



UNIVERSITY OF CALCUTTA

Notification No. CSR/ 85 /18

It is notified for information of all concerned that the Syndicate in its meeting held on 13.07.2018 (vide Item No.11) approved the Regulations and Syllabi of the following Two-Year (Four-Semester) Courses :

- (i) M.Sc. in Sports Biochemistry,
- (ii) M.Sc. in Sports Nutrition, and,
- (iii) M.Sc. in Sports Physiology

under CBCS imparted in the Department of Sports Sciences of this University and in the affiliated Colleges offering Post-Graduate Courses under this University, as laid down in the accompanying pamphlet.

The above shall be effective from the academic session 2018-2019.

SENATE HOUSE
KOLKATA-700073
The 31st August, 2018


(Debabrata Manna)

Deputy Registrar (Acting)

**Department of Sports Sciences
University of Calcutta**

M.Sc. in Sports Nutrition

**SYLLABUS
&
REGULATIONS**

2018

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2.2.	Discipline Specific Elective Courses (DSEC)	DSEC will be offered by Parent Department for Neuroscience students. Students will opt any one of the following subject. 1. Sports Nutrition & Kinesiology 2. Sports Nutrition & Neuropsychophysiology included in 4th Semester ----16 credits (4 credits X 4 papers)	18-19
2.3.	Generic Elective Course (GEC)	GEC will be offered by the Departments for Students of Other Department, “Science in Sports performances” included in 3rd Semester. ---- 08 credits (4 credits X 2 papers)	20
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** The course will follow the regulation frame published by the University time to time.*

ORIENTATION OF COURSES: FOUR SEMESTERS (2 years) FOR M. SC. IN SPORTS NUTRITION

Subject Code	Theory/ Practical /Project	Subject	Marks	Credit
1st SEMESTER (CORE COURSES)				
SN CC11-(TH)-P01	Theory	Fundamentals of Human Nutrition, Nutritional Biochemistry & Exercise	50	4
SN CC12-(TH)-P02	Theory	Basic Physiology, Metabolism, Exercise Nutrition	50	4
SN CC13-(TH)-P03	Theory	Assessment of Health & Fitness of Athletes	50	4
SN CC14-(PR)-P04	Practical	Nutritional Biochemistry & Exercise Basic Physiology & Metabolism	50	4
SN CC15-(PR)-P05	Practical	Basic Physiology Assessment of Health & Fitness of Athletes	50	4
Total			250	20
2nd SEMESTER (CORE COURSES)				
SN CC21-(TH)-P06	Theory	Exercise Physiology & Metabolism	50	4
SN CC22-(TH)-P07	Theory	Sports Specific Nutrition & Clinical Sports Nutrition	50	4
SN CC23-(TH)-P08	Theory	Research Methodology & Biostatistics	50	4
SN CC24-(PR)-P09	Practical	Exercise Physiology & Metabolism Clinical Sports Nutrition-I	50	4
SN CC25-(PR)-P10	Practical	Sports Specific Nutrition Clinical Sports Nutrition-II	50	4
Total			250	20
<i>Summer project: Student will opt their DSEC for their 4th Semester curriculum based on merit and will be assigned for summer projects. Students will present summer project in 4th Semester under DSEC curriculum.</i>				
3rd SEMESTER (CORE COURSES & GENERIC ELECTIVE COURSES)				
SN CC31-(TH)-P11	Theory	Dietary supplements & Ergogenic Aids	50	4
SN CC32-(TH)-P12	Theory	Communication skill for sports promotion, Food service management & Entrepreneurship	50	4
SN CC33-(PR)-P13	Practical	Dietary supplements & Ergogenic Aids Mass communication in Sports nutrition	50	4
SN GEC31-(TH)-P14	Theory	CBCC-X or other codes Students will opt subjects offered by other Departments	50	4
SN GEC32-(TH)-P15	Theory	CBCC-Y or other codes Students will opt subjects offered by other Departments	50	4
Total			250	20
4th SEMESTER (CORE COURSES & DISCIPLINE SPECIFIC ELECTIVE COURSES)				
SN CC41-(TH)-P16	Theory	Sports Psychology & Nutritional Counselling,	50	4
SN DSEC41-(TH)-P17	Theory	Students will opt subjects offered by the Department	50	4
SN DSEC42-(TH)-P18	Theory	Students will opt subjects offered by the Department	50	4
SN DSEC43-(PR)-P19	Practical	Students will opt subjects offered by the Department	50	4
SN DSEC44-(PS)-P20	Project	Students will opt subjects offered by the Departments (a) Project work & Seminar; (b) Viva	50	4
Total			250	20
Grand Total			1000	80

"P" stands for paper

DSE Courses: Department will offer following courses for students of "Sports Nutrition".

- 1. Sports Nutrition & Kinesiology**
- 2. Sports Nutrition & Neuropsychophysiology**

GE Course: Department will offer following course for students of other Departments.

"Science in Sports Performances"

Detailed Syllabus for Two-year M. Sc. Course in Sports Nutrition University of Calcutta - 2018

First Semester

SN CC11-(TH)-P01: Fundamentals of Human Nutrition, Nutritional Biochemistry & Exercise

Fundamentals of Human Nutrition

Introduction to Nutrition: Definition; Nutrients; Food; Classification of nutrients; Role of nutrients.

Carbohydrates: Chemical composition; Properties; Classification; Sources; Functions; Digestion and Absorption of Carbohydrates; Transport; Utilization and Storage of Carbohydrates; Metabolic fate of dietary carbohydrates-Oxidation; Storage as glycogen and triglyceride; Glycaemic Index and Glycaemic Load; Consumption pattern of carbohydrates across various ethnicities; Dietary reference values for carbohydrate intake; Consequences of excess or deficient intake of carbohydrates.

Dietary Fibre: Components; Functions; Sources; Recommendations.

Protein: Chemical composition; Properties; Structural and Functional classification of protein; Amino acids and nitrogen compounds of the body; Functions; Role in growth and maintenance of life; Sources (Complete and Incomplete); Digestion, Absorption, Transport and Storage.

Protein status of the body: Protein turnover, protein status and degradation; Energy cost of protein turnover; Linear growth; Protein turnover in muscle and its

Micronutrients

Vitamins: Classification; Sources; Functions; Requirements; Transport, Utilization and Storage; Deficiencies and Toxicity of vitamins; Bioavailability and Bioconversion of Fat Soluble Vitamins.

