School of Sports Sciences
Department of Sports Biosciences

Proposed Course Structure and Course Details

M.Sc. Sports Nutrition

Central University of Rajasthan NH-8,
Bandar Sindri, Kishangarh-305817 Dist. –
Ajmer (Rajasthan)

M.Sc. Sports Nutrition

SEMESTER I (Total credits: 24)

Code	Title of Course	Type of Course	Credits
MSSN 101	Human Anatomy and Physiology	Core	3
MSSN 102	Biomolecules and Metabolism	Core	3
MSSN 103	Kinesiology	Core	3
MSSN 104	Psychological and Social Aspects of Sports	Core	3
MSSN 105	Biomechanics and Motor Learning	Core	3
MSSN 106	Elective I • Elective from any other Department • Sports First Aid and Emergencies • History of Physical Education and Sports • Physiological Aspects of Ageing	Elective	3
MSSN 107	Laboratory I	Core	3
MSSN 108	Laboratory II	Core	3

SEMESTER II (Total credits: 24)

Code	Title of Course	Type of Course	Credits
MSSN 201	Principles and Methods of Sports Training	Core	3
MSSN 202	Exercise Physiology and Metabolism	Core	3
MSSN 203	Fatigue, Injuries and Rehabilitation	Core	3
MSSN 204	Food and Nutrition	Core	3
MSSN 205	Statistics for Sports Science	Core	3
MSSN 206	Elective II • Elective from any other Department • Kinanthropometry in Sports • Health Fitness and Wellness • Adaptations to Exercise and Training	Elective	3
MSSN 207	Laboratory III	Core	3
MSSN 208	Laboratory IV	Core	3

SEMESTER III (Total credits: 24)

Code	Title of Course	Type of Course	Credits
MSSN 301	Clinical Sports Nutrition	Core	3
MSSN 302	Dietary Supplements and Ergogenic Aids	Core	3
MSSN 303	Assessment of Health and Fitness of Athlete	Core	3
MSSN 304	Nutritional and Exercise Biochemistry	Core	3
MSSN 305	Sports Specific Nutrition	Core	3
MSSN 306	Elective III • Elective from any other Department • Food Psychology and Counselling • Sports Genetics and Performance • Exercise Immunology	Elective	3
MSSN 307	Laboratory V	Core	3
MSSN 308	Laboratory VI	Core	3

SEMESTER IV (Total credits: 24)

Code	Title of Course	Type of Course	Credits
MSSN 401	Research Methodology	Core	3
MSSN 402	Journal Club Presentation	Presentation	3
MSSN 403	Major Project	Tutorial/Laboratory	18

SEMESTER-I

MSSN 101 Human Anatomy and Physiology Credit 3

Unit-I
Anatomy and Physiology of: Blood, Cardiovascular System, Lymphatic System, Integumentary System and Respiratory System.

Unit-II
Anatomy and Physiology of: Nervous System, Special Senses, Endocrine System, Skeletal System, Joints and Muscular System.

Unit-III
Anatomy and Physiology of: Digestive System, Immune System, Urinary System, Fluid and Electrolyte Balance, Reproductive System, Pregnancy and Human Development.

Recommended Books:

- Human Anatomy and Physiology (10^{th} edition) by Elaine N Marieb, Katja N Hoehn.
- Introduction to Human Body- The Essentials of Anatomy and Physiology by Gerard J. Tortora.
- Textbook of Anatomy with Coloured Atlas by Inderbir Singh.
- Textbook of Medical Physiology by Arthur C. Guyton.
- Principle of Human Anatomy (10^{th} Edition) by Gerard J. Tortora.
- Gray's Anatomy: Anatomical Basis of Clinical Practice by Standring, Susan. Borley, Neil R. Gray Henry.
- Human Physiology by C.C. Chatterjee.
- Chowdhary Medical Physiology by S K Chowdhary.
- Netter's Atlas of Human Anatomy by Frank H. Netter.

MSSN102 Biomolecules and Metabolism Credit 3

Unit-I
Foundation of Biochemistry, Properties of Water, Amino Acids, Peptides and Proteins, Structure and Function of Proteins, Enzymes, Sugars, Carbohydrates and Glycobiology, Nucleotides and Nucleic Acids, Fatty Acids, Structure and Functions of Lipids.

Unit-II
Principles of Bioenergetics, Major Metabolic Pathways in Human and its Relevance with Exercise, Glycolysis, Gluconeogenesis, Pentose Phosphate Pathway, Citric Acid Cycle, Electron Transfer System in Mitochondria, Oxidative Phosphorylation.

Unit-III
Basic Concepts and Design of Metabolism, Metabolic Regulation of Glucose and Glycogen, Biosynthesis of Carbohydrates, Lipid Biosynthesis, Fatty Acids Catabolism, Amino Acids- Biosynthesis, Oxidation and Production of Urea, Metabolism of Lactate, Integration and Regulation of Metabolism.

Recommended Books:

- Principles of Biochemistry- Lehninger Nilson and Cox W.H. Freeman.
- Principles of Biochemistry- Donald Voet, CW Pratt, JG Voet (2012) Wiley, ISBN:1118092449.
- Principles of Exercise Biochemistry Editor(s): Poortmans J.R. (Brussels) Karger Publishers.
- Biochemistry JM Berg, TL Tymoczko L Stryer W. H. Freeman and Company.
- West & Todd Text book of Biochemistry. Mac Millan Company London.
- G.P. Talwar & ID Singh Textbook of Biochemistry & Human Biology - Prentice Hall of India, New Delhi.
- Vasudevan Textbook of Biochemistry. Jaypee Brothers Medical publishers (P) Ltd.
- Jain J.L., Jain Sanjay, Jain Nitin, S Fundamentals of Biochemistry –. Chand and Company Ltd, New Delhi.
- A.C. Dev. Comprehensive Viva and practical Biochemistry. New Central Book Agency Pvt. LTD.

MSSN 103 Kinesiology Credit 3

Unit-I
Meaning of Kinesiology, Aims and Objectives of Kinesiology, Role of Kinesiology in Sports; Anatomical Position, Principles of Plane and Axis, Various types of movements.

Unit-II
Bones: Meaning and composition of bone, Kinds of bones (flat, long, short, irregular and sesamoid), Function of bones, Bone fracture and its types; General features of the following bones: Upper Extremities: Clavicle, Scapula, Radius and Ulna, Humorous; Lower Extremities: Femur, Patella, Tibia, Fibula, Pelvic Bones; Joints: Meaning and types of joints, Joint flexibility, Technique to increase the flexibilities, Structure, function, fundamental movements around the joints; General features, structure and movements of the following joints: Shoulder Complex, Elbow Complex, Hip Complex, Knee joint, Spinal column and Pelvic girdle.

Unit-III

Introduction to Muscular System: Muscles and Tendons, Classification of muscles**,** Structure of Skelton muscle, classification of muscles on the basis of fibre arrangement**,** Physiology of muscle contraction, types of muscle contraction**,** Role of muscle in the movement, Methods of studying the action of muscle. Origin, Insertion and action of major muscle groups of the body; Nervous System: Overview of Nervous system, Neurons, Motor Unit and Receptors.

