RBC (Red Blood Corpuscles) and WBC (Leucocytes)
14. To measure the Haemoglobin concentration of blood

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005). Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England

MSCSP-PC: 102: Musculoskeletal Adaptation in Sports Physiology

Learning Objectives: To gain skill in measurement of various physiological responses due to exercise and sports activities.

Learning Outcome: Students will be able to measure the changes and interpret them in the context of sports.

Practical

1. Measurement of Height and Sitting Height
2. Measurement of Bi Acromial Diameter (Shoulder Width)
3. Measurement of Humerus Bicondylar Diameter (Elbow Width)
4. Measurement of Chest Circumference Normal and Maximal
5. Measurement of BMI; BMI Estimation with and without software
6. Evaluation of Physical Efficiency Index
7. Evaluation of Flexibility (Sit and Reach Test)
8. Evaluation of Strength (Hand, Leg and Back)
9. MMT for Major Muscle Groups of the body
10. Determination of Physiological adaptation with training through sub- maximal exercise on treadmill / bicycle ergometer.
11. Tests for: Speed, Agility, Balance, Coordination, Reaction time, Flexibility
12. Circumferences or Girths of body parts, Calf circumference, Thigh circumference, Waist circumference, Chest circumference.

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005). Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England

Semester - II

MSCSP-CC: 201- Applied Sports Physiology

Learning Objectives: To understand the physiological adaptation and metabolic changes during exercise at varying intensities.

Learning Outcome: Enables the students to gain an overall understanding of human body functioning during exercise and thus provide appropriate nutrition/fuel.

UNIT-I: ENDURANCE PERFORMANCE

- 1.1 Physiology of Endurance Performance:
- 1.2 Cardiovascular control during exercise and training,
- 1.3 Cardiovascular responses to endurance exercise and training,
- 1.4 Respiratory regulation during exercise and training,
- 1.5 Cardiovascular and respiratory adaptation to training.

UNIT-II: STRENGTH PERFORMANCE

- 2.1 Physiology of Strength Performance: Types of muscle fibers,
- 2.2 Generation of muscle force; Factors influencing force generation
 - 2.2.1 Strength curve and rate of force development for various muscles
- 2.3 Resistance training, Periodization of resistance training development for various muscles.
- 2.4 Physiological adaptation in response to resistance training, Delayed Onset Muscle Soreness (DOMS).

UNIT-III: HUMAN ENERGY SYSTEM

- 3.1 Human energy transfer in Rest, Exercise and Sports;
- 3.2 Concept of Aerobic and anaerobic energy production;
- 3.3 Fluids and Electrolytes during Exercise: Energy expenditure in different activities;
 - 3.3.1 Exercises, Recreational and Competitive sports
- 3.4 Physiological Adaptations to exercises and training;
- 3.5 Measurement of sports exercises and training related changes.

UNIT-IV SPORTS AND PHYSIOLOGY

- 4.1 Physiology of Team Sports (Soccer, Basketball, Hockey)
- 4.2 Physiology of Individual Sports (Triathlon, Swimming, Gymnastic, Cycling, Marathon, Rock Climbing,)
- 4.3 Physiology of Racket Sports (Badminton, Tennis, Squash and Table Tennis)
- 4.4 Physiology of Power Sports (Weight Lifting and Power Lifting)
- 4.5 Physiology of Combat Sports (Boxing, Judo, Wrestling)

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Nigel Thomas and Andrew Smith (2009) Disability, sport, and society an introduction. Routledge, NY
- Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
- Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Yves C. Vanlandewijck and Walter R. Thompson (2011) The Paralympics athlete handbook of sports medicine and science. Wiley- Blackwell.
- John Wesson (2002). The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
- John J. Fontanella (2006). The physics of basketball. The Johns Hopkins University Press
- Monèm Jemni (2011) The Science of Gymnastics. Routledge, NY.
- Thomas Reilly (1996). Science and Soccer. SPON PRESS
- Ben Greenfield (2012). Weight Training for Triathlon: The Ultimate Guide. Price World Publishing, (USA).

MSCSP-CC: 202: Sports and Exercise Physiology

Learning Objectives: To understand the physiological adaptation and metabolic changes during exercise at varying intensities.

Learning Outcome: Enables the students to gain an overall understanding of human body functioning during exercise and thus provide appropriate nutrition/fuel.

UNIT-I:

- 1.1 Introduction to sports physiology and exercise physiology of the Performance
- 1.2 Sports physiology verses exercises physiology
- 1.3 Physiological responses to exercise and sports activities on various system of the body;
- 1.4 Contribution of study sports physiology and exercise physiology on performance.

UNIT-II

- 2.1 Physiological testing of athlete's Maximal aerobic capacity- Explanation of result, its implication in sports
- 2.2 Training intensity and improvement in VO₂max
 - 2.2.1 Limitations of assessing VO₂max
 - 2.2.2 Indirect assessment of VO₂max- Multi-stage shuttle run test, Cooper test, Queens College Step test
- 2.3 Sub- maximal aerobic test- Astrand Nomogram, PWC 170.

UNIT-III

- 3.1 Assessment of strength- Dynamometers, 1repetition maximum (1RM)
- 3.2 Assessment of dynamic strength
- 3.3 Assessment of muscular endurance;
- 3.4 Assessment of flexibility;
- 3.5 Assessment of Speed
- 3.6 Assessment of coordination

UNIT-IV

- 4.1 Assessment of anaerobic power-
 - 4.1.1 Mergaria power test, de Bruyn Prevost test;
 - 4.1.2 Wingate test-Peak power output, Relative peak power output
 - 4.1.3 Anaerobic fatigue, anaerobic capacity/power.
 - 4.1.4 Running based Anaerobic Sprint Test (RAST)- Maximum power, Minimum power,
- 4.2 Fatigue index. Peak lactate and its importance in talent selection
 - 4.2.1 Transfer of talent
 - 4.2.2 Changes of lactate peak during season,
 - 4.2.3 Lactate peak and training

Suggested Books:

- Exercise Physiology: Theory and Application to Fitness and Performance 10th Edition By Scott Powers and Edward Howley 2018.
- Talent Identification and Development in Sport International Perspectives Edited by Joseph Baker, Steve Cobley, Jörg Schorer © 2012 – Routledge
- Routledge, NY Mike Hughes and Ian M. Franks. (2015). Essentials of performance analysis in sport. Routledge, NY
- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005) Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.

MSCSP-CC: 203- Physiological Support of Athletes

Learning Objectives: To understand the physiological adaptation and metabolic changes during exercise at varying intensities.

Learning Outcome: Enables the students to gain an overall understanding of human body functioning during exercise and thus provide appropriate nutrition/fuel.