Minerals: Classification; Sources; Functions; Requirements; Transport, Utilization and Storage; Deficiencies and Toxicity; Bioavailability of Major, Trace and Ultra Trace Minerals.

Water and Electrolytes: Distribution; Components of Body Fluids; Functions; Sources; Requirements; Regulation of water Balance; Abnormalities of water Imbalance; Electrolytes and Electrolyte Balance; Acid-Base Balance (Sodium and extracellular fluid-Significance and functions of sodium, amount and distribution in the body, sodium balance and depletion, Salt deficiency; Excess of body sodium; Potassium-Significance and functions; Amount and distribution in the body; Potassium balance and depletion; Excess of body potassium). Nutritional Biochemistry & Exercise

Energy intake and Energy expenditure: Energy content of foods (chemical energy and metabolizable energy); Basal metabolism (Definition, protocol for measurement and factors affecting basal metabolism); Thermic effect of food (Definition, experimental approach and factors affecting thermic effect of food); Physical activity (Definition, experimental approach, factors affecting physical activity); Non-exercise activity thermogenesis-NEAT (Definition, experimental approach, factors affecting NEAT).

Methods to assess energy cost: Direct and indirect calorimetry; Measurement of energy expenditure; Principle; equipment; measurement and calculations; Food intake and energy balance method; Heart Rate monitoring; doubly labelled water technique.

Energy balance and Energy requirement: Concepts and basis; Adaption in energy expenditure-energy balance; Energy requirements across various age groups; Estimation of total energy needs across different age groups using factorial approach.

Nutritional Biochemistry & Exercise

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.

Hormones: Chemistry; Regulatory system; Physiological function and nutrient interactions of Pituitary hormones (Growth Hormone, TSH, Vasopressin, Prolactin, Oxytocin, Corticotrophic, Luteinizing Hormone, Follicle Stimulating Hormone); Thyroid and Parathyroid gland hormones (Thyroxine (T4), Triiodothyronine

(T3), Calcitonin, Para Thyroid); Pancreatic Hormones (Glucagon, Insulin); Adrenal Glands (Adrenalin, Non-Adrenaline, Corticosteroids); Sex Hormones (Estrogen, Progesterone, Testosterone); Pineal gland (Melatonin).

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.

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

Free Radicals, Immune Response, Aging

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 & Drug-nutrient interaction

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.

SN CC12-(TH)-P02: Basic Physiology, Metabolism & Exercise Nutrition

Basic Physiology

Introduction: Human Physiology; Cells, Tissues, Organs and System Organization; Cell structure; Transport through Cell Membrane; Classification of Tissue; Homoeostasis; Role of organ and its system in regulation of homeostasis; Factors altering homeostasis.

Nervous System: Classification of nervous system (Central and peripheral); Structure and Function of neuron; ion channels; Role of action potential in neuro transmission; Neurotransmitters and drug abuse.

Muscular System: Structure and Types of muscles; Anatomy of muscle fibre; Muscle contraction; Muscle fibres; types and characteristics of muscle fibres including metabolism; Remodelling of muscle fibres for strength and conditioning; Muscle hypertrophy and atrophy; Muscle tone and fatigue.

Respiratory system: Anatomy of respiratory system; Upper and lower respiratory tract; External, Internal and Cellular respiration; Pulmonary ventilation; Principles of gaseous exchange – diffusion of oxygen and carbon-di-oxide from respiratory membrane; Transport of oxygen and carbon-di-oxide in the blood and body fluids. **Regulation of respiration:** Chemical control; Peripheral chemo receptors in the regulation of respiration.

Cardiovascular System: Anatomy of heart and blood vessels; Conduction system in heart; Normal electrocardiogram; Systemic, Coronary and Pulmonary circulation; Cardiac cycle; Cardiac output and Blood Pressure.

Endocrine System: Different endocrine glands and their hormones; Major functions; Mode of action mechanism and regulation.

Digestive System: Organs of GI Tract and their major functions.

Excretory System: Anatomy; Function; Renal circulation; Auto regulation of the circulation; structural and functional unit; Urine formation; Body fluid compartments and its regulation; Intracellular and extracellular body compartments; Constituents of extracellular fluids and osmotic regulation; Kidney functions; Basic theory of nephron function; Renal blood flow and glomerular filtration; Renal mediated

regulation of extracellular fluid osmolality and sodium concentrations; Regulation of acid base balance; Respiratory & renal mechanism; Clinical abnormalities of acid base balance.

Immunity: Innate and Adaptive immunity; Non-specific and Specific defence mechanism; Immune response pathway like inflammation and antigen specific responses.

Reproductive System: Male reproductive system (structure and function) and Female reproductive system (structure and function, menstrual cycle and pregnancy).

Metabolism

Carbohydrate metabolism: Glycolytic pathway; Pentose phosphate pathway; Gluconeogenesis; Glycogen pool in liver and muscle and its regulation by glycogenesis and glycogenolysis; Factors regulating conversion of excess glucose into fat.

Fat metabolism: Transport of lipids in body fluids, fat deposits or storage in body; synthesis of triglycerides from carbohydrate and protein sources; regulation of energy release from triglycerides; phospholipids and cholesterol metabolism.

Protein metabolism: amino acid pool; essential and non-essential amino acids; hormonal regulation of protein synthesis and degradation.

Exercise Nutrition

Introduction To Sports Nutrition: Definition; History; Role of international agencies in sports nutrition.

Carbohydrate Intake and performance: Type; structure and function of Carbohydrate and its utilisation in the body; Intensity of training impacting carbohydrate utilisation; Type, timing and quantity of carbohydrate intake in Resistance training and Endurance training; Food sources from different types of carbohydrate; Recommendations of carbohydrate for varying intensities, level of training and for fitness & recreational sports.

Fat Intake and performance: Structure and function of fat and its utilisation in the body; Intensity of training impacting fat utilisation; Type, timing and Quantity of fat intake in Resistance training and Endurance training; Amount of fat recommended for varying level of training, fitness or recreational sports.