Recommended Books:

- Clinical Mechanics and Kinesiology With Web Resource, Human Kinetics, by Janice Loudon, Robert Manske, Michael Reiman.
- Biomechanics and Kinesiology of Exercise – 2013 by Michael Yessis.
- Cynthia C. Norkin, Pamela K. Levangie : Joint structure & function- A comprehensive analysis 2nd edition.
- Brunnstrom - Clinical Kinesiology, F.A. Davis.
- Rasch and Burk: Kinesiology and Applied Anatomy, Lee and Fabiger.
- Shaw, D,, Pedagogic Kinesiology, Khel Sahitya Kendra, 2007.
- Thompson, C., Manual of Structural Kinesiology. (10th Ed.), St. Louis: Times Mirror/ Mosby College Publishing, 1995.
- Shaw, Dhanonjoy, Kinsiology and Biomechanics of Human Motion, Khel Sahitya Kendra, 1998.
- White and Punjabi - Biomechanics of Spine - Lippincott.
- Kapandji: Physiology of Joints Vol. I, II & III, W.B. Saunders.
- Luttgens K., Hamilton N.: Kinesiology – Scientific Basis of Human Motion 9th Edi.
- Basic Biomechanics 4th edition, susan J. Hall, MCGraw Hill.

MSSN 104 Psychological and Social Aspects of Sports Credit 3

Unit-I

Sports Psychology and role of Psychology in Sports, Methods of Psychology employed in Sports, Motor leaning and Performance, Importance of Sports Psychology for Athletes, Coaches and others related to Sports settings.

Unit-II

Personality and its role in Sports, Attention and Perception in Sports; Motivation and Goal setting and its role in Sports, Emotions in Sports, Stress and Anxiety in Sports, Biofeedback techniques in Sports.

Unit-III

Sociology of Sports, Social Factors and Socio-metric techniques in Sports, Group processes, Team cohesiveness and Leadership in Sports, Effect of crowd behaviour in Sports, Economics and Politics in Sports.

Recommended Books:

- Weinberg & Gould, Foundations of Sports and Exercise Psychology. Human Kinetics 2016.
- Motor Learning and Performance 5th Edition With Web Study Guide From Principles to Application, Human Kinetics by Richard Schmidt, Tim Lee.
- Morgan and King: Introduction to Psychology - Tata McGraw Hill.
- M.L. Kamlesh Psychology in Physical Education and Sports by Publisher Mehopolitan book co. Pvt. Ltd., Netaji Subash Marg, New Delhi 11002.
- Sanjeev. P. Sahni Psychology and its application in sports by, Publisher D.V.S. publications, 100, Giri Nagar Kalkaji, New Delhi-110019.
- Agyajit Singh Psychology of Coaching , Friends Publications, # 101 Ansari Road Darya Ganj, New Delhi-110002.
- Jitendra Mohan Recent Advances in Sports psychology, By, Publisher, Friends Publications.
- Fundamentals of Sociology of Sport and Physical Activity, Human Kinetics by Katherine M. Jamieson, Maureen M. Smith.
- Doing Exercise Psychology, Human Kinetics by Mark Andersen, Stephanie Hanrahan.
- Social Issues in Sport 3rd Edition, Human Kinetics by Ron Woods.

MSSN 105 Biomechanics and Motor Learning Credit 3

Unit-I

Role of Bio–Mechanics in the field of Sports Science, Principles of Biomechanics; Biomechanical Concepts: Motion, Newton's law of Angular Motion and Linear Motion and its relationships, Force, Centripetal and Centrifugal forces, Equilibrium, Centre of Gravity and Stability, Freely falling bodies and Projectile, Momentum, Impulse, Lever and its Classification, Work, power, Energy: Relationship of Work, Power and Energy, Friction, Spin, Impact, Elasticity, Rebound, Fluid mechanics, Air resistance and Water Resistance.

Unit-II

Determine the simultaneous-sequential nature of a variety of movement skills, Classify motor skills using the classification system presented, Bio-Mechanical analysis of fundamental skills: Walking, Running, Jumping, Pulling, Pushing, Lifting, Lowering, Throwing.

Unit-III
Introduction to Gait Analysis. Mechanical Analysis of Sports Skills: Athletics (Running, Jumping and Throwing), Swimming, Football, Basketball, Volleyball, Cricket. Technological Use and Advances in Biomechanics: Techniques and Tools for Measurement of Biomechanical Variables.

Recommended Books:

- Biomechanical Analysis of Fundamental Human Movements by Arthur Chapman, 2008, Human Kinetics.
- Biomechanics of Sport and Exercise 3rd Edition With Web Resource and MaxTRAQ 2D Educational Software Access-Loose-Leaf Edition, Human Kinetics, By Peter McGinnis.
- Biomechanics and Kinesiology of Exercise – 2013 by Michael Yessis.
- Cynthia C. Norkin, Pamela K. Levangie : Joint structure & function- A comprehensive analysis 2nd edition, F.A. Davis Company Philadelphia.
- Brunnstrom - Clinical Kinesiology, F.A. Davis.
- Rasch and Burk: Kinesiology and Applied Anatomy, Lee and Fabiger.
- White and Punjabi - Biomechanics of Spine - Lippincott.
- Kapandji: Physiology of Joints Vol. I, II & III, W.B. Saunders.
- Luttgens K., Hamilton N.: Kinesiology – Scientific Basis of Human Motion 9th Edi.
- Basic Biomechanics 4th edition, susan J. Hall, MCGraw Hill.
- Joseph Hamill, Kathleen M. Knutzen. Biomechanical Basis of Human Movement.

MSSN 106 **Elective I** **Credit 3**

Sports First Aid & Emergencies

Unit-I
Introduction to Sports First Aid, Athletic Health Care Team, Sport First Aid Game Plan , First Aid Equipment and Kit, Basic Life Support System, Recovery Position, Head to toe- survey, Artificial Ventilation, Basic Sport First Aid Skills, Anatomy and Sport Injury Terminology, Emergency Action Steps , Physical Assessment and First Aid Techniques, Moving Injured or Sick Athletes.

Unit-II
Sport First Aid for Specific Injuries: Unconsciousness: ABC, CPR, AED, Respiratory Emergencies and Illnesses , Shock, Wounds and Bleeding, Head, Spine and Nerve Injuries , Internal Organ Injuries , Upper and Lower Body Musculoskeletal Injuries , Facial and Scalp Injuries, Skin Problems.

Unit-III
Disaster Preparedness and Management: Weather-Related Problems, Environmental Emergencies: Animal Bites and Stings, Allergies, First Aid Protocols, Practical Skills in using: Triangular Bandages, Broad fold, Thin fold, Slings, Collars, Cardiac Emergencies.

Recommended Books:

- Sport First Aid-5th Edition by Melinda Flegel, Human Kinetics, 2014.
- American Red Cross, First Aid/CPR/AED : PARTICIPANT'S MANUAL.
- Practical First Aid: British Red Cross in Association with donning kinder sley.
- John Morris: First Aid Training Manual, Everyday learning PVT., Ltd.
- Authorized Manual of St. John Ambulance (India): First Aid.
- Bradley R.A. Wilson. Timothy E. Glaros : Managing Health Promotion Programs Human Kinetics Publishers.

History of Physical Education and Sports

Unit-I
What are Play, Game and Sports? Types of sports and recreational activities, Importance of free play and organizational games, Terminology: Sports Science and Physical Education, Health related and Motor performance related fitness, Health and Wellness (Physical, Mental, Psychological, Social and Spiritual) and Athletics, Sports Carriers: Media, Management, Performance, Coaching and other related areas.