UNIT-I: INTRODUCTION

- 1.1 Physiology of the Performance
- 1.2 Physical Activity for Health and Fitness
- 1.3 Environmental Influences on Performance
- 1.4 Prescription of Exercise for Health and Fitness

UNIT-II DEVELOPMENT OF ATHLETES

- 2.1 Concept of Athlete Development
- 2.2 Athlete Development stages; Child, Pre-adolescent, Adolescent and Adult
- 2.3 Factors affecting Physical Growth and Development
- 2.4 Talent Identification, Steps of Sports talent Selection and counseling
 - 2.4.1 Talent Development and Promotion

UNIT-III MONITORING AND ANALYSIS

- 3.1 Concept of Athlete Monitoring and Analysis
- 3.2 Time-motion analysis in Sport
- 3.3 Analysis of Athlete Tracking Systems
- 3.4 GPS and accelerometer analysis of training and competition
- 3.5 Monitoring and analysis of sport-specific physical, psychological physiological monitoring

UNIT-IV MONITORING AND ANALYSIS (CONT.)

- 4.1 External sources of data relating to sports performance; reliability of data and sources
- 4.2 The use of performance indicators in performance analysis
- 4.3 Feedback based analysis of performance
- 4.4 Sport-specific notational systems; computerized notational analysis;
 - 4.4.1 Notation in individual sports; notation in team sports
- 4.5 Augmented feedback through video-based technologies
- 4.6 Analysis of structures of sports informing performance indicators;
- 4.7 Flowcharts and presentation models of sports performance;

Suggested Books:

- Exercise Physiology: Theory and Application to Fitness and Performance 10th Edition By Scott Powers and Edward Howley 2018.
- Talent Identification and Development in Sport International Perspectives Edited by Joseph Baker, Steve Coble, Jörg Schorer © 2012 – Routledge
- Peter O'Donoghue.(2015) An introduction to performance analysis of sport.
- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England

MSCSP-CC: 204: Applied Statistics in Sports Science

Learning Objectives: To understand Research Methods, Processing & Presentation of Data & Analysis Techniques using software program.

Learning Outcome: Enables students to Learn Scientific Methods, Statistical Analysis Techniques Using Software Programmed and Manually.

UNIT- I

- 1.1 Basic concepts of Statistics, Need of Statistics in Sports Physiology
- 1.2 Nature of Data: Four Levels of Data- Nominal, Ordinal, Interval and Ratio
- 1.3 Graphical Presentation of Data; Line, Pie and Bar Diagram, Frequency Distribution: Frequency Polygon, Frequency Curve, Histogram, Less than and Greater than Ogives.
- 1.4 Measure of Central Tendency: Mean, Median, Mode, Percentiles, Deciles and Quartiles
- 1.5 Measure of Dispersion: Range, Mean Deviation, Variance, Standard Deviation, Coefficient of Variation

UNIT-II

- 2.1 Normal Distribution: Properties, Skewness and Kurtosis,
- 2.2 Problem based on Normal Distribution
- 2.3 Developing Norms in the form of grading, Percentile Scale, T-Scale, Scales based on difficulty of ratings
- 2.4 Sampling Distribution of Means, Standard Error of Means, Interval Estimates and Point Estimates of Means, Coefficients interval for mean when sample size is large.
- 2.5 Student's t-distribution- confidence interval for mean sample size is small concept of procedure of testing of hypothesis- region of acceptance and region of rejection null and alternative hypotheses: level of significance, type I and type II errors, one tailed and two tailed hypothesis.

UNIT-III

- 3.1 Parametric and Different Statistical Techniques Parametric Statistics:
 - 3.1.1 One way ANOVA, Two way ANOVA, One way ANCOVA
- 3.2 Non- Parametric Statistics:
 - 3.2.1 Chi-Square, Mann Whitney U Test, Assumptions, Calculation, and Interpretation.
- 3.3 Concept of correlation- Scatter Diagram, Linear Correlation, Rank Correlation
 - 3.3.1 Partial Correlation coefficient of first order
 - 3.3.2 Multiple Correlation coefficient involving three variables

UNIT-IV

- 4.1 Statistical Software Package: Preparations of data file: Types of data, defining variables and its properties, Data entry validating data, Installing and starting the statistical package.
- 4.2 Computations of descriptive statistics and its interpretation
- 4.3 Computing Statistical Techniques using the software: Prepare the correlation matrix and compute partial and multiple correlations, Regression analysis with step and step down methods, Application of t, F and Z tests, one and two way Analysis of variance, Chi Square tests

Suggested Books:

- Jerry R Thomas & Jack K Nelson (2000) Research Methods in Physical Activities; Illinois: Human Kinetics;
- Rothstein A (1985) Research Design and Statistics for Physical Education, Englewood Cliffs: Prentice Hall, Inc
- Garrett ,H.E (2000) Statistics in Psychology and Education, Hyderabad: International Book Bureau
- J. P. Verma(2012) Using SPSS: An Interactive Hands - On Approach, Sage South Asia
- J. P. Verma(2015) Repeated Measures Design for Empirical Researchers, Wiley-Blackwell
- Ruud H. Koning and James H. Albert (2008) Statistical thinking in sports. Chapman & Hall/CRC, Taylor & Francis Group.

MSCSP-EC: 201- Applied Technology in Sports Physiology

Learning Objectives: It will present an introduction to clinical exercise physiology through the topics of: Exercise and disease, Legal and Ethical Considerations, weight training for cardiac rehabilitation etc.

Learning Outcome: Understand the cardiovascular, respiratory and metabolic responses to the acute sports activity of differing intensities and compare the responses of individuals of differing levels.

UNIT-I: RESEARCH STRATEGIES IN SPORTS PHYSIOLOGY

- 1.1 Ethical Considerations in Sports Physiology
- 1.2 Dealing with human and animal participants
- 1.3 Design and Analysis Techniques for various types of studies-
 - 1.3.1 Epidemiological Studies
 - 1.3.2 Experimental Studies
 - 1.3.3 Association Analysis

UNIT-II: LATEST ADVANCEMENTS IN EVALUATION IN SPORTS PHYSIOLOGY

- 2.1 Methods of Body Composition Analysis
 - 2.1.1 DEXA
 - 2.1.2 Air Displacement Plathysmography
 - 2.1.3 Bio-Electrical Impedance Techniques
- 2.2 Strength and Power Assessment Techniques
 - 2.2.1 Isokinetic Testing System
 - 2.2.2 Ultrasonography: An emerging alternative of Muscle Biopsy
 - 2.2.3 Role of MRI and fMRI in Sports Physiology
- 2.3 One-field activity tracking of athletes