Protein Intake and performance: Type and Quality of protein and its utilisation in the body; Quantitative measures of protein quality; Protein turnover during endurance versus resistance training; Specific role of amino acids for performance; Type of proteins available in food; Dietary protein strategies for performance enhancement; Requirements set for protein intake for athletes at varying levels of expertise, for fitness and recreational sports.

Macronutrients and Energy balance

Energy balance concept for athletic performance: Contribution of macronutrients to Energy; Caloricity of nutrients and its impact on optimal performance; Factors affecting energy expenditure (age, gender, ethnicity, level of

training, training intensity, type of sport and phase of training); Importance of understanding carbohydrate, protein and fat balance among athletes; Consequences of Energy imbalance in performance.

Determining energy requirements of athletes: Contribution of Resting metabolic Rate, Thermic effect of food and Exercise and Non-exercise activity thermogenesis (NEAT) towards energy expenditure; Variation in Resting metabolic rate across resistance versus endurance training; Principles and methods for determining energy expenditure commonly used among athletes; Differences in energy expenditure across events and level of training expertise; Energy availability in assessing energy requirement for athletes; Energy and nutritional requirements for athletes; Variation across age and gender; Energy expenditure pattern during growth; Identifying gaps in research for requirements among Indian athletes.

Energy intake pattern of athletes: Nutritional intake concerns for athletes in sport and exercise; Food fads and beliefs among athletes regarding nutrition intake; Energy intake pattern of athletes across various levels of training expertise; Energy intake of athletes during training and for competition.

Vitamins and Minerals in exercise performance

Vitamins: Types; mode of action; primary functions; excess vs. deficiency; Role of increased intake of vitamins in exercise performance; Role of vitamins in indirectly affecting performance through mental ability, immunity and recuperation to an injury; Research findings relating to performance benefits of key vitamins; Requirements for athletes.

Minerals: Types; mode of action; Primary functions; Excess vs. Deficiency; Role of increased intake of minerals in exercise performance; Role of minerals in indirectly affecting performance through mental ability, immunity and recuperation to an injury; Research findings relating to performance benefits of key

minerals; Requirements for athletes.

Antioxidant: Definition; Enzymatic and Non-Enzymatic antioxidants; Mode of action; Antioxidant effects to reduce oxidative stress; Effect on muscle contraction and exercise performance; Antioxidant deficiencies and exercise performance; Antioxidant requirements for exercise.

Nutrient periodisation, meal timing and hydration among athletes

Nutrient periodisation and Meal timing: Importance of periodisation and meal timing related to the type of training and exercise intensity; Effect of energy intake and co-ingestion of other nutrients like carbohydrate and protein composition before, during and after training; Importance of timing of carbohydrate intake; Type of carbohydrates and proteins beneficial for maximum refuelling post exercise sessions; Gender differences in carbohydrate, protein and fat refuelling strategies; Effect of high or low carbohydrate, protein and fat on training adaptation and performance; Periodisation of macronutrients based on the phase/season of training and strategies to be followed.

Dehydration: Causes; Symptoms and its effects on cardiovascular system and muscle metabolism; Tolerable levels of dehydration; Synergistic effect of dehydration and hyperthermia; Effects of dehydration on endurance performance; Methods for determining degree of dehydration among athletes; Strategies for lowering hyperthermia.

Hydration strategies: Beverage composition and formulation (isotonic, hypotonic and hypertonic); Only fluid versus fuelling with other macronutrients and electrolytes for exercise benefits; Beverage volume for maintaining euhydration with performance benefits; Beverage timing (Pre-exercise hydration, during exercise hydration protocol, Post-exercise rehydration); Factors that influence intake; Gastric emptying and absorption of fluids; Beverage palatability and fluid intake; Intravenous rehydration; Food versus fluid consumption during exercise.

SN CC13-(TH)-P03: Assessment of Health & Fitness of Athletes

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 (Fat Mass and Fat Free Mass).

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).

Dietary Assessment of Athletes

Different methods of dietary assessment (food and fluid intake): Description; 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.

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

Biochemical estimation: 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).

SN CC14-(PR)-P04 : Practical

Nutritional Biochemistry & Exercise

1. Estimation of total carbohydrate.
2. Estimation of moisture.
3. Estimation of dietary fibre.
4. Estimation of protein using micro kjeldahl method.
5. Estimation of fat using soxhlet extraction procedure.
6. Estimation of calcium.
7. Estimation of iron.
8. Estimation of beta-carotene.
9. Estimation of Vitamin C.
10. Estimation of polyphenols.
11. Estimation of Haemoglobin in blood samples.
12. Estimation of Glucose in blood samples.
13. Estimation of Lactate in blood samples.
14. Handling and using the blood gas/chemistry analyser.
15. Estimation of serum Iron.
16. Estimation of serum Ferritin.
17. Estimation of Lipids.
18. Estimation of Serum Albumin.
19. Estimation of Total Antioxidant Capacity. Estimation of Vitamin A or Vitamin C.

Basic Physiology & Metabolism

1. Determining total energy expenditure using activity records and energy cost of activities from compendium for strength athletes.
2. Menu planning of energy and nutrient intake of strength athletes.
3. Determining total energy expenditure based on activity records and energy cost of activities from compendium for endurance athletes.
4. Menu planning of energy and nutrient intake for endurance athletes.
5. Meal timing and nutrient periodisation for athletes during training season and for competition
6. Estimation of hydration status in athletes.
7. Menu planning inclusive of fluid intake among strength athletes.
8. Menu planning inclusive of fluid intake for endurance athletes.
9. Preparation of isotonic, hypotonic and hypertonic beverages for athletes.
10. Developing and standardisation of pre, during and post-training snacks based on ACSM recommendations.

SN CC15-(PR)-P05: Practical

Basic Physiology

1. Measurement of blood pressure using traditional sphygmomanometer.
2. Determining Heart rate both manually and using heart rate monitors.
3. Handling and observing ECG and EEG monitors.
4. Pulmonary Function Test: Handling and monitoring using spirometer.
5. Measurement of running economy.
6. Combined measurement of running economy, lactate threshold and turn Point, and VO₂max
7. Measurement of loaded running efficiency
8. Measurement of the efficiency of cycling and stepping
9. The effects of load carriage on the economy of walking
10. Estimation of body surface area and Resting Metabolic Rate (RMR) from fat-free mass.
11. Assessment of the respiratory quotient (RQ).