Unit-II
Philosophy and its need in Sports and Physical Education, Idealism, Naturalism and Pragmatism in Physical Education, Physical Education in Ancient Greek, Rome, India and Modern India. History of Olympic Games, Asian Games, SAARC Games and SAF Games, National Sports Awards, Trends and problems in Sports Sciences and Physical Education in 21st Century.

Unit-III
Introduction to general Rules and Regulations of Selected Sports (Football, Field Hockey, Basketball, Volleyball, Cricket, Badminton, Tennis), Introduction to Playfields and Track Specifications, General organizational process of Sports Competitions.

Recommended Books**:**

- Bucher, C.A.: Foundation of Physical Education, St. Louis: The C.V. Mosby company, 1983.
- History and Philosophy of Sport and Physical Activity, Human Kinetics by R. Scott Kretchmar, Mark Dyreson, Matthew Liewellyn, John Gleaves, 2017.
- Synder and Geoh: Professional preparation in Health Education, Physical Education and Recreation.
- Barrow, H.M.: Man and Movement: Principles of Physical Education, Philadelphia Lea and Fabiger, 1977.
- Joseph, P.M.: Organisation of Physical Education, Kandivila,: Old students Association, T.I.P.E.
- Kamlesh, M.L. and Sangral, M.S. : History and Principles of Physical Education, Prakash Brothers, 1983.
- Wuest and Bucher: Foundations of Physical Education and Sports, B.I. Publications Pvt. Ltd., New Delhi.
- William, H.F.: Physical Education and Sports in Changing Society, Surjeet Publication, Delhi.

Physiological Aspects of Ageing

Unit-I
Growth and Biological Maturation: Relevance to Athletic Performance; Muscle Development during Childhood and Adolescence, Relevance to Understanding Effects of Growth on Performance.

Unit-II
Theory of ageing, Age related changes in different body systems, Cardiovascular Concerns in the Young Athlete, Trainability During Childhood, Ageing and muscular strength, Ageing and joint flexibility.

Unit-III
Exercise guideline for Geriatric populations. Introduction to Masters Sports, Ageing and Performance, and the role of continued involvement, Psychosocial issues in Masters Sports, Model of lifespan physical activity, health and performance.

Recommended Books**:**

- Helge Hebestreit and Oded Bar-Or (2008) The young athlete. Blackwell Publishing Ltd.
- Joseph Baker, Sean Horton and Patricia Weir (2000) The masters athlete: understanding the role of exercise in optimizing aging. Routledge.
- “Fitness and Wellness": Warner W. K Hoeger and Sharvon A. Hoegor.
- "Fitness & Wellness concepts": Charles B. Corbina & Ruth Lindsey.
- "Lifetime Fitness & Wellness - A personal choice": Melvin H. Williams.

MSSN 107 Laboratory I Credits-3

- Introduction to laboratory techniques- pipetting, calculations, introduction to equipments, sterile techniques and lab safety.
- How to Use microscopes.
- To study Counting Chambers.
- To determine the total Red Blood Corpuscles count.
- To determine the total Leucocyte Count in blood.
- To measure the Haemoglobin concentration of blood.
- To measure Blood Pressure of a subject in different positions.
- Calculation of Energy expenditure.
- Measurement of blood glucose Cholesterol/HDL, Glycerol, Lactate, Triglycerides.
- Biochemical Assessment of Metabolites.
- Biochemical Assessment of Enzymes.
- Biochemical Assessment of Hormones.
- Estimation of sugars, iron, phosphate, vitamin C and organic acids.
- Estimation of protein concentration.

MSSN 108 Laboratory II Credits-3

- To analyse various planes and axes of the body.
- To demonstrate the surface anatomy and muscle attachments of following bones: Clavicle, Scapula, Humerus, Radius, Ulna, Meta Carpals, Phalanges, Femur, Tibia , Fibula, Patella, Tarsals and metatarsals.
- To demonstrate the following joints including corresponding muscles and movements of Upper Extremity: Acromioclavicular joint, Sternoclavicular joint, Shoulder joint, Elbow joint, Proximal Radioulnar joint, Distal Radioulnar joint, Wrist joint Thumb joint.
- To demonstrate the following joints including corresponding muscles and movements of Lower Extremity: Hip Joint, Knee complex, Ankle joint.
- Demonstration and Estimation of Centre of Gravity of Human Body.
- Determination of Human Gait pattern.

SEMESTER-II

MSSN 201 Principles and Methods of Sports Training Credit 3

Unit-I

Scientific basis of Sports Training, Importance, Aims and Objectives of Sports Training; Characteristics of Sports Training; Biological Process in Training; Components of Physical Fitness (motor abilities) – Endurance, Strength, Speed, Flexibility, Co-ordination; Agility.

Unit-II

Principles of Sports Training - Overload, Specificity, Progression and Reversibility; Meaning and concept of Training load; Adaptation and Recovery, Super Compensation, Training Structure - Volume, Intensity, Frequency, Peaking, Errors in Training, Adaptations to Resistance Training, Adaptations to Aerobic and Anaerobic Training.

Unit-III

Training plan; Need and importance in planning; Types of training plans - short term and long term plans; Training and Competition Cycles (training conception, macro, micro, meso); Periodization – Need, Types; Aims of various phases of Periodization (Preparatory, Competition and Transition); Competition -Types of Competition, Preparation for competition; the number and frequency of competition. Training athletes with disability, Adapted games for Disabled; Special Olympics and Paralympics.

Recommended Books:

- Physiology of Sport and Exercise 6th Edition with Web Study Guide-Loose-Leaf Edition by W. Larry Kenney, Jack Wilmore, David Costill.
- Periodization-6th Edition Theory and Methodology of Training by Tudor Bompa, Carlo Buzzichelli.
- Physiological Aspects of Sport Training and Performance With Web Resource-2nd Edition, Human Kinetics By Jay Hoffman.
- Recovery for Performance in Sport by Institut National du Sport de l'Expertise et de la Performance INSEP, Human Kinetics, Christophe Hausswirth, A. Mujika.
- Essentials of Sports Training and Conditioning by JB Learning, NASM.
- Singh, H: Science of Sports training, DVS Publication, New Delhi, 1991.
- Matweyev, L.P.: Fundamentals of Sports training, publication Moscow, 1984.
- Harre, D: Principles of sports training, Sportverlag, Berlin, 1988.
- Singh, H: Science of Sports training: General theory and methods, NIS, Patiala, 1984.
- Scholisch, M: Circuit training, Sportverlag, Berlin.
- Willmore, J.H.: Athletic training and physical fitness, Antro and Becon Inc, Sydney.

MSSN 202 Exercise Physiology and Metabolism Credit 3

Unit-I

Introduction to Exercise Physiology: Definitions of terminologies (Work, Power, speed, strength, efficiency etc.); Types of exercise (aerobic and anaerobic) and limiting factors, Exercise intensity and duration, Adaptations to exercise**:** Physiological and metabolic adaptations to training; Muscle hypertrophy and performance.

Unit-II

Adaptation of Respiratory and Cardiovascular Systems to exercise: Respiratory responses during exercise at varying intensities, Cardiovascular responses to exercise. Fluid balance and Thermoregulation: Energy Production; Aerobic metabolism during exercise (oxygen and carbon-di-oxide production, oxygen cost of breathing, RER, Estimation of calorie expenditure, MET, Field estimates of energy expenditure, efficiency and economy), Exercise in environmental stress; Exercise in the heat; Cardiovascular demands of exercise in the heat; Exercise in cold; Cold induced injuries.