UNIT-III: SPORTS DRUG TESTING

- 3.1 History of Sports Drug Testing; Various Methods of Doping
- 3.3 Profiling of Blood and Urine for Doping Control
- 3.4 Mass Spectrometry in Sports Drug Testing
- 3.5 Modern Mass Spectrometry Based Analytical Assays

UNIT-IV EMERGING CONCEPTS IN MOLECULAR AND GENETIC ANALYSIS

- 4.1 Techniques used in Genetic Analysis;
- 4.2 Polymerase Chain Reaction (PCR) and RFLP
- 4.3 Western Blotting, Northern Blotting and Southern Blotting
- 4.4 Gene Sequencing, SANGER
- 4.5 Recombinant DNA Technology

Suggested Books:

- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Roy J. Shephard and Henry S. Miller, Jr. (1999) Exercise and the Heart in Health and Disease. Marcel Dekker
- Christopher B. Cooper and Thomas W. Storer (2004) Exercise testing and interpretation- A practical approach. Cambridge University Press.
- Denise L. Smith and Bo Fernhall (2011). Advanced cardiovascular exercise physiology. Human Kinetics

MSCSP-EC: 202- Exercise Psychology

Learning Objective: To develop an understanding of the nature psychology and its factor responsible to sports performance.

Learning Outcomes: Students will come to the others factors apart from sports training psychological factors also contribute in the spots performance.

UNIT -I: INTRODUCTION

- 1.1 Meaning, Importance, Relevance
- 1.2 Scope of Educational and Sports Psychology
- 1.3 General characteristics of Various Stages of growth and development
- 1.4 Types and nature of individual differences;
 - 1.4.1 Factors responsible - Heredity and environment

UNIT-II: METHODS OF PSYCHOLOGICAL STUDY

- 2.1 Methods of psychological study: (Introspection method, Observation method and Experimental method
- 2.2 Psycho-sociological aspects of Human behavior in relation to physical education and sports
- 2.3 Nature of learning, theories of learning, Laws of learning, Plateau in Learning & transfer of training

UNIT-III: PERSONALITY AND SPORTS PERFORMANCE

- 3.1 Meaning and definition of personality,
- 3.2 Types and Characteristics of personality
- 3.3 Theories of Personality
- 3.4 Dimension of personality
- 3.5 Personality and Sports performance
- 3.6 Types and nature of individual differences

UNIT- IV: MOTIVATION AND AGGRESSION IN SPORTS

- 4.1 Motivation: Nature of motivation
 - 4.1.1 Factors influencing motivation
 - 4.1.2 Motivation and techniques; Impact on sports performance
- 4.2 Aggression and Sports: Meaning and nature of anxiety, Kinds of anxiety
- 4.3 Meaning, nature and Types of stress
- 4.4 Anxiety, Stress, Arousal and their effects on sports performance

Suggested Books:

- Ball, D. W. & Loy, J. W. (1975). Sport and Social Order; Contribution to The Sociology Of Sport. London: Addison Wesley Publishing Co., Inc.
- Blair, J.& Simpson, R.(1962). Educational Psychology, New York: McMillan Co.
- Cratty, B. J.(1968). Psychology and Physical Activity. Eaglewood Cliffs. Prentice Hall.
- Kamlesh, M.L. (1998). Psychology in Physical Education and Sport. New Delhi: Metropolitan Book Co.
- Loy, J. W., Kenyon, G. S. & McPherson, B. D. (1978). Sport and Social System. London: Addison Wesley Publishing Company Inc.
- Loy, J. W., Kenyon, G. S. & McPherson, B. D. (1981). Sports Culture and Society. Philadelphia: Lea & Febiger.
- Mathur, S.S., (1962). Educational Psychology. Agra. Vinod Pustak Mandir.
- Skinnner, C. E., (1984.). Education Psychology. New Delhi: Prentice Hall of India.
- William, F. O. & Meyer, F. N. (1979). A Handbook of Sociology. New Delhi: Eurasia Publishing House Pvt Ltd.

MSCSP-PC: 201- Applied Sports Physiology

Learning Objectives: To understand the physiological adaptation and metabolic changes during exercise at varying intensities.

Learning Outcome: Enables the students to gain an overall understanding of human body functioning during exercise and thus provide appropriate nutrition/fuel.

Practical:

1. Evaluation of Percent Body Fat and Lean Body Mass through Skin Fold (Durnin and Rehman Chart)
2. Calculation of Energy expenditure
3. Measurement of Aerobic and Anaerobic Power
4. Resting Metabolic Rate Determinations: Predicting and Measuring RMR
5. Determination of VO₂max by direct and indirect method
6. Assessment of Peak lactate, lactate tolerance, lactate clearance
7. Oxygen Deficit and EPOC Evaluations
8. Submaximal Exercise Testing: Submaximal Bench Step Test, Submaximal Treadmill Test, Submaximal Cycle Ergometer Test
9. Aerobic Power Field Assessments: Cooper 1.5-Mile Run/Walk Test and 12-Minute Run/Walk Test, Rockport Fitness Walking Test
10. Sports Skill Tests for: Soccer, Basketball, Hockey, Tennis

Suggested Books:

- Astrand, P.-O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
- Shephard, R.J. and Astrand, P.O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Ron J. Maughan (2009) The Olympic textbook of science in sport. Blackwell Publishing Ltd
- John Wesson(2002) The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
- John J. Fontanella (2006). The physics of basketball. The Johns Hopkins University Press
- Monèm Jemni (2011) The Science of Gymnastics. Routledge, NY.

MSCSP-PC: 202- Physiological Support of Athletes

Learning Objectives: To understand the physiological adaptation and metabolic changes during exercise at varying intensities.

Learning Outcome: Enables the students to gain an overall understanding of human body functioning during exercise and thus provide appropriate nutrition/fuel.

Practical:

1. Skinfold measurement and Body Fat Percentage calculations
2. Training Program: Circuit Training Program, Interval Training Program, Ballistic Training Program, Fartlek Training Program
3. Techniques of taking various anthropometric measurements: Diameters or Breadths (cms): Bicipital diameter (Shoulder Breadth), Transverse chest diameter, Anteroposterior chest diameter, Femur bicondylar diameter (knee breadth), Humerus Bicondylar diameter (elbow Breadth)
4. Use of Fitness Related Software
5. Assessment of EMG and ECG
6. Use of Body Composition Software
7. Determination of anaerobic threshold
8. Biochemical Assessment of Metabolites
9. Biochemical Assessment of Enzymes
10. Biochemical Assessment of Hormones

Suggested Books:

- Astrand, P.-O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
- Shephard, R.J. and Astrand, P.O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Ron J. Maughan (2009) The Olympic textbook of science in sport. Blackwell Publishing Ltd
- John Wesson(2002) The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
- John J. Fontanella (2006). The physics of basketball. The Johns Hopkins University Press
- Monèm Jemni (2011) The Science of Gymnastics. Routledge, NY.