Assessment of Health & Fitness of Athletes

1. Methods of measuring dietary recalls: Food diary, Weighed food record, Recall.
2. To assess energy and nutrient intake from diet using suitable software.
3. Procedure to collect and monitor activity record using Time Allocation Pattern and activity monitors.
4. Energy balance: Calculation of total energy expenditure (TEE) and energy intake.
5. Measuring height, body mass, MUAC and skinfold thickness.
6. Measuring body composition using various techniques: Skinfold technique, BOD POD, DEXA and In Body.
7. Exercise testing: Submaximal and maximal level.
8. Fitness tests: Aerobic, Anaerobic and Intermittent.
9. Fitness tests: Strength, Flexibility, Agility.
10. Using Handgrip dynamometer to test strength and endurance of athletes.

Second Semester

SN CC21-(TH)-P06: Exercise Physiology & Metabolism

Introduction to Exercise Physiology

Introduction: 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; Endurance versus resistance training and performance; Training adaptations and maladaptation and detraining.

General principles of training: Exercise response (Modality, Intensity, Duration, categories, response patterns and interpretation); Exercise training (Health and sports related fitness, Dose-response relationship, training principles, periodization); Metabolic training principles and adaptations (specificity, overload, rest/recovery/adaptation, progression, individualization, maintenance, retrogression, warm-up and cool down).

Adaptation of Respiratory and Cardiovascular Systems to exercise

Respiratory responses during exercise at varying intensities: Overview of pulmonary system and circulation; Factors effecting pulmonary ventilation and diffusion; Transport of gases in blood and blood doping; Gas exchange at the muscle; Respiratory limitations to performance (oxygen deficit and steady state); Acid-base balance; Factors limiting Maximal Oxygen Uptake in athletes.

Respiratory responses across various types of exercise and environment conditions: Short-term, light to moderate submaximal aerobic exercise; Long-term, moderate to heavy submaximal aerobic exercise; Incremental aerobic exercise to maximum static exercise; Entrainment of respiration at rest; Influence of sex and age on respiration at rest and during exercise; Respiratory muscle training principles and adaptations; Whole body respiratory training principles and adaptations (Lung volumes and capacities, pulmonary ventilation, external and internal respiration, detraining and the respiratory system); Special considerations (during altitude change and/or pollution).

Cardiovascular responses to exercise: The heart, vascular system and hormonal control of blood volume, cardiovascular dynamics; regulation of the cardiovascular system (neural control, anatomical sensors and neuro-hormonal control); Changes in Cardiovascular variables (cardiac output, stroke volume, heart rate, maximal oxygen consumption and blood pressure) during exercise; Cardiovascular responses to aerobic exercise; Cardiovascular responses to static exercises and dynamic exercises; Cardiovascular responses to exercise across gender, in children and older adults; Cardiovascular adaptation to aerobic endurance training and dynamic resistance; Detraining effects on cardiorespiratory system.

Metabolic adaptation to exercise, Fluid balance and Thermoregulation

Energy Production: ATP and Cellular respiration (Carbohydrate, fat and protein metabolism); Intracellular and extracellular regulation of cellular respiration and ATP Production; Fuel utilisation during rest and exercise.

Anaerobic and aerobic metabolism during exercise: Alactic and Lactic acid levels in energy production; Anaerobic exercise response; Measurement of anaerobic metabolism; Response to anaerobic exercise (Oxygen deficit and excess post exercise oxygen consumption); ATP-PC Changes and lactate changes; Time frame for lactate removal post exercise; Anaerobic exercise response in male versus female, children, older adults (availability and utilization of ATP-PC, accumulation of lactate, mechanical power and capacity); 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).

Fluid balance and Thermoregulation: Exercise in environmental stress; Measurement of environmental condition; Measurement of body temperature; Thermal balance; Heat exchange; Exercise in the heat; Cardiovascular demands of exercise in the heat; Influence of sex and age on the exercise response to heat; Exertional heat illness syndromes; Exercise in cold; Cold induced injuries; Cold tolerance across age and sex; Maintaining fluid balance.

Adaptation of skeletal muscle, endocrine and immune system in training

Skeletal system: Functions; Regulation of blood calcium; Levels of organization; Bone development; Factors influencing bone health; Skeletal adaptation to exercise training and detraining; Special applications in osteoporosis; Female athletic triad; Skeletal injuries.

Skeletal muscle and neuromuscular system: Functions; Characteristics; Macroscopic and microscopic structure; Molecular structure of the myofilaments; Contraction and muscle fibre types; Importance of muscle fibre types in athletes; Skeletal muscle force production; Fatigue and muscle soreness; Measuring muscle function; Influence of age and sex on muscle function; Skeletal muscle oxygen consumption and interplay between aerobic and anaerobic respiration; Neuromuscular aspects of movement; The nervous system (basic structure and activation of nerve cell, neural control of muscle contraction, reflex control of

movement, volitional control of movement, flexibility); Physiological response to stretching; Application of training principles to flexibility; Adaptation to flexibility training and balance; Neuromuscular adaptation to resistance training and detraining, Muscular adaptation to concurrent training.

Endocrine and immune response: Hormonal system; Role of endocrine system in exercise; Hormonal responses to exercise; Hormonal adaptation to training; Immune system structure and function; Functional organisation; Immune response to exercise across various intensities and/or duration of exercise; Cytokine response to exercise; Neuroendocrine control of immune response to exercise.

SN CC22-(TH)-P07 : Sports Specific Nutrition & Clinical Sports Nutrition

Sports Specific Nutrition

Nutrition for popular team sports (Hockey, Football, Volleyball, Kabaddi and Cricket)

Playing position and rules of the game; Basic physiology of playing team sports; Physique mapping for each event (body composition).

Determining position wise fuel need for Training and Competition; 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.

Nutrition for Athletics, Racket Sports and Cyclic sports

Athletics (Sprinters, middle and long distance, field events): Physiological variations and differences in energy systems; Fuel utilisation across various track and field events; Body composition; Dietary guidelines and nutrient requirements; Distribution of macronutrients in the diet; Guidelines for fuel during different phases of training and competition; Nutrient timing; Travel nutrition; Ergogenic aids commonly used for performance; Case studies of athletes.

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 or other ergogenic aids commonly used in racket sport; Recovery strategies; Case studies on racket sports.