Unit III

Adaptation of skeletal muscle, endocrine and immune system in training: Bone development; Factors influencing bone health; Special applications in osteoporosis; Female athletic triad; Skeletal injuries. Skeletal muscle and neuromuscular system, Importance of muscle fibre types in athletes; Skeletal muscle force production; Fatigue and muscle soreness;Physiological response to stretching; Application of training principles to flexibility; Adaptation to flexibility.

Recommended Books:

- Christopher B. Scott. (2010). A Primer for the Exercise and Nutrition Sciences: Thermodynamics, Bioenergetics, Metabolism. Humana Press.
- Raven, P., Wasserman, D., Squires, W., & Murray, T. (2012). Exercise Physiology: An Integrated approach. Nelson Education.
- ACSM's Resources for Clinical Exercise Physiology: Musculoskeletal, Neuromuscular, Neoplastic, Immunologic and Hematologic Conditions by American College of Sports Medicine.
- Powers, S. (2014). Exercise physiology: Theory and application to fitness and performance. McGraw-Hill Higher Education.

- Smith, D. L., & Fernhall, B. (2011). Advanced cardiovascular exercise physiology. Human Kinetics.
- Farrell, P. A., Joyner, M., & Caiozzo, V. (2011). ACSM's advanced exercise physiology.
- Cheung, S. (2010). Advanced environmental exercise physiology. Human Kinetics.
- Hale, T. (2005). Exercise physiology: a thematic approach (Vol. 5). John Wiley & Sons.
- Ehrman, J. K., Kerrigan, D., & Keteyian, S. (2017). Advanced Exercise Physiology: Essential Concepts and Applications. Human Kinetics.
- McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise physiology: nutrition, energy, and human performance. 8th Edition, Lippincott Williams & Wilkins.

MSSN 203 Fatigue, Injuries and Rehabilitation Credit 3

Unit-I

Concept of Overloading, Overtraining, Fatigue and Staleness, Symptoms and Causes of Fatigue, Types of Fatigue, Theories associated with Fatigue, Definition, Types, Symptoms, Findings, Underlying Mechanisms and Frequency of Overtraining and Overtraining Syndrome, Oxygen Debt Theory, Recovery Oxygen Uptake or Excess Post-Exercise Oxygen Consumption (EPOC), Implications of EPOC for Exercise and Recovery, Optimal Recovery From Steady-Rate Exercise and Non–Steady-Rate Exercise, Intermittent Exercise and Recovery.

Unit-II

Sports Injury- Meaning, Classification, Causes, Types, General guidelines for their Prevention, Recovery Time, Introduction and Management of common Sports Injuries (Fracture, Dislocation, Laceration, Abrasion, Sprain and Strain), How to avoid Sports Injuries, Role of Warm-up and Cool Down.

Unit-III

Rehabilitation: Meaning, Concepts, Objective and scope of Rehabilitation**,** Principal of care and Rehabilitation
Therapeutic Modalities: Electrotherapeutic modalities (Shortwave Diathermy**,** Ultra Sound**,** T.E.N.S**),** Heat and Cold, Soft tissue Massage**,** Aquatic Rehabilitation Exercise, Therapeutic Exercise, Therapeutic Nutrition, Psychological Rehabilitation.

Recommended Books**:**

- Shaun Phillips (2015) Fatigue in Sport and Exercise. Routledge, NY
- Therapeutic Modalities for Musculoskeletal Injuries 4th Edition, Human Kinetics by Craig Denegar, Ethan Saliba, Susan Saliba, 2016
- Essentials of Athletic injury management 10th edition by William E. Prentice, Human Kinetics.
- Clinical Sports Medicine Fifth Edition by Peter Brukner, Karim Khan, McGraw-Hill Education Australia, 2016
- Principles and Practice of Therapeutic Massage by Sinha, Jaypee Publishers
- Textbook of Electrotherapy by Singh Jagmohan, Jaypee Publishers
- Manfred Lehmann, Carl Foster, Uwe Gastmann, Hans Keizer and Jtirgen M. Steinacker(Eds) (1997) Overload, Performance Incompetence and Regeneration In sport. Kluwer Academic / Plenum Publishers, N.

MSSN 204 Food and Nutrition Credit 3

Unit-I

Nutrients: Functions and Recommended Intakes, Healthy Eating and Balanced Diet, Fuel Sources for Muscle and Exercise Metabolism, Energy: Food Energy and Expenditure, Gastric Emptying, Digestion, and Absorption.

Unit-II

Nutritional Role and Recommendations for following: Carbohydrate, Fat, Protein and Amino Acids, Water Requirements and Fluid Balance, Vitamins and Minerals, Nutrition Supplements.

Unit-III

Nutrition and Training Adaptations, Nutrition and Immune Function in Athletes, Body Composition and Weight Management, Eating Disorders in Athletes, Personalized Nutrition, Menu Planning (Meal Timing and Spacing).

Recommended 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.
- Exercise Physiology: Nutrition, Energy and Human Performance 8th Edition by William D. McArdle, Frank I. Katch, Victor L. Katch
- Nancy Clark's Sports Nutrition Guidebook by Nancy Clark, Human Kinetics
- NSCA's Guide to Sport and Exercise Nutrition by National Strength Conditioning Association, 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.

MSSN 205 Statistics for Sports Science Credit 3

Unit-I
Introduction to Biostatistics, Frequency Distribution, Variable and Attribute, Line-diagram, Bar-diagram, Pie chart, Histogram, Mean, Median and Mode.

Unit-II
Variance, Standard deviation; Standard error of mean, Null hypothesis, Level of significance and Probability; Regression and correlation.

Unit-III
Student‘s t-test, Fisher's t-test, Chi-square test, Analysis of Variance (ANOVA), ANCOVA,
Introduction and Application of Statistical Software.

Recommended Books:
- A Text book of Biostatistics, by A.K.Sharma, Discovery publishing house.
- Introduction to Biostatistics, By Dr. Pranab Kumar Banerjee, S. Chand Publishers.
- Research Methodology: Methods and Techniques Book by C. R. Kothari.
- Dutta N.K. Fundamentals of Bio-Statistics. 2002; Kanishka Publishers, New Delhi.
- Gupta S.P. Statistical Methods. 2004; S. Chand & Sons, New Delhi.
- Ruud H. Koning and James H. Albert (2008) Statistical thinking in sports. Chapman & Hall/CRC.

MSSN 206 Elective II Credit 3

Kinanthropometry in Sports

Unit–I
Introduction, scope and general consideration, i.e. Application of anthropometric data in sports, Body proportions and indices, Sports specific body proportions and indices, Body mass index and its importance in sports.

Unit–II
Anthropometric Measurements and Procedures, Equipment for anthropometric measurements, Gross Body Measurements and procedures, Length of Body Parts, Measurements and procedures, Diameters of Body Parts, Measurements and procedures, Circumferences of Body Parts, Measurements and procedures, Skinfold Thickness, Measurements and procedures.

Unit–III
Physiological Maturation: Decimal Age and concept of Physiological maturity in sports. Assessment of skeletal maturity of athletes, Body Composition: Anthropometric determination, Importance in sports and various methods to estimate body composition, Somatotyping: Introduction, Definition of Somatotyping and Classification.