Semester - III

MSCSP-CC: 301- Sports Genetics and Talent Identification

Learning Objectives: To provides understanding of the sport and exercise genetics. A working understanding of the genetic terminology required to be able to function well in the transfusion laboratory. And understand the clinical relevance of genetics concepts.

Learning Outcome: Student will understand some of the types of disease that might be treatable by gene therapy. Understand the basic principles of sports genetic manipulation Understand how genetics may be used in the design of drugs.

UNIT-I

- 1.1 Basic Genetic Concepts, Mendelian inheritance, population genetics,
- 1.2 Human chromosome Karyotype, Chromosome Disorders,
- 1.3 Genome Structure and Genetic Mapping, Mitochondrial Inheritance,
- 1.4 The Genetic Code and Genetic Alterations,
- 1.5 DNA Injuries and Repair, Monogenic and Polygenetic Diseases, Molecular Diagnostics

UNIT- II

- 2.1 Ethics of Genetic Testing and Research in Sport,
- 2.2 Current Challenges and Directions to the Future,
- 2.3 Genetic Modifications in Sports, Ethical Considerations of Genetic Manipulation in Sport,
- 2.4 Gene Therapy and Gene Doping
- 2.5 Connecting Sports and Genetics,
- 2.6 The Genetics of Sports Injuries and Athletic Performance,

UNIT- III

- 3.1 Genetic Contributors to Hypertrophic Cardiomyopathy, Chronic Traumatic Encephalopathy,
- 3.2 Different Classes of Performance Enhancing Genetic Variants
- 3.4 Components of Performance, Heritability of sub- traits, Key Performance Genes, ACE I/D, ACTN3 R577X
- 3.5 Experimental approaches for studying genetics of sport performance;
- 3.6 The importance of making comparisons between homogeneous groups, Single gene approach vs. polygenic profile,

UNIT- IV

- 4.1 Identification of new polymorphisms:
 - 4.1.1 Strategies to identify physiological roles of a polymorphism,
- 4.2 Genetic interactions, rare variants,
- 4.3 The use of genetic markers to detect sports talent,
- 4.4 Traditional performance tests versus genetic tests that predict performance-related variables;
- 4.5 Genetic performance tests and its consequences

Suggested Books:

- Bruce R. Korf and Mira B Irons (2012) Human Genetics and Genomics, WILEY-BLACKWELL
- Manu L Kothari, Lopa A Mehta, Sadhana Sroychoudhury, (2009) Principles of Genetics, Universities Press
- Ricki Lewis (2017) Human Genetics the basics, Routledge, ISBN 978-1-138-66801-0
- Michael Posthum and Malcolm Collins (2016) Genetics and Sports, Karger Publisher
- Elaine A. Ostrander, Heather J. Huson, and Gary K. Ostrander Genetics of Athletic Performance (2009) Annu. Rev. Genomics Hum. Genet. 2009.10:407–29
- Lisa M. Guth and Stephen M. Roth (2013) Genetic influence on athletic performance, Curr Opin Pediatr. 2013 December; 25(6): 653–658.
- Nicola Mafulli et al (2013) the genetics of sports injuries and athletic performance. Muscles, Ligaments and Tendons Journal, 3 (3): 173-189.

MSCSP-CC: 302- Physiological Assessments in Sports and Exercise

Learning Objectives: To gain skill in measurement of various physiological responses

Learning Outcome: Students will be able to measure the changes and interpret them in the context of sports

UNIT-I: INTRODUCTION

- 1.1 Meaning of Measurement and Evaluation
- 1.2 Relationship among Test, Measurement and Evaluation
- 1.3 Purpose of Evaluation in the field of Sports
- 1.4 Principles of Evaluation
- 1.5 Domains of Human Performance- Cognitive and Psychomotor
- 1.6 Norm Referenced and Criterion Referenced Standard

UNIT-II: SELECTION OF CONSTRUCTION OF TESTS

- 2.1 Criteria of Test Selection
- 2.2 Factors Affecting Scientific Authenticity
- 2.3 Procedure of establish Scientific Authenticity
- 2.4 Guidelines and Construction of Test - Knowledge and Skill Tests, Subjective and Objective Test.
- 2.5 Administration of testing program, its procedure and follow up

UNIT-III: MEASUREMENT OF SPORTS PERFORMANCE

- 3.1 Cooper's 12 minutes continuous run-walk test and modification
- 3.2 Cooper's 12 minutes cycling tests
- 3.3 Oregon Motor Fitness Test
- 3.4 Canadian Fitness Award
- 3.5 Test Component of Sports and Motor Fitness Test; Agility, Cardio-Respiratory, Strength, Endurance, Speed and Power.
- 3.6 Measurement of Health Related Fitness.

UNIT-IV OTHER TESTS OF SPORTS SKILLS

- 4.1 Kraus Weber Muscular Fitness Test
- 4.2 Instrument of Measuring Strength
- 4.3 AAHPERD Volleyball Test, Russell and Lung Test, AAHPERD Basketball, Johnson Test, Soccer Sozi Test and Johnson Test, Miller Wall Valley Test, Lockhort and McPherson Test, Harbans Singh Hockey Test, Akhil Malhotra Test.
- 4.4 Measurement of IOWA Posture.

References:

- Astrand, P.-O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Hu- man Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
- Shephard, R.J. and Astrand, P.O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Ron J. Maughan (2009) The Olympic textbook of science in sport. Blackwell Publishing Ltd
- John Wesson(2002) The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
- John J. Fontanella (2006). The physics of basketball. The Johns Hopkins University Press
- Monèm Jemni (2011) The Science of Gymnastics. Routledge, NY.

MSCSP-CC: 303- Environmental Sports Physiology

Learning Objectives: The objective of this course is to examine the responses and adaptations of the human body to exercise under different environmental conditions.

Learning Outcome: Students will be able to describe and discuss the stresses placed on the human body during exercise performed under different environmental conditions and the adaptations made by the body with extended or repeated exposure to those conditions.

UNIT- I

- 1.1 Environment and Exercise Thermoregulation,
- 1.2 Physiology in Hot and Cold Climates
- 1.3 Exercise in cold - physiological responses to exercise in cold,
- 1.4 Health risks during exercise in cold, and effect of cold on human performance.

UNIT- II

- 2.1 Physiological changes in desert, heat illness, heat stroke
- 2.2 Exercise in hot environment- physiological responses to exercise in heat
 - 2.2.1 Health risks during exercise in heat,
- 2.3 Exercise in high temperature and humidity; Human Adaptation
- 2.4 Hypobaric and Hyperbaric Condition Physiological changes in Hypobaric and Hyperbaric Condition,
- 2.5 Safety and management.