Nutrition for Endurance Sports (Long distance Swimming, Cycling and Marathon): Characteristics; Physiology; Energy systems; Body Composition; Duration and intensity of event; Nutritional Requirements

in Training and Competition; Dietary and Hydration Strategies; Use of Supplements; Case studies on endurance sports.

Nutrition for Weight-dependent and balance sports

Strength and Combat sport (Wrestling, Weightlifting, Judo, Boxing, Taekwondo and Fencing): Game dynamics; Fuel utilisation (energy and macronutrients); Case studies of Indian players; Energy demands of the game; Nutrient timing and dietary periodisation; Current research on strength & combat sport.

Weight management issues: Overemphasis on protein requirements; Tailored nutrition and hydration guidelines before, during and post-training/competitions; Supplement or other ergogenic aids; Recovery strategies (dietary and non-dietary components).

Balance sports (Gymnastics, Golf): 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 sports; Tailored nutrition and hydration guidelines before, during and post-training/competitions; Supplement or other ergogenic aids commonly used; Recovery strategies.

Nutrition for water sport and coordination sport

Water sports (Rowing, Kayaking): Physiological and Biochemical changes in water sports; Research on water sports in relation to nutrition and dietary habits.

Common nutritional problems associated to water sports; Guidelines specific to nutrition in water sports; Identifying individual energy and other macronutrient requirements; Nutrient timing; Dietary periodisation; Supplement usage.

Coordination sport (Archery, Shooting): Playing formats and specific demands of the game; Eye-hand coordination; Current research relating nutrition and coordination sports performance; Maintaining proper fuel and hydration in coordination sport; Case studies of archers and shooters; Identifying the current nutritional problems; Dietary guidelines for pre, during and post training/competition, Supplement usage.

Clinical Sports Nutrition

Athletes with Nutrition related disorders

Diabetes and Cardiovascular disease: Definition and description of diabetes mellitus; Physiological effect of exercise; Problems of athletes with type 1 diabetes and cardiovascular diseases; Physical activity prescription for athletes with type 1 diabetes and cardiovascular disease; high risk sport, insulin abuse and sport; Effects of long-term physical activity or exercise training on Insulin sensitivity; Acute effects of exercise in athletes with Type 1 diabetes and cardiovascular disease; Exercise in the presence of Hyperinsulinemia and Hypoinsulinemia; Medical nutrition therapy (MNT) for athletes with type-1 diabetes and cardiovascular disease; Dietary guidelines and Nutrient timing; type of carbohydrate and timing; Pre and post event carbohydrate loading and fluids; Insulin adjustments for athletes with type-1 diabetes; Special problems for athlete with Type-1 diabetes and cardiovascular disease; Complications with poorly controlled diabetes.

Osteoporosis: Definition and description; Causes and consequences; Physiological effects of exercise; Pathophysiology; Medical Nutrition Therapy.

Sports Anaemia: Definition and description; Causes and consequences; Physiological effects of exercise; Pathophysiology; Medical Nutrition Therapy.

Athletes with gastrointestinal disorders, food allergies and food intolerance: GI disturbance occur in some athletes before, during and after competition and training; Excessive flatulence; Abdominal distention; Intermittent diarrhoea; Constipation; Food related adverse reactions (FRAR); Physiological and dietary factors affecting gastric emptying and 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 (Diagnosis and treatment); Inflammatory bowel disease (IBD)-Diagnosis, Nutrition related concerns for athletes with untreated IBD; Medical Nutrition Therapy.

Food-Related adverse reactions (FRAR): FRAR includes Food allergy and Food intolerance; Diagnosis and Medical Nutrition Therapy; Recommendations for effective nutrition intervention for athletes with FRAR

Nutrition for Special groups and Sports injuries

The Paralympic Athlete: Athletes with physical or intellectual impairments (Classification and associated risk for injury or health outcomes); Body composition assessment and management; Eating difficulties and behaviours observed in some athletes with impairments.

Paralympic athletes and nutritional demands: 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; Travelling with Paralympic Athletes.

Sport injury and rehabilitation: Type of injury and rehabilitation required, Physiological and metabolic changes during injury and rehabilitation; Eating habits commonly followed during an injury; Overweight among injured athletes; Role of nutrition and dietary guidelines in recovery from an injury; Common injuries among athletes-Maxillofacial fractures, Knee injury, ACL tear, Patellofemoral syndrome, Tennis elbow, Ankle sprain, Groin pull, Hamstring sprain.

Nutrition for athletes with special dietary needs

Children and adolescent athletes: Growth and development; Nutritional issues commonly faced; Eating habits and addiction; Nutritional requirements for growth and training.

Female athletes: Vulnerability to nutrition assault and insufficiency; Differences in fuel or nutrient utilisation among female athletes; Female athletic triad (FAT) including eating disorder, menstrual irregularity and poor bone mineral density; energy availability-definition and its association with FAT; Assessment for FAT; Dietary guidelines and suggestions for FAT.

Vegetarian athletes: Classification; Nutritional status and dietary considerations; Nutritional gaps currently identified and suitable dietary modification for fuelling during training, competitions and traveling.

Altitude, Cold and Heat

Altitude training and Physiology: Physiological changes and metabolic adaptation for high altitude training; Dietary recommendations at varied altitudes; Common Nutritional problems faced by athletes at high altitude.

Cold and Heat: Effect of Cold environment on dietary habits and recommendations for training and competing in cold environments; Special emphasis on hydration strategies; Effects of exercising in the heat; Heat stress and injury; Athlete performance and weight change while exercising in the heat; Strategic timing of water and electrolyte consumption during extreme climatic conditions.

Medical and Nutritional Issues for the Travelling Athlete: Nutritional problems often faced by the travelling athletes; Monitoring and Documentation of climate, time zones, altitude, food safety and availability by the support staff or nutritionist; Market surveys and research support for the journey (travel, accommodation, catering, training and event schedules); Noting vaccination and existing allergies; Hydration and supplements for travel within country and overseas; Tips for preventing jet lag and adaptation to different time zone; Guidelines for preventing food borne diseases; Strategies for Treating Diarrhoea and Vomiting; Replacing fluid and electrolytes; Strategies to note for meeting dietary guidelines while traveling and follow up strategies.