Recommended Books:
- Sports Anthropemetry by H.S. Sodhi, ANOVA Publication.
- Physique and Selection of Sportsmen by H.S. Sodhi and L.S. Sidhu.
- Kinanthropometry by S.P. Singh and P. Malhotra, Luna Publication, Patiala.
- Kinanthropometry by Roger Eston and Thomas Reilly, E & F.N. SPON, London.
- Skeletal Maturity by S.P. Singh, L.S. Sidhu, and J. Singh, Human Biology Publication Society, Punjabi University, Patiala.
- Genetic and Anthropological Studies of Olympic Athletes by De Garray, Louis Levine & Cater, Academic Press, London.

Health Fitness and Wellness

Unit-I
Introduction to Health: Concept of health, Lifestyle and Disease, Ageing.

Unit-II
Physical Activities & Fitness: Concept to Fitness, Exercise and its Principles, Health Education Recreation & Dance.

Unit-III
Healthy Life Style Approach: Concept of Wellness, Wellbeing, Stress Management.

Recommended Books:
- "Fitness and Wellness" : Warner W. K Hoeger and Sharvon A. Hoegor.
- "Fitness & Wellness concepts": Charles B. Corbina & Ruth Lindsey.
- "Lifetime Fitness & Wellness - A personal choice": Melvin H. Williams

- Oxford Textbook of Public Health, Helen Liepman.
- Sunderlal, Aadarsh, Pankaj, 2007, Textbook of Community Medicine, CBS Publishers & Distributors.
- Kirch, Wilhelm, 2008, Encyclopedia of Public Health, Volume 1 & 2, Kluwer Academic Publishers.
- Mary -Jane Schneider and Henrey Schneider, 2006 (2nd edition), Introduction to Public Health, Jones and Bartlett Publishers.

Adaptations to Exercise and Training

Unit-I

Cardiovascular Adaptations to Endurance and Strength Training, Hypertrophy and Cardiomyopathy in Young and Older Athletes, Heart rate training zone, Effects Of High Altitude, Sudden Cardiac Death and Exercise in Healthy Adults.

Unit-II

Respiratory System Adaptations to Endurance and Strength Training, Ventilatory response to exercise and its use in sports, Ventilatory threshold, Effects Of Exercise, response to steady- state exercise, Exercise-Induced Bronchoconstriction, Control of Breathing during exercise; The Respiratory System under Stress, respiratory systems adaptation to long-term exercise, Adaptations to systematic Training, Effects Of High Altitude.

Unit-III

Muscular Mechanisms in Aerobic Endurance Training; Neural Mechanisms in Aerobic Endurance Training, Muscle Molecular Mechanisms in Strength Training, Muscle Property Changes in Strength Training, Neural Mechanisms in Strength Training. Initial responses of the neuromuscular systems to exercise; Training Adaptation of the Neuromuscular System.

Recommended Books:

- 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.-0. (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.
- Victor F. Froelicher, Jonathan Myers (2006) Exercise and the heart. Elsevier Inc.
- Christopher B. Cooper and Thomas W. Storer (2004) Exercise testing and interpretation- A practical approach. Cambridge University Press.
- K. Wasserman, J Hansen, D Sue, W Stringer, B Whipp, eds (2004) Principles of Exercise Testing and Interpretation, 4th edn.. Lippincott Williams & Wilkins, Philadelphia, USA.
- Christopher Bell. Cardiovascular Physiology in Exercise and Sport . 1st Edition. 2008; Churchill Livingstone.
- Michael G. Levitzky. Pulmonary Physiology, 8e. 2013; Lange. The McGraw-Hill Companies.
- Denise L. Smith and Bo Fernhall (2011) Advanced cardiovascular exercise physiology. Human Kinetics.

MSSN 207 Laboratory III Credit 3

- Techniques of taking various anthropometric measurements.
- To define and illustrate various body landmarks.
- Gross body measurements: Body weight (Kg), Stature, sitting height, Height of interior superior Iliac spine, Subischial length.
- Diameters or Breadths (cms): Bicristal diameter (Shoulder Breadth), Transverse chest diameter, Antero-posterior chest diameter, Femur bicondylar diameter (knee breadth), Humerus Bicondylar diameter (elbow Breadth).
- BMI Estimation with and without software.
- Assess Energy and Nutrient intake from Diet using suitable Software.
- Circumferences or Girths of body parts, Calf circumference, Thigh circumference, Waist circumference, Chest circumference
- Skinfold measurement and Body Fat Percentage calculations.
- Training Program: Circuit Training Program, Interval Training Program, Ballistic Training Program, Fertlek Training Program.

MSSN 208 Laboratory IV Credit 3

- Aerobic Power Field Assessments: Cooper 1.5-Mile Run/Walk Test and 12-Minute Run/Walk Test, Rockport Fitness Walking Test.
- High-Intensity Fitness Testing: Léger 20 m Shuttle Run Test, Yo-Yo Intermittent Recovery Test, 30-15 Intermittent Fitness Test, Sprinting Performance, Jumping Performance, Power Endurance, Anaerobic Cycling Power, Margaria-Kalamen Stair-Climb Test, BROCKPORT test system, AAHPER health related physical fitness test, Philips JCR test for General motor ability testing.
- Tests for: Speed, Agility, Balance, Coordination, Reaction time, Flexibility.
- Sports Skill Tests for: Soccer, Basketball, Hockey, Tennis.

SEMESTER III

MSSN 301 Clinical Sports Nutrition Credits 3

Unit I

Athletes with Nutrition related disorders; Diabetes and Cardiovascular disease: Physiological effect of exercise; Physical activity prescription; insulin abuse; Effects of long-term physical activity; Acute effects of exercise; Exercise in the presence of Hyperinsulinemia and Hypoinsulinemia; Medical nutrition therapy (MNT); Dietary guidelines and Nutrient timing; type of carbohydrate and timing; Pre and post event carbohydrate loading and fluids; Insulin adjustments. Osteoporosis: Causes and consequences; Physiological effects of exercise; Pathophysiology; Medical Nutrition Therapy. Sports Anaemia: Causes and consequences; Physiological effects of exercise; Pathophysiology; MNT. Athletes with gastrointestinal disorders: food allergies and food intolerance; GI disturbance; Excessive flatulence; Abdominal distention; Intermittent diarrhoea; Constipation; Food related adverse reactions (FRAR); Physiological and dietary factors affecting gut comfort; Gut trainability; Lower GI tract conditions; Irritable Bowel Syndrome (IBS); Low FODMAP diet for IBS; Composition, food sources of FODMAP and pattern of consumption; Coeliac disease; Inflammatory bowel disease (IBD)-Diagnosis, Nutrition related concerns; MNT; Food allergy and Food intolerance: Diagnosis and MNT; nutritional intervention.

Unit II

Nutrition for Special groups, Special Needs and Sports injuries; The Paralympic Athlete: Body composition assessment and management; Eating difficulties and behaviours, Dietary intakes and potential issues; Reported dietary intakes; Fibre timing of food intake and bowel control;Fluid intake; Medicine requiring Therapeutic Use Exemption (TUE) under WADA; Use of vitamin, mineral or sports supplement; Children and adolescent athletes: Growth and development; Nutritional issues; Eating habits and addiction; Nutritional requirements for growth and training; Female athletes: Vulnerability to nutrition assault and insufficiency; Differences in nutrient utilisation; Female athletic triad (FAT) (eating disorder, menstrual irregularity and poor bone mineral density); energy availability and its association with FAT; Assessment for FAT; Dietary guidelines for FAT. Vegetarian athletes: Nutritional status and dietary considerations; Nutritional gaps currently identified and suitable dietary modification for fuelling during training, competitions and traveling.