UNIT- III

- 3.1 Exercise underwater; Pressure, O₂, CO₂, Temperature and Relative humidity,
- 3.2 The travelling athlete altitude- Altitude training
- 3.3 Effect of altitude on sports performance
- 3.4 Adaptation to altitude detraining.

UNIT- IV

- 4.1 Atmospheric requirements of Man in space
- 4.2 Short and long term acclimatization;
 - 4.2.1 Role of Acclimatization on athletes and sports performance.
- 4.3 Sports Performance and Environment; consideration before, during and after competition
 - 4.3.1 Before Competition
 - 4.3.2 During Competition
 - 4.3.3 After Competition

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005) Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.

MSCSP-RC: 304	Thesis (Synopsis Presentation and data collections)
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MSCSP-EC: 301- Sports and Exercise Immunology

Learning Objectives: To Provide and understanding of humeral and cellular immunity and their relative significances to transfusion science theory and practice. And also provide understanding of the nature of antigen-antibody reactions in response to sports activities.

Learning Outcome: This course will provides with knowledge and understanding of, and practical skills in, immunology and the way it is applied in diagnostic and therapeutic techniques and research.

UNIT- I

- 1.1 Immunity: Innate and Adaptive immunity; Non-specific and Specific defense mechanism;
- 1.2 Immune response pathway like inflammation and antigen specific responses.
- 1.3 Immunological system and exercise: Exercise and innate and humeral immunity,
- 1.4 Exercise induced change in Ig and antibody, exercise and cytokines.

UNIT- II

- 2.1 Sex Differences in Immune Function after Aerobic Exercise,
- 2.2 Sex differences in immune variables and respiratory infection,
- 2.3 Killer cell immunoglobulin- like receptors and exercise,
- 2.4 Anti inflammatory influence of exercise training Physical activity, fitness, and chronic inflammation, C-Reactive Protein (CRP)

UNIT- III

- 3.1 Cytokines, Free radicals, Antioxidants,
- 3.2 Importance of exercise immunology in health promotion.
- 3.3 Effect of exercise on immunity,
- 3.4 Physical activity – A stimulator and an inhibitor to the immune system.

UNIT- IV

- 4.1 Exercise and upper respiratory tract infection,
- 4.2 Infection and exercise performance,
- 4.3 Exercise and HIV infection,
- 4.4 Exercise and Cancer,
- 4.5 Exercise aging and immunity,
- 4.6 Maintaining immune health for sports performance

Suggested Books:

- Michael Gleeson, Nicolette Bishop, and Neil Walsh.(Eds) (2013) Exercise immunology. Routledge
- Warren Levinson (2016) Review of Medical Microbiology and Immunology. LANGE, Mc Graw Hill
- Astrand, P.-O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Hu- man Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005) Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England
- Nigel Thomas and Andrew Smith (2009) Disability, sport, and society an introduction. Routledge, NY.

MSCSP-EC: 302- Sports Biomechanics

Learning Objectives: To provide knowledge the application of principles of physic in sport and analysis of various sports techniques.

Learning Outcome: Student will come to know the application of principles of physic to analyze the sports techniques and their responses to enhance the sports performance.

UNIT-I

- 1.1 Exercise and sports biomechanics basic concepts of kinematics and kinetics–vectors,
- 1.2 Motion, degrees of freedom,
- 1.3 Force, moment of force, Forces and torques
- 1.4 Equilibrium.

UNIT- II

- 2.1 Biomechanical considerations in reducing sporting injury rates.
- 2.2 Terminology of Fundamental Movements
- 2.3 Fundamental concepts of following terms – Axes and Planes, Centre of Gravity, Equilibrium, Line of Gravity
- 2.4 Fundamental concepts of following terms- Angle of Pull, All or None Law, Reciprocal Innervations

UNIT- III

- 3.1 Posture static and dynamic posture, postural diversity within individuals,
- 3.2 Posture and its relationship to somatotype posture assessment,
- 3.3 Desirable postures for high level sport performance,
- 3.4 Modifying posture and technique to improve performance.

UNIT- IV

- 4.1 Image analysis in sports performance errors in motion analysis,
- 4.2 Planar video analysis and 3D motion analysis,
- 4.3 Movement patterns – the essence of sports biomechanics
- 4.4 Qualitative analysis of sports movements
- 4.5 More on movement patterns – the geometry of motion
- 4.6 Quantitative analysis of movement, Causes of movement

Suggested Books:

- Terry Wood, Weimo Zhu. Measurement Theory and Practice in Kinesiology. 2006; Human Kinetics.
- Declan Connolly. Basic and Applied Sports Kinesiology. 2016; LW
- Bunn, John W. Scientific Principles of Coaching, Second Edition. (Englewood cliffs, New Jersey : Prentice Hall, Inc. 1972)
- Hall, Susan J. Basic Biomechanics, Fourth Edition (Boston etc. : WCB/MC Graw-Hill Companies, 2004
- Hay, James G. The Biomechanics of Sports Techniques, Fourth Edition (Englewood cliffs, New Jersey; Prentice Hall, 1993
- Kreighbaum, Ellen and Barthels. Biomechanics – A qualitative Approach for studying Human movement. Third edition (New York : MC millan publishing company, 1990)
- Mc. Ginnis, Peter M. Biomechanics of Sport and Exercise, Second Edition (Champaign : Human kinetics publishers, 2005)
- Rai Ramesh, Biomechanics – Mechanical Aspects of human motion (Mohali Punjab : Agrim Publication, 2003)
- Robertson, D. Gordon E. et. Al. Research Methods in Biomechanics. (Champaign etc : Human kinetics publishers, 2004

MSCSP-PC: 301- Sports Genetics and Talent Identification

Learning Objectives: To provides understanding of the sport and exercise genetics. A working understanding of the genetic terminology required to be able to function well in the transfusion laboratory. And understand the clinical relevance of genetics concepts.

Learning Outcome: Student will understand some of the types of disease that might be treatable by gene therapy. Understand the basic principles of sports genetic manipulation Understand how genetics may be used in the design of drugs.

Practical:

1. Techniques used in Genetic Analysis;
2. Polymerase Chain Reaction (PCR) and RFLP
3. Western Blotting, Northern Blotting and Southern Blotting
4. Gene Sequencing, SANGER
5. Recombinant DNA Technology
6. AAHPERD Volleyball Test, Russell and Lung Test,
7. AAHPERD Basketball, Johnson Test,
8. Soccer Sozi Test and Johnson Test,
9. Miller Wall Valley Test, Lockhort and McPherson Test,
10. Harbans Singh Hockey Test, Akhil Malhotra Test.
11. Measurement of IOWA Posture.