SN CC23-(TH)-P08: Research Methodology & Biostatistics

Introduction & Research Design

Research: Definition; Significance of research; Steps in Research Process. Scientific Methods; Selection & Defining a Research Problem; Problems Encountered by Researchers.

Research Design: Features; Types of Research Designs; Basic Principles of Experimental Designs.

Presentation & Processing of Data

Presentation of Data: Graphical presentation; Tabular; Chart; Diagrammatic presentation.

Processing of Data: Measures of Central Tendency (Mean, Mode, and Median); Measures of location (Quartiles, percentiles).

Measures of Dispersion: Range; Minimum; Maximum value; Quartile deviation; Mean Deviation; Standard Deviation; Coefficient of Variation; Skewness.

Data Analysis

Correlation analysis: Sample Correlation Analysis; Partial Correlation Analysis.

Correlation analysis: Multiple Correlation Analysis.

Regression Analysis: Simple Regression Analysis; Multiple Regression Analysis.

Computers and Software Programmes

Introduction, designing graphs and charts.

Basics of computer operating systems; Spreadsheets. Software Programmes in Biomedical Statistics

Qualitative Research Methods, Scientific Writing, Research Regulation Qualitative Research

Methods: Methodology of scientific research; Nature of scientific methods; Design of experiments; Policies in regulating research; Guidelines for use of Humans and Animals in research.

Scientific Writing: Characteristics; Literary writing styles; Presentation of review; Objective; Design of the experiment; Parameters used; Data obtained; Interpretation; Summary.

Research Regulation: Policies; Guidelines for use of Humans and Animals in research.

Sampling & Estimating Population

Sampling: Representation Sample; Sample Bias; Sampling Techniques (Simple Random, Systematic, Stratified, Multistage, Cluster and Multiphase).

Sampling Distribution.

Estimating Population Parameters: Testing of Hypothesis (Type I and Type II Errors, Level Of Significance); Paired & Unpaired T-Test for Testing Population Mean (S) & Proportion (S); Analysis of variance (ANOVA & ANCOVA).

Non-Parametric Tests

Importance of Non-Parametric Tests. Chi – Square Test.

Demography & Vital Statistics: Collection of demographic data; Collection of vital statistics; Records of vital statistics; Reports of nutrition surveys; Measures of vital statistics and Indices of health.

Analysis using data packages

Data software: Introduction; Applications; Resources.

SPSS: Data entry; analysis and interpretation.

Graphpad: Data entry; analysis and interpretation.

SN CC24-(PR)-P09 : Practical

Exercise Physiology & Metabolism

1. Assessment of lung function at rest and during exercise.
2. Measurement of oxygen uptake by closed-circuit indirect calorimetry.
3. Estimation of maximal oxygen capacity.
4. The Tlac (lactate threshold) and OBLA (onset of blood lactate accumulation).
5. Gas exchange and ventilatory threshold.
6. Critical power.
7. Lactate minimum speed.
8. Heart rate deflection point (Conconi Test).
9. Wingate test and Optimization procedures.
10. Correction procedures.
11. Assessment of maximal accumulated oxygen deficit.

Clinical Sports Nutrition - I

1. Conducting an Eating attitudes test (EAT) for athletes to assess eating disorder.
2. Nutrition strategies and menu planning for athletes in different altitude.
3. Nutrition strategies and menu planning for athletes in different climatic conditions
4. Nutrition guidelines/suggestions for athletes while travelling and to overcome jet lag.
5. Planning a diet during traveling, including fluid intake strategies

SN CC25-(PR)-P10: Practical

Sports Specific Nutrition

Menu planning and fluid intake during training and competition including nutrient periodisation for,

1. Football players.
2. Hockey players.
3. Cricketers.
4. Sprinters.
5. Marathon runners.
6. Badminton players.
7. Rowing.
8. Power sports including weight-management.
9. Gymnastics including weight-management.
10. Archery.

Clinical Sports Nutrition – II

Planning a year round diet for,

1. An athlete with diabetes.
2. An athlete with sports anaemia.
3. An athlete with Food-Related adverse reactions.
4. An athlete with sports injury.
5. A Paralympic athlete.
6. Vegetarian athletes.

Third Semester

SN CC31-(TH)-P11: Dietary supplements & Ergogenic Aids

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: A Need for Better Consumer Confidence.

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.

Macronutrient 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.

Metabolite and Botanical Ergogenic Supplements

Botanical Ergogenic Supplements: Wheat Germ oil, Beetroot, Green Tea Extract, Tart Cherries, Caffeine, Curcumin, Phytosterols, Bio Flavonoids, Ashwagandha, Rhodiola, Shilajit, Ginseng, Grape Seed Extract, chyanprash, Herbal Testosterone-Boosters (Eg. Tribulus Terrestris, 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, Melatonin, Gamma Oryzanol (Ferulates), FRAC, Glucosamine, Alcohol, Adaptogens, Alkalizers, 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.

SN CC32-(TH)-P12: Communication skill for sports promotion, Food service management & Entrepreneurship

Communication skill for sports promotion

Introduction: Need for communication; Communication as a social science; Communication and information.

Communication: Definition; Types; Three stages of interpersonal communication; Group communication.

Barriers to communication: Barriers to effective communication; Barriers to written communication; Body language as a barrier to effective oral communication; Barriers caused by varying perceptions of reality; Psychological/attitudinal barriers; Cultural Barriers; Semantic Barriers; Wrong choice of the medium of communication.

Mass communication

Bases of communication: Biological and neurological; Economic bases of communication; Normative bases; Models of communicative efficiency; Western models of communication; Indian communication theories.

Socio-cultural aspects: Communication as persuasion; Theories of public opinion; Mediation theory; Mass communication and culture; Socio-cultural models of communication.

Mass Communication: Defining and Redefining; Evolution of mass communication; Different tools used for communication (Visual aids, Printing, Digital media).

Communication theories and content writing in communication

Theories in communication: Science and Human Behaviour Defining Theory; Post positivist Theory; Hermeneutic Theory; Critical Theory; Normative Theory.

Theories in communication: Evaluating Theory; Flexible Social Science; Mass Communication Theory; Action theory; ACT Theory of Communication.

Health-content writing: Definition; Importance; Collection of evidence-based content; Format for content writing.

Sports Communication

Importance: Definition, theoretical framework, elements in sports communication.