Unit III

Nutrition for extreme environmental conditions**;** Altitude: Altitude training and Physiology; Dietary recommendations at varied altitudes; Common Nutritional problems faced by athletes at high altitude. Cold and Heat: Effect of Cold/Hot environment on dietary habits and recommendations for training and competing in cold/Hot environments; Effects of exercising in the heat; Heat stress and injury; Strategic timing of water and electrolyte consumption during extreme climatic conditions; Guidelines for preventing food borne diseases; Strategies for Treating Diarrhea and Vomiting; Replacing fluid and electrolytes.

Recommended Books:

- Burke, Louise, and Vicki Deakin. (2015). Clinical sports nutrition. McGraw-Hill.
- Broad, E. (Ed.). (2014). Sports Nutrition for Paralympic Athletes. CRC Press.
- Maughan, R. J., & Shirreffs, S. M. (Eds.). (2013). Food, Nutrition and Sports Performance III. Routledge.
- Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
- Larson-Meyer, D. E. (2007). Vegetarian sports nutrition. Human Kinetics.
- Marie Dunford. (2017) Nutrition for Sport and Exercise.
- LeMura, L. M., & Von Duvillard, S. P. (Eds.). (2004). Clinical exercise physiology: application and physiological principles. Lippincott Williams & Wilkins.
- Cheung, S. (2010). Advanced environmental exercise physiology. Human Kinetics.

MSSN 302 Dietary Supplements and Ergogenic Aids Credits 3

Unit I

Nutritional supplements: Evolution into ergogenic aids or drugs among athletes and government regulations. Dietary supplement: Definition and classifications; Ergogenic aids: Definitions and Classifications; Dietary Supplement Health and Education Act of 1994; Government Protections from Dietary Supplement Hazards and Risks; New Dietary Ingredients; FDA Regulatory Action: Ephedra Supplements and DMAA; FDA Regulatory Actions: Androstenedione, Piracetam, and ATD; Contaminated Supplements and Banned Ingredients; Anabolic Steroid Control Act and Designer Anabolic Steroid Control Act; Adverse Event Regulation and Legislation; Contamination or Adulteration. Doping control and Supplement testing: World anti-doping agency and National Anti-doping agency (NADA), Formation, History and Standards; List of prohibited substances and Drugs; Analytical procedures and testing of samples from athletes; Drug abuse and athletic performance; Regulations on Dietary supplements: FSSAI and NADA.The Role of Nutritional Supplements Complementing Nutrient-Dense Diets: General versus Sport/Exercise-Specific Dietary benefits, Use of Nutritional Supplements in Sport and Exercise; Consequences of mega dosage in sports performance.

Unit II

Macronutrient and Micronutrient Supplements; Protein Supplements: Whey, Casein, Egg Albumen, Soy Protein, Pea Protein & Other Vegan Proteins/Protein Blends), Protein Bars, Protein shakes Amino Acid Supplements- BCAA, Glutamine, Arginine, Taurine. CHO Supplements: Carbo loading, Sports Drinks, Bars and Gels. Fat Supplements: Omega Fatty acids, Medium Chain TCG, Fish Oils. Vitamin Supplements: B-Complex Vitamins, Vitamin C, Vitamin D, Vitamin E Supplements, Multi-Vitamin

Supplements. Mineral Supplements: Calcium-Magnesium-, Iron Supplements, Chromium, Zinc.Antioxidants Supplements: Antioxidants Vitamins & Mineral Supplements.

Unit III

Botanical Ergogenic Supplements: Wheat Germ oil, Beetroot, Green Tea Extract, Tart Cherries, Caffeine, Curcumin, Phytosterols, Bio Flavonoids, Ashwagandha, Rhodiola, Shilajit, Ginseng, Grape Seed Extract, chyawanprash, Herbal Testosterone-Boosters (Eg. Tribulus Terristris, Nettle Root, Long Jack Root Etc), Bitter Orange (Citrus aurantium), Capsaicin, White Kidney Bean (Phaseolus vulgaris), Garcinia Cambogia (Hydroxycitric Acid), Guar Gum, and Psyllium, Glucomannan. Metabolite Ergogenic Supplements: Beta-Alanine, L-Carnitine Co Enzyme Q 10, Creatinine, DHEA, NADH, Glycerol, Inosine, Melatonine, Gamma Oryzanol (Ferurates), FRAC, Glucosania, Alcohol, Adoptogens, Alkalinizers, Androstenedione, B HMB. Use of Nutritional Supplements in Sport and Exercise: Motivational Antecedents and behavioural Outcomes: Motivational Theories Applied to Supplement Use; Behavioural Effects of Selected Supplements Commonly Employed for Performance, Fitness, and Health.

Recommended Books:

- Antonio, J., & Stout, J. R. (2002). Supplements for endurance athletes. Human Kinetics.
- Greenwood, M., Cooke, M. B., Ziegenfuss, T., Kalman, D. S., & Antonio, J. (Eds.). (2015). Nutritional supplements in sports and exercise. Humana Press.
- Cooper, C. E. (2008). Drugs and ergogenic aids to improve sport performance. Essays in biochemistry, 44, 1-10.

MSSN 303 Assessment of Health and Fitness of Athletes Credits 3

Unit I

Assessment of Physique; Kinanthropometry: Definition; Introduction; Body size and proportion; Somatotyping; Circumferences; Skinfold measurement sites and determining body composition; Applications. Body Composition and Performance: Factors that affect Body Composition; Assessment and Interpretation of Anthropometric and body composition data; Ideal Body Composition for Different Sports.Body Composition Assessment Techniques: Direct, Indirect and Doubly indirect (Under Water Weighing, Dexa, Whole Body Conductivity, Skin folds, Bioelectrical Impedance, Total Body Potassium, Near Infrared Interactance).

Unit II

Dietary Assessment of Athletes: Different methods (food and fluid intake); Advantages and Disadvantages; Applications; Assessing food and fluid intake while traveling. Special issues with dietary assessment in sports: Diversity in intake; Training periodisation and food intake; Misreporting; Season and region specific dietary practices. Estimation of dietary intakes: Food data tables and software use; Evaluation of Nutrient Adequacy of Athletes' dietary intake; Methods for assessing food and fuel intake among athletes; Types of dietary assessment tools (Validity and reliability among athletes); Special concerns in assessing food intake among athletes; Translating the dietary intake data into analysis and determining nutritional information.

Unit III

Assessment of Physical fitness: Functional tests; Cardiorespiratory and muscular assessment; Type of measurement and protocol for evaluation and interpretation of performance; Aerobic Power or VO2max; Anaerobic Threshold; Economy of Movement. Fitness assessment: Types of exercise, Components of physical fitness and its evaluation in health and performance. Activity Recording: Self-reporting of activities vs. Direct monitoring of activities. Biochemical and clinical assessment in sports: Assessment of Lipids, Protein, Vitamin and Mineral Status.Clinical Assessment: Signs and symptoms of various nutritional deficiencies. Assessment of Hydration: Estimation of sweat loss and sweat rate; urine volume and indicators of dehydration (Water, Urine and Thirst).