Suggested Books:

- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Roy J. Shephard and Henry S. Miller, Jr. (1999) Exercise and the Heart in Health and Disease. Marcel Dekker
- Christopher B. Cooper and Thomas W. Storer (2004) Exercise testing and interpretation- A practical approach. Cambridge University Press.
- Denise L. Smith and Bo Fernhall (2011). Advanced cardiovascular exercise physiology. Human Kinetics

MSCSP-PC: 302- Physiological Assessments in Sports

Learning Objectives: To gain skill in measurement of various physiological responses

Learning Outcome: Students will be able to measure the changes and interpret them in the context of sports.

Practical:

1. Cooper's 12 minutes continuous run-walk test and modification
2. Cooper's 12 minutes cycling tests
3. Oregon Motor Fitness Test
4. Canadian Fitness Award
5. Test Component of Sports and Motor Fitness Test; Agility, Cardio-Respiratory, Strength, Endurance, Speed and Power.
6. Measurement of Health Related Fitness.
7. Kraus Weber Muscular Fitness Test
8. Instrument of Measuring Strength
9. High-Intensity Fitness Testing: Léger 20 m Shuttle Run Test,
10. Yo-Yo Intermittent Recovery Test,
11. 30-15 Intermittent Fitness Test,
12. Sprinting Performance, Jumping Performance, Power Endurance,
13. Anaerobic Cycling Power,
14. Margaria-Kalamen Stair-Climb Test,
15. BROCKPORT test system,
16. AAHPER health related physical fitness test,
17. Philips JCR test for General motor ability testing.

References:

- Astrand, P.-O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
- Shephard, R.J. and Astrand, P.O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Ron J. Maughan (2009) The Olympic textbook of science in sport. Blackwell Publishing Ltd
- John Wesson(2002) The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
- John J. Fontanella (2006). The physics of basketball. The Johns Hopkins University Press
- Monèm Jemni (2011) The Science of Gymnastics. Routledge, NY.

Semester - IV

MSCSP-CC: 401: Clinical Sports Physiology

Learning Objectives: To provide and understand exercise and disease, Legal and Ethical Considerations, weight training for cardiac rehabilitation etc.

Learning Outcome: Understand the cardiovascular, respiratory and metabolic responses to the acute physical activity of differing intensities and compare the responses of individuals of differing levels.

UNIT- I:

- 1.1 Disease, exercise and health- Sports Exercise,
- 1.2 Fitness and health, Physiological benefits of sports activities
- 1.3 Sports Exercise and disease.
- 1.4 Exercise physiology in prevention and rehabilitation of cardiovascular diseases
- 1.5 Physiological bases for using exercise in CHD prevention

UNIT- II

- 2.1 Exercise tests for assessment of cardiovascular dysfunctions
- 2.2 Exercise induced indicators of coronary heart diseases
- 2.3 Principle of exercise testing in cardiac rehabilitation
- 2.4 Exercise prescription of cardiac patients
- 2.5 Weight training for cardiac rehabilitation

UNIT- III

- 3.1 Exercise prescription for pulmonary diseases
- 3.2 Neuromuscular diseases and renal disorders
- 3.3 Exercise for diabetic patients
- 3.4 Exercise prescription for pregnancy
- 3.5 Effect of exercise on cancer

UNIT- IV

- 4.1 Demonstrating Functional Outcomes for Health and Fitness
- 4.2 Legal and Ethical Considerations
- 4.3 Exercise prescription for health- Screening and exercise testing
- 4.4 Guidelines for exercise prescription for Special Olympics Games

Suggested Books:

- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
- C.L. Ghai (2013) A Textbook of Practical Physiology Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
- Tudor Hale (2003) Exercise Physiology A Thematic Approach. John Wiley & Sons Ltd, England
- Nigel Thomas and Andrew Smith (2009) Disability, sport, and society an introduction. Routledge, NY
- Komi, Paavo V. (Ed) (2003) Strength and power in sport. Blackwell Science Ltd, USA
- Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Yves C. Vanlandewijck and Walter R. Thompson (2011) The Paralympics athlete handbook of sports medicine and science. Wiley- Blackwell.

MSCSP-CC: 402- Nutrition and Sports Performance

Learning Objectives: To provide knowledge about the nutrition and its components and specific nutrition for sports performance.

Learning Outcomes: The students will also gain knowledge about the relationship between balanced diet and maintenance of performance and planning to gain performance.

UNIT- I: INTRODUCTION TO NUTRITION

- 1.1 Meaning and Definition of Nutrition
- 1.2 Basic Nutrition guidelines
- 1.3 Role of nutrition in sports
- 1.4 Factors to be considered for developing nutrition plan

UNIT- II: NUTRIENTS: INGESTION TO ENERGY METABOLISM

- 2.1 Carbohydrates, Protein, Fat – Meaning, classification and its function
- 2.2 Role of carbohydrates, Fat and protein during exercise
- 2.3 Vitamins, Minerals, Water – Meaning, classification and its function
- 2.4 Role of hydration during exercise, water balance, Nutrition – daily caloric requirement and expenditure.

UNIT-III:

- 3.1 Metabolism, Energy: Food Energy and Expenditure, Gastric Emptying, Digestion, and Absorption.
- 3.2 Nutrition and Training Adaptations
- 3.3 Nutrition and Immune Function in Athletes
- 3.4 Body Composition and Weight Management
- 3.5 Eating Disorders in Athletes
- 3.6 Personalized Nutrition: Menu Planning (Meal Timing and Spacing)

UNIT-IV: PRACTICAL NUTRITION GUIDELINES

- 4.1 Practical Nutrition Guidelines for Different Team Sport Athletes
 - 4.1.1 Field sports- hockey, football, rugby
 - 4.1.2 Batting sports- cricket, baseball, softball
 - 4.1.3 Court sports- volleyball, basketball
 - 4.1.4 Indian team sports- kabaddi, kho-kho
- 4.2 Use of Nutritional supplements in team sports
 - 4.2.1 Creatine monohydrate, Protein supplements
 - 4.2.2 Caffeine, Sports bars, drinks and gels

Suggested Books:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Werner W.K. Hoeger, Sharon A. Hoeger (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Sport Nutrition 3rd Edition by Asker Jeukendrup, Michael Gleeson, Human Kinetics, 2018.
- Nutrition for Sport, Exercise, and Health by Marie Spano, Laura Kruskall, D. Travis Thomas, Human Kinetics.
- Physiology of Sport and Exercise 6th Edition with Web Study Guide-Loose-Leaf Edition by W. Larry Kenney, Jack Wilmore, David Costill.
- Nancy Clark's Sports Nutrition Guidebook by Nancy Clark, Human Kinetics
- Groff & Gropper (2000). Advanced Nutrition and Human Metabolism, 3rd Ed., Wadsworth,
- Jeukendrup & Gleeson. Sport Nutrition, Human Kinetics, 2004
- Ed. Burke & Deakin (2007). Clinical Sports Nutrition, 3rd Ed., McGraw-Hill

MSCSP-CC: 403- Sports Ergonomics and Ergogenic Aids

Learning Objectives: To provide knowledge of prohibited substances.