Theories and research in sports communication; Sociological and legal aspects in sports communication.

Content writing and use of various aids in sports communication: Electronic and visual communication (Sports magazine, sports books, web, online sports communication, marketing communication in sports).

Food service management & Entrepreneurship

Institutional Food Service Management Introduction: Historical perspective; Challenges ahead.

Planning to setting up a food service unit; Management of food service and Personnel; Administration.

Food service area Layout: Kitchen Spaces (Size and type of spaces, developing kitchen plans, designing kitchens, storage and maintenance); Storage Spaces (Types, planning of storage spaces, sanitation, safety and security); Service Areas (Planning of a service area, dimensions, décor & dining).

Food service management – Quality assessment

Quantity of Food Preparation: Menu planning; Sequence of courses; Menu display; Preparation for service; Standardization of recipes; Portion control; Left over foods; Recipe modification; Selection & storage; Standards for selection of fresh food; Substitutes, convenience or ready-to-eat food purchase and storage.

Quality of Food Service: Objectives (variety and nutrition balance); Food preferences; Timing; Type of service; Different ages, gender, cultural background and specific for sports.

Food safety standards, Quality control and Laws: FDA; FSSAI; Concept of Hazard Analysis Critical Control Point (HACCP).

Sanitation and Hygiene

Environmental hygiene (Site, structure, equipment, furniture and fittings, ventilation, lighting, water supply, waste disposal).

Hygiene in food handling (Receiving food materials, storage, prevention and control of infestation, preparation centre, cooking, holding, serving, disposal and personal hygiene of a food handler).

Safety (Accidents in food service areas, safety procedures, training, educating, legal responsibility of food service manager).

Entrepreneurship, Sports Facility & Event Management

Entrepreneurship: Definition; Types; Classification; Qualities of an entrepreneur; Project formulation; Evaluation and feasibility analysis; Celebrity Management; Digital & Media Marketing in Sports; Public Relations in Sports & Business Communication.

Sports Law; Legal aspects of Business; Business statistics; Sports financial management; Corporate social responsibility.

Strategic Management: Product & Brand management; Sports marketing tools; Sports analytics management (software, sports sponsorships & funding, business negotiations skills).

SN CC33-(PR)-P13: Practical

Dietary supplements & Ergogenic Aids

1. Development and standardisation of a sports bars or meal replacement bars.
2. Composition and brand names of supplements that improve Muscle mass commonly available in the market and role of nutrients listed in athletic performance.
3. Composition and brand names of carbohydrate supplements commonly available in the market.
4. Composition and brand names of fat supplements commonly available in the market.
5. Composition and brand names of supplements micronutrients commonly available in the market.
6. Composition and brand names of metabolite supplements commonly available in the market.
7. Composition and brand names of botanical supplements commonly available in the market.
8. Planning a diet for strength athletes with supplements for muscle building.
9. Planning a diet for endurance athletes with supplements for energy and micronutrients.
10. Providing diet for clinical conditions with supplement usage (Planning the type, quantity and timing of supplement intake).

Mass communication in Sports nutrition

1. Content writing on a sports nutrition related topic.
2. Conducting interview with an athlete of state level.
3. Conducting a one-on-one nutrition counselling.

4. Conducting a telephonic nutrition counselling.
5. Conducting a nutrition education using any one of the tools of communication.
6. Preparing a nutrition education using a pre-existing communication theory.
7. Credibility of Nutrition related information published in sports magazines.
8. Credibility of Nutrition/health related informed published in websites.
9. Developing a questionnaire/schedule for nutrition assessment.
10. Group discussion on a sports nutrition related topic by the students.

SN GEC31-(TH)-P14: Students will opt subjects offered by other Departments

SN GEC32-(TH)-P15: Students will opt subjects offered by other Departments

Fourth Semester

SN CC41-(TH)-P16: Sports Psychology & Nutritional Counselling

Important concepts in Sports Psychology

Motivation: Definition; Interactional approach; Goal setting; Strategies to enhance motivation; Goal orientation; Reinforcement; Positive approach; Intrinsic and Extrinsic motivation; Mental preparation.

Attention Concept and Thought management: Definition; Ways in which athletes lose concentration; Concentration principles and thought management strategies.

Management of competitive stress and athletes responses: Relationship between anxiety and sports performance; Stress management intervention; Restructuring approach; Tools to assess stress among athletes; Mental preparation.

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.

Concepts of Health Behaviour change psychology

Theories of behaviour change-Part A: Usefulness of theories in behaviour change; Health Belief Model; Theory of Reasoned Action/Theory of Planned Behaviour Self-Efficacy; The Trans theoretical Model.

Theories of behaviour change-Part B: 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.

Nutrition counselling and education

Nutrition counselling: Definition; Requirement; Procedures to adopt; Role of a Sports Dietitian 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.

SN DSEC41-(TH)-P17: (Theory) Students will opt subject offered by the Department

SN DSEC42-(TH)-P18: (Theory) Students will opt subject offered by the Department

SN DSEC43-(PR)-P19: (Practical) Students will opt subject offered by the Department

SN DSEC44-(PS)-P20: (Project & Seminar) Students will opt subject offered by the Department

(Detailed syllabus of DSEC are in page 18-19)

[Project work (Summer Project) & Seminar: Students will submit and present performance report of their summer project opted at end of the session of 2nd Semester, for their specific DSE course assigned during 4th Semester curriculum. A project will be performed during the summer research training in a reputed laboratory of excellence. A presentation of the accomplishments will be required before a panel of experts. Evaluation will be based on both the project report and presentation.]

[Viva: Students will be evaluated on all the topics discussed in the two years programme by a panel of experts.]

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSEC)

**Offered by the Parent Department
for the Students of “Sports Nutrition”
Assigned for 4th Semester Curriculum**

Detailed Syllabus for theory and practical classes under DSEC curriculum during 4th Semester.

Students will opt any one of the following subjects offered by the Centre. Selection will be made on merit basis during 2nd Semester curriculum. Each paper carry 50 marks equivalent to 4 credits.