Recommended Books:

- Driskell, J. A., & Wolinsky, I. (Eds.). (2016). Nutritional assessment of athletes. CRC press.
- Eston, R., & Reilly, T. (Eds.). (2013). Kinanthropometry and exercise physiology laboratory manual: tests, procedures and data: volume two: physiology. Routledge.
- ACSM's Health-Related Physical Fitness Assessment Manual.
- H Aile, L., Agher Jr, G. A., Ael, M., & J Robertson, R. (2016). Perceived exertion laboratory manual. Springer New York.
- Heyward, V. H., & Gibson, A. (2014). Advanced fitness assessment and exercise prescription 7th edition. Human kinetics.

MSSN 304 Nutritional and Exercise Biochemistry Credits 3

Unit I

Enzyme chemistry and hormones in macronutrient metabolism and energy production; Enzymes: Structure; Composition; Nomenclature; Classification; Enzyme activity; Factors affecting enzyme activity; Role of co-enzymes; Enzyme kinetics; Enzyme inhibition; Drug and enzyme interactions; Regulation of enzyme activity; Enzymes of clinical significance. Hormone Chemistry: Regulatory system; Physiological function and nutrient interactions of Pituitary hormones; Thyroid and Parathyroid gland hormones; Pancreatic Hormones; Adrenal Glands; Sex Hormones; Pineal gland. General introduction on energy states and anabolism/catabolism: Phosphate energy (short) and oxidation-reduction reactions (long term) as energy sources; Role of glycolysis, gluconeogenesis, glycogenolysis, beta oxidation, Krebs cycle, HMP, ketone body formation, urea cycle and electron transport chain in energy (ATP) production; Biochemical changes during exercise performance; Biochemical characteristics of sub-cellular skeletal muscle during rest and activities.

Unit II

Nucleic Acids and Gene Expression; Biosynthesis and Degradation of Nucleotides: Purine & Pyrimidine Metabolism; Bio Synthesis of Deoxy nucleotides. DNA & RNA: Type; Structure; Metabolism; Transcription; Translation; Protein Biosynthesis and Turn Over. Gene Expression: Basic Mechanisms; Regulation; Nutrient Gene Expressions.

Unit III

Free Radicals: Introduction; Reactive Oxygen Species; Reactive Nitrogen Species; Oxidative Stress; Antioxidant defences (Endogenous & Exogenous). Immune Response: Introduction; Types; Immune dysfunction; Effect of Malnutrition. Aging: Theories; Damage to Mitochondria; Intervention in delaying aging; Genetic modules of aging, exercise and healthy aging, metabolic adaptation to exercise in aging. Inter Relationship between Nutrients: Energy and B Vitamins; Fats and Vitamin A, D, E, K; Vitamin A and Zn; Vitamin E and Se; Fe and Protein; Vitamin C and Fe; Vitamin D and Ca, P; B-Complex and Mn, Mg, Co. Drug Metabolism: Absorption; Metabolism; Excretion; Mechanism; Drugs as Anti Metabolites. Interaction between Nutrient and Drug: Interaction between Food and Drugs; Nutrient and Drugs; Effect on Nutritional Status; Cytochrome P450; Mono Oxidase Inhibitors.

Recommended Books:

- Mougios, V. (2006). Exercise biochemistry. Human Kinetics.
- Poortmans, J.R. (2004). Principles of Exercise Biochemistry, 3rd edition, Karger Publishers.
- MacLaren, D., & Morton, J. (2011). Biochemistry for sport and exercise metabolism. John Wiley & Sons.
- Brody, T. (1998). Nutritional biochemistry. Academic press.
- Tiidus, P., Tupling, A. R., & Houston, M. Biochemistry Primer for Exercise Science 4th Edition. Human Kinetics.

MSSN 305 Sports Specific Nutrition Credits 3

Unit I

Nutrition for popular team sports (Hockey, Football, Volleyball, Kabaddi and Cricket): Playing position; Basic physiology of playing team sports; body composition; Determining position wise fuel need; Quantity and timing of nutrient intake; Current research on position-specific nutrition needs and fuel utilisation; Current literature suggestions on food intake and recovery strategies; Supplement usage and Dietary periodisation among the athletes; Case studies on team sports.

Unit II

Nutrition for Athletics and Endurance Sports (Long distance Swimming, Cycling and Marathon): Physiology; energy systems; Fuel utilisation; Body composition; Duration and intensity of event; Dietary and Hydration Strategies; nutrient requirements; Distribution of macronutrients in the diet; Guidelines for fuel during different phases of training and competition; Nutrient timing; Travel nutrition; Use of Supplements; Case studies of athletes. Nutrition for Racket sports (Badminton, Tennis, Squash): Game dynamics and fuel utilisation (energy and macronutrients & micronutrients); Body composition; Energy demands of the game; Nutrient timing and dietary periodisation; Current research on racket sports; Tailored nutrition and Hydration guidelines pre, during and post training/competitions, Supplement/ ergogenic aids; Recovery strategies; Case studies on racket sports.

Unit III

Nutrition for Strength and Combat sport (Wrestling, Weightlifting, Judo, Boxing, Taekwondo and Fencing): Game dynamics; Energy demands andFuel utilisation; Case studies of Indian players; Nutrient timing and dietary periodisation; Current research on strength & combat sport; Weight management issues; Supplement or other ergogenic aids; Recovery strategies. Nutrition for Balance (Gymnastics, Golf)/Coordination sports (Archery, Shooting): Playing formats and Fuel utilisation (energy and macronutrients); Different energy demands of balance sport; Physique maintenance and weight management issues; nutrient timing and dietary periodisation; Current research on balance/Coordination sports; Tailored nutrition and hydration guidelines; Supplement/ergogenic aids; Recovery strategies. Case studies of Gymasts/archers /shooters. Nutrition for water sport (Rowing, Kayaking): Physiological and Biochemical changes; Research in relation to nutrition and dietary habits. Common nutritional problems; Nutrtional Guidelines; individual energy/macronutrient requirements; Nutrient timing; Dietary periodisation; Supplement usage.

Recommended Books**:**

- Maughan, R. J. (Ed.). (2008). Nutrition in sport (Vol. 7). John Wiley & Sons.
- Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones & Bartlett Learning.
- Eberle, S. G. (2013). Endurance Sports Nutrition, 3E. Human Kinetics.
- Ryan, M. (2012). Sports nutrition for endurance athletes. Velo Press.
- Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
- Reaburn, P. R. (Ed.). (2014). Nutrition and Performance in Masters Athletes. CRC Press.
- Slater, G., & Phillips, S. M. (2011). Nutrition guidelines for strength sports: sprinting, weightlifting, throwing events, and bodybuilding. Journal of sports sciences, 29(sup1), S67-S77.
- Christoph Zinner and Billy Sperlich. (2016). Marathon Running: Physiology, Psychology, Nutrition and Training Aspects.

MSSN 306 **Elective III** **Credit 3**

Food Psychology and Nutrition

Unit I

Important concepts in Food psychology; Effect of psychology on eating behaviour and food choices: Models of food choices; Neuropsychology and food choices; Food choices across life span. Biological and Learning Influences on Food Choice: Biological influences on energy intake; Food Neophobia in humans; Role of learning in development of food preferences; Mood, Emotions and Food choice; Food cravings and Addictions.Societal Influences on Food Choice: Marketing parameters and their Influence on consumer food choice; Role of context in food choice; Food acceptance and Food consumption; Impact of the media on food choice; Impact of advertising on food choice.