Learning Outcome: Student will come to know the prohibited substances and can save athletes life.

UNIT- I:

- 1.1 Introduction to Ergonomic
- 1.2 Ergonomical Risk Factors in Sports
- 1.3 Physical Properties of Human Structures, Health and Safety
- 1.4 Ergonomics Models and Training Modes in Sports and Leisure
- 1.5 Influence of Sports Equipment and Playing Surfaces

UNIT- II

- 2.1 Ergonomics in Physical Activities
- 2.2 Clinical Aspects in Sports Ergonomics
- 2.3 Holistic and Nutritional Ergonomics Perspective
- 2.4 Ergonomic Aids in Sports
- 2.5 Researching Ergogenic Aids
- 2.6 Nutritional Ergogenic Aids

UNIT-III

- 3.1 Introduction to Anti Doping: Anti Doping Codes and Drug Testing
- 3.2 WADA and NADA
- 3.3 Prohibited Substances and Techniques: Drugs and Doping in Sports
- 3.4 Different Methods and Chemicals of Doping and Masking, Anabolic Androgenic Steroids, Stimulants, Glucocorticoids, Peptide-Protein Hormone, Beta-2 Agonists, Hormone and Metabolic Modulators, Narcotics, Beta Blockers, Manipulation of Blood and Blood Components, Chemical and Physical Manipulations, Gene Doping, Diuretics and Masking

UNIT- IV

- 4.1 Substances and Methods Permitted in Sports
- 4.2 Sport Supplements and Herbal Preparations
- 4.3 Evolving Issues Concerning Drug Use in Sports
- 4.4 Athletic Testing, Analytical Procedures and Adverse Analytical Findings
- 4.5 The Future of Performance Enhancing Substances in Sports
- 4.6 Anti-doping Movement

Suggested Books:

- Handbook of Ergonomics in Sport and Exercise Edited by Youlian Hong, Routledge 2013
- Ergonomics in Sport and Physical Activity Enhancing Performance and Improving Safety by Thomas Reilly, Human Kinetics, 2010.
- Physiology of Sport and Exercise 6th Edition with Web Study Guide-Loose-Leaf Edition by W. Larry Kenney, Jack Wilmore, David Costill
- A Textbook of Sports & Exercise Physiology by Dey Swapan Kumar, Jaypee Publishers
- Anthony C Hackey (2017) Doping, Performance-Enhancing Drugs, and Hormones in Sports ISBN:978-0-12-813442-9
- David R. Mottram, Neil Chester (2018) Drugs in Sports, Routledge, ISBN:1351838989
- Portefield, Jason (2008) Doping: athletes and drugs, Rosenn Publishing, New York, ISBN:1-4042-1917-5.

MSCSP-RC: 404	Submission of Thesis
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MSCSP-EC: 401- Sports Injuries, Physiotherapy and Rehabilitation

Learning Objectives: To provide the students to understand and facilitate the process of recovery from injury, illness or disease to normal condition as soon as possible.

Learning Output: Student will understand the proper and adequate rehabilitation program in helping athletes or sports person to reverse many disabling conditions or patients cope with deficits that cannot be reversed by medical care.

Unit-I: - Sports Injuries:

- 1.1 Concepts, Aims, Objectives, Modern Concepts and Importance.
- 1.2 Need and Importance of the study of sports injuries in the field of Sports
- 1.3 Prevention and causes of injuries in sports
- 1.4 Common sports injuries and First Aid Diagnosis
- 1.5 Bandages – Types of Bandages – trapping and supports.

Unit-II: Physiotherapy

- 2.1 Definition – Guiding principles of physiotherapy,
- 2.2 Importance of physiotherapy,
- 2.3 Introduction and demonstration of treatments:
 - 2.3.1 Infrared Rays
 - 2.3.2 Short Wave Diathermy
 - 2.3.3 Paraffin Wax

Unit-III: Hydrotherapy:

- 3.1 Introduction and demonstration of treatments of:
- 3.2 Cryotherapy; types and its applications
- 3.3 Thermo-therapy;
 - 3.3.1 Contrast Bath,
 - 3.3.2 Whirlpool Bath
 - 3.3.3 Hot Water Fomentation;
- 3.4 Massage: concepts, Classification of Manipulation (Swedish System)
 - 3.4.1 Physiological Effect of Massage.

Unit-IV: Therapeutic Exercise:

- 4.1 Definition and Scope
- 4.2 Principles of Therapeutic Exercise – Classification, Effects and Uses
- 4.3 Therapeutic exercise – passive Movements (Relaxed, Forced and passive - stretching)
– Active movements (concentric, Eccentric and static)
- 4.4 Application of the therapeutic exercise; Free Mobility Exercise of the following:
 - 4.4.1 Shoulder, Elbow
 - 4.4.2 Hips, Knee,
 - 4.4.3 Ankle and Foot joints

References:

- Christine, M. D., (1999). Physiology of Sports and Exercise. USA: Human Kinetics.
- Conley, M. (2000). Bioenergetics of Exercise Training. In T.R. Baechle, & R.W. Earle, (Eds.), Essentials of Strength Training and Conditioning (pp. 73-90). Champaign, IL: Human Kinetics.
- Jeyaprakash, C. S., Sports Medicine, J.P. Brothers Pub., New Delhi, 2003.
- Khanna, G.L., (1990). Exercise Physiology & Sports Medicine. Delhi: Lucky Enterprises.
- Mathew, D.K. & Fox, E.L, (1971). Physiological Basis of Physical Education and Athletics. Philadelphia: W.B. Saunders Co.
- Pandey, P.K., (1987). Outline of Sports Medicine, New Delhi: J.P. Brothers Pub.
- Williams, J. G. P. (1962). Sports Medicine. London: Edward Arnold Ltd.

MSCSP-EC: 402- Sports Physiology and Gender

Learning Objective: To provide and understanding the difference between the gender and adaptation of load.