Unit II

Concepts of Health Behaviour change psychology; Theories of behaviour change: Usefulness of theories in behaviour change; Health Belief Model; Theory of Reasoned Action/Theory of Planned Behaviour Self-Efficacy; The Trans theoretical Model; Self-Determination Theory; Motivational Interviewing; Social Cognitive Theory; Dual-Process Models; Social Support/Social Networks; Diffusion of Innovations; Ethics of Behaviour Change. Behaviour modification strategies to influence eating habits and health outcomes: Impact of optimistic bias on dietary behaviour; Implementation intentions; Strategic Automatization of food choice; Use of the Stages of Change Model with dietary behaviours; Addictive behaviour assessment and strategies to overcome, General behavioural assessment and psychological testing tools.

Unit III

Nutrition counselling and education; Nutrition counselling: Definition; Requirement; Procedures to adopt; Role of a Sports Dietition and theories and strategies to be adopted in nutrition counselling. Computer applications and protocols for nutrition counselling: Counselling session for individual athlete, for team, for coaches and other supporting staff.
Models of health and nutrition education in sports persons: Definition; Tools useful for education; Strategies for effective nutrition education.

Recommended Books:

- Shepherd, R., & Raats, M. (Eds.). (2006). The psychology of food choice (Vol. 3). Cabi.
- Tenenbaum, G., & Eklund, R. C. (Eds.). (2007). Handbook of sport psychology. John Wiley & Sons.
- Luiselli, J. K., & Reed, D. D. (Eds.). (2011). Behavioral sport psychology: Evidence-based approaches to performance enhancement. Springer Science & Business Media.

Sports Genetics and Performance

Unit I

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

Unit II

Ethics of Genetic Testing and Research in Sport, Current Challenges and Directions to the Future, Genetic Modifications in Sports, Ethical Considerations of Genetic Manipulation in Sport**,** Gene Therapy and Gene Doping.

Unit III

Connecting Sports and Genetics, The Genetics of Sports Injuries and Athletic Performance, Genetic Contributors to Hypertrophic Cardiomyopathy, Chronic Traumatic Encephalopathy, Different Classes of Performance Enhancing Genetic Variants.

Recommended Books**:**

- Bruce R. Korf and Mira B Irons (2012) Human Genetics and Genomics, Wiley-Blackwell.
- Manu L Kothari, Lopa A Mehta, Sadhana S roychoudhury, (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. OstranderGenetics 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. doi:10.1097/MOP.0b013e3283659087.
- Nicola Mafulli et al (2013) the genetics of sports injuries and athletic performance. Muscles, Ligaments and Tendons Journal, 3 (3): 173-189.

Exercise Immunology

Unit I

Immunological system and exercise: Exercise and innate and humoral immunity, Exercise induced change in Ig and antibody, exercise and cytokines.

Unit II

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

Unit III

Cytokines, Free radicals, Antioxidants, Effect of exercise on immunity, Physical activity – A stimulator and an inhibitor to the immune system, Exercise and upper respiratory tract infection, Infection and exercise performance, Exercise and HIV infection, Exercise and Cancer, Exercise aging and immunity, Maintaining immune health, Importance of exercise immunology in health promotion.

Recommended 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.

MSSN 307 **Laboratory V** **Credits 3**

1. Planning a year round diet for an athelete with diabetes/Sports anaemia.
2. Planning a year round diet for an athelete with Food-Related adverse reactions.
3. Planning a diet for an athlete with sports-injury/Paralympic athlete.
4. Planning a year round diet for vegetarian athletes.
5. Nutrition strategies and menu planning for athletes in different altitude.
6. Nutrition guidelines/suggestions for athletes while travelling and to overcome jet lag.
7. Composition and brand names of supplements that improve Muscle mass commonly available in the market and role of nutrients listed in athletic performance.
8. Composition and brand names of carbohydrate/fat/ supplements commonly available in the market.
9. Composition and brand names of supplements micronutrients commonly available in the market.
10. Composition and brand names of metabolite supplements commonly available in the market.
11. Composition and brand names of botanical supplements commonly available in the market.
12. Planning a diet for strength athletes with supplements for muscle building.
13. Planning a diet for endurance athletes with supplements for energy and micronutrients.
14. Providing diet for clinical conditions with supplement usage (Planning the type, quantity and timing of supplement intake.
15. Methods of measuring dietary recalls: Food diary, Weighed food record, Recall.
16. To assess energy and nutrient intake from diet using suitable software.
17. Procedure to collect and monitor activity record using Time Allocation Pattern and activity monitors.
18. Energy balance: Calculation of total energy expenditure (TEE) and energy intake.
19. Measuring height, body mass, MUAC and skinfold thickness.
20. Measuring body composition using various techniques: Skinfold technique, BOD POD, DEXA and In Body.
21. Exercise testing: Submaximal and maximal level.
22. Fitness tests: Aerobic, Anaerobic, Intermittent, Strength, Endurance, Flexibility and Agility.

MSSN 308 **Laboratory VI** **Credits 3**

1. Estimation of Glucose in blood samples.
2. Estimation of Lactate in blood samples.
3. Handling and using the blood gas/chemistry analyser.
4. Estimation of serum Iron.
5. Estimation of serum Ferritin.
6. Estimation of Lipids.
7. Estimation of Serum Albumin.
8. Estimation of Total Antioxidant Capacity.
9. Estimation of Vitamin A or Vitamin C.
10. Menu planning and fluid intake during training and competition including nutrient periodisation for Cricket/football/Hockey players.
11. Menu planning and fluid intake during training and competition including nutrient periodisation for sprinters/Marathon Runners.
12. Menu planning and fluid intake during training and competition including nutrient periodisation for badminton.
13. Menu planning and fluid intake during training and competition including nutrient periodisation for rowing.
14. Menu planning and fluid intake during training and competition including nutrient periodisation and weight-management for power sports/gymnastics.
15. Menu planning during training and competition including nutrient periodisation for archery.

SEMESTER-IV

MSSN 401 **Research methodology** **Credit 3**

Unit-I

Introduction to Research in Physical Activity, Developing the Problem and Using the Literature, Presenting the Problem, Formulating the Method, Ethical Issues in Research and Scholarship.

Unit-II

Types of Research: Socio Historical Process in Sport Studies, Philosophical Research in Physical Activity, Research Synthesis (Meta-Analysis), Surveys, Other Descriptive Research Methods, Physical Activity Epidemiology Research, Experimental and Quasi-Experimental Research, Qualitative Research, Mixed-Methods Research.

Unit-III

Writing the Research Report: Completing the Research Process, Ways of Reporting Research

Introduction to review of literature, Evaluation of scientific literature; organizing literature – strategies, use of software; Meta-analysis, Writing review – structuring the review, quoting/paraphrasing, the citation referencing system.

Recommended Books**:**

- Research Methodology: Methods and Techniques by C. R. Kothari.
- ICMR. Ethical Guidelines for Biomedical Research on Human Subjects. 2006; ICMR, New Delhi.
- Research Methods in Physical Activity- 7th Edition By Jerry Thomas, Jack Nelson, Stephen Silverman, Human Kinetics.
- Research Methods in Sport by Mark F Smith.
- Research Methods for Sports Performance Analysis By Peter O' Donoghue.
- Research Methods in Physical Education and Youth Sport 1st Edition by Kathleen Armour and Doune Macdonald.
- Ridley, D. The Literature Review a step-by-step guide for students. 2012; Sage Publications Limited, New Delhi.