Learning Output:

UNIT- I

- 1.1 Introduction; Characteristics
- 1.2 Anthropometric structure of men and women (Difference)
- 1.3 Exercises in Athletic Women
- 1.4 Exercises in Athletic men
- 1.5 Sports Events and Performances

UNIT- II

- 2.1 Gender difference in muscle morphology
- 2.2 Sports activities and physical responses between women and men
- 2.3 Sports activities and Physiological responses between women and men
- 2.4 Sports activities and Psychological responses between women and men
- 2.5 Swimming and gymnastics for women

UNIT- III

- 3.1 Exercise Psychology and Women
- 3.2 Exercise for the childbearing year
- 3.3 Perimenopausal and post menopausal
- 3.4 Medical Problems in Sports Women

UNIT- IV

- 4.1 Gender and load adaptation;
 - 4.1.1 Strength (Resistance Training)
 - 4.1.2 Power
 - 4.1.3 Endurance
 - 4.1.4 Speed and Agility
- 4.2 Gender and Nutrition;
 - 4.2.1 Regular training
 - 4.2.2 Before Competition
 - 4.2.3 During Competition
 - 4.2.4 After Competition

References:

- Nadya Swedan (2001): Women's Sports Medicine and Rehabilitation. An Aspen Publication.
- Mary Lloyd Ireland & Aurelia Nattiv (2002): The Female Athlete. Saunders Publication.
- Cardozo L and Staskin D (2006): Textbook of Female Urology and Urogynaecology (2nd edn). London: Isis Medical Media Ltd.
- Mantle J, Haslam J and Barton S (2004): Physiotherapy in Obstetrics and Gynaecology. (2nd ed.) London: Butterworth-Heinemann.
- Sapsford R, Markwell S and Bullock-Saxton J (1998): Women's Health: A Textbook for Physiotherapists. London: WB Saunders Company Ltd.
- Bo, K., Berghmans, L.C.M., Van Kampen, M., Morkved, S. (2007). Evidence-Based Physical Therapy for the Pelvic Floor: Bridging Science and Clinical Practice. London: Churchill Livingstone.

MSCSP-PC: 401: Clinical Exercise Physiology & Sports Psychology

Learning Objectives It will present an introduction to clinical exercise physiology through the topics of: Exercise and disease, Legal and Ethical Considerations, weight training for cardiac rehabilitation etc.

Learning Outcome: Understand the cardiovascular, respiratory and metabolic responses to the acute physical activity of differing intensities and compare the responses of individuals of differing levels of fitness to a range of relative and absolute exercise intensities.

Clinical Exercise Physiology

1. Exercise and disease
2. Rehabilitation of cardiovascular diseases
3. Exercise in CHD prevention
4. Exercise tests for assessment of cardiovascular dysfunctions
5. Weight training for cardiac rehabilitation
6. Exercise for diabetic patients
7. Demonstrating Functional Outcomes for Health and Fitness of Cancer Patients.
8. Exercise prescription for health- Screening and exercise testing
9. Exercises for Special populations
10. Exercise Prescription and Counselling for Weight Management
11. Measurement of blood glucose Cholesterol/HDL, Glycerol, Lactate, Triglycerides
12. Estimation of sugars, iron, phosphate, Vitamin C and organic acids
13. Estimation of protein concentration
14. Demonstration of ROM Exercises and Prescription

References:

- William D. McArdle, Frank I. Katch, Victor L. Katch (2010) Exercise physiology nutrition, energy, and human performance. Lippincott Williams & Wilkins, Baltimore, USA.
- Astrand, P.O. and Rodahl, K. (2003) Text book of Work Physiology Physiological basis of exercise. Human Kinetics, USA.
- Scott Powers and Edward Howley (2014) Exercise Physiology Theory and Application to Fitness and Performance. McGraw-Hill Higher Education
- K. Birch, D. MacLaren, K. George. (2005). Instant notes in sport and exercise physiology. Garland Science/BIOS Scientific Publishers.
- Werner W.K. Hoeger, Sharon A. Hoeger. (2010) Principles and Labs for Physical Fitness. Wadsworth, Cengage Learning.
- Joseph P. Winnick and Francis X. Short. (2014) Brockport physical fitness test manual a health-related assessment for youngsters with disabilities.
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- Shephard, R.J. and Astrand, P.-O. (1992) Endurance in sport. Blackwell Science Ltd, USA.
- Ron J. Maughan (2009) The Olympic textbook of science in sport. Blackwell Publishing Ltd
- Yves C. Vanlandewijck and Walter R. Thompson (2011) The Paralympics athlete handbook of sports medicine and science. Wiley- Blackwell.
- John Wesson (2002). The Science of Soccer. Institute of Physics Publishing, Bristol and Philadelphia.
- John J. Fontanella (2006). The physics of basketball. The Johns Hopkins University Press

MSCSP-PC: 402- Nutrition and Sports Performance

Learning Objectives: To provide knowledge about the nutrition and its components and specific nutrition for sports performance.

Learning Outcomes: The students will also gain knowledge about the relationship between balanced diet and maintenance of performance and planning to gain performance.

Practical:

Research related to pre-competition meals

1. Timing of pre-competition meals
2. Content of pre-competition meals
3. Glucose and insulin responses of pre-competition meals
4. Glycogen loading (supercompensation)
5. Different needs for specific sports activities

Research related to post-competition meals

1. Timing of post-competition meals
2. Content of post-competition meals
3. Different needs for specific sports activities
4. The importance of recovery; optimal amount of recovery time according to training/competition

Research related to dietary supplements and their effects on performance

1. Vitamins and minerals
2. Creatine phosphate; creatine monohydrate; other creatine supplements
3. Sodium bicarbonate and other buffering agents
4. Ginseng
5. Caffeine Over the counter drugs: i.e., amphetamines
6. Prescribed drugs: i.e., beta blockers

Suggested Books:

- Sport Nutrition 3rd Edition by Asker Jeukendrup, Michael Gleeson, Human Kinetics, 2018.
- Nutrition for Sport, Exercise, and Health by Marie Spano, Laura Kruskall, D. Travis Thomas, Human Kinetics.
- Physiology of Sport and Exercise 6th Edition with Web Study Guide-Loose-Leaf Edition by W. Larry Kenney, Jack Wilmore, David Costill.
- Nancy Clark's Sports Nutrition Guidebook by Nancy Clark, Human Kinetics
- Fundamental of Foods, Nutrition & Diet Therapy 5th edition by S.R. Mudambi, M.V. Rajagopal, New Age International Limited, New Delhi.
- Applied Nutrition. By R. Rajlaxmi, IBH Publications, New Delhi.
- Nutritional Supplements in Sports, Exercise and Health: An A to Z Guide by Linda M. Castell, Smantha J. Stear, Louise M. Burke, Routledge.
- Groff & Gropper. Advanced Nutrition and Human Metabolism, 3rd Ed., Wadsworth, 2000
- Jeukendrup & Gleeson. Sport Nutrition, Human Kinetics, 2004
- Ed. Burke & Deakin. Clinical Sports Nutrition, 3rd Ed., McGraw-Hill
- Burke, Practical Sports Nutrition, Human Kinetics, 2007.