1. **Sports Nutrition & Kinesiology**
2. **Sports Nutrition & Neuropsychophysiology**

DSEC-1: Sports Nutrition & Kinesiology

SN DSEC41-(TH)-P17 : Nutrition for physical performances in sports

Biomechanics, Motion study, Motor Skill & Sports specific training
Maintenance of Body Composition, Sports Nutrition Supplements, Maintenance of Energy Balance, Sports Food and Energy Drinks, Protein Nutrition, Physical Fitness Athletes training

SN DSEC42-(TH)-P18 : Nutritional assessment for Sports performances

Advance Nutritional aspects for better performances
Influences of Genetics & Environment on Nutrition
Periodized Nutrition for athletes
Nutritional assessment, validity of methods and Counselling of Athletes
Dietary Guidelines for different types of Games & adaptation of diet during travel for National & International competitions.

SN DSEC43-(PR)-P19 : Practical Kinesiology and motor skill

1. Correctly identify and label the composition, structure and types of bone using skeletal models.
2. Differentiate accurately between palpating tendon, muscle, bone, artery and nerve.
3. Properly demonstrate and instruct the osteokinematic movements of the body -flexion, extension, rotation etc.
4. Analyze precisely a given functional activity by joint angle, joint movements and muscle activity.
5. Analyze accurately activities based on the center of gravity and base of support of a person.
6. Identify accurately and palpate the structures, bones and bony landmarks of the upper and lower extremities.
7. Prepare a description of a selected motor skill, breaking it down into component phases and identifying starting and ending points.
8. Determine the simultaneous-sequential nature of a variety of movement skills
ECG, EMG for sports performances

SN DSEC44-(PS)-P20 : Project work & Seminar

DSEC-2: Sports Nutrition & Neuropsychophysiology

SN DSEC41-(TH)-P17 : Food, Mind, Fitness and Sports performances

Food choices, food Purchase and eating behaviour: Psychological basis; Social interaction; Ethnic, religious and economic influences. Food psychology for health maintenance and fitness:

Neurophysiology: Special senses, Sensory processing, sleep & wakefulness Neural basis of cognition - Learning, Memory, emotion, Neuronal control of eating & drinking behaviour,

Biological clock, nutrition & sports performances

Eating disorder in athletes

SN DSEC42-(TH)-P18 : Body & mind testing for Sports performances

Psychological assessment and testing, Sports psychometry, Cognitive therapy in sports
Measurement of neural/brain activity (EEG and imaging) in sports training & concussion
Yoga therapy

SN DSEC43-(PR)-P19 : Practical

Sports Psychology & Nutritional Counselling

1. Using Rate of perceived exertion using Borg's scale.
2. Learning to use the EAT questionnaire to determine eating disorder.
3. Assessment of Self-esteem of an athlete using Rosenberg questionnaire.
4. Estimation of anxiety using physical activity and sport anxiety scale.
5. Estimation of competitive anxiety using trait anxiety inventory.
6. Estimation of depression using BDI-II Beck's depression inventory (version 2).
7. Estimation of negative affectivity using the positive and negative affect scale.
8. Estimation of anticipation time.
9. Estimation of reaction time.
10. Estimation of IQ and attention using Wechsler Adult Intelligence Scale.

EEG, f-NIRS for sports performances

SN DSEC44-(PS)-P20 : Project work & Seminar

**GENERIC ELECTIVE (GE) COURSE OFFERED BY
DEPARTMENT OF SPORTS SCIENCES
FOR OTHER DEPARTMENTS**

Paper – CBCC-X

[one paper for 50 marks in 3rd Semester as draft syllabus for CBCC course offered by the Dept. of Physiology; each module carry 10 marks; 5x10 = 50 marks; Credit - 04]

Title: “Science in Sports performances”

Sports Exercise Physiology

1. Elementary concepts of different physiological systems
2. Physiological measurements of fitness
3. Exercise & performances
4. Sports apparels, Ergonomics and comfort
5. Sports Anthropometry

Sports Biochemistry

1. Biomolecules and their chemistry
2. Cellular structure & function, Cellular signaling
3. Metabolism& Biochemical pathways
4. Biochemical analysis in sports
5. Pharmacology & Doping

Sports Nutrition

1. Food, nutrients & Bioenergetics
2. Diet, Diet survey& Nutritional assessment
3. Food habits & Nutritional disorder
4. Diet, Exercise, Fitness& performances
5. Sports food and Nutritional supplements

Sports Management

1. Human Anatomy and Sports Injury
2. Strategies to decrease risk of injury
3. Drugs in sports
4. Ethical issues in sports
5. Sports training& management

Sports Psychology

1. Sports Psychology: Basics
2. Sportsmanship
3. Cognition, behaviour and performances
4. Performances in Sports and Psychological aspects
5. Self-regulation techniques; emotion management,

Recommended Readings

1st Semester

FUNDAMENTALS OF HUMAN NUTRITION

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2009). Textbook of human nutrition. Oxford & IBH.
2. Gilchrist, J. M. (2003). Introduction to Human Nutrition. Blackwell Science Ltd, Oxford, United Kingdom.
3. Geissler, C., & Powers, H. (2009). *Fundamentals of Human Nutrition E-Book: for Students and Practitioners in the Health Sciences*. Elsevier Health Sciences.
4. Mann, J., & Truswell, S. (Eds.). (2017). *Essentials of human nutrition*. Oxford University Press.
5. Geissler, C., & Powers, H. (2005). *Human Nutrition* with CD-Rom. Churchill Livingstone.
6. Latham, M. C. (2002). *Human nutrition in the developing world* (Vol. 29). FAO.

NUTRITIONAL BIOCHEMISTRY AND EXERCISE

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

BASIC PHYSIOLOGY, METABOLISM & EXERCISE NUTRITION

1. Hall, J. E., & Guyton, A. C. (2015). Textbook of medical physiology.
2. Pocock, G., Richards, C. D., & Richards, D. A. (2013). *Human physiology*. Oxford university press.
3. Sherwood, L. (2015). Human physiology: from cells to systems. Cengage learning.
4. Sherwood, L. (2011). *Fundamentals of human physiology*. Cengage Learning.
5. Wright, D. B. (2000). *Human physiology and health*. Heinemann.
6. Maughan, R. J., & Shirreffs, S. M. (Eds.). (2013). Food, Nutrition and Sports Performance III. Routledge.
7. Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC Press.
8. Marie Dunford. (2017) Nutrition for Sport and Exercise.
9. Jeukendrup, A. (2010). Sports Nutrition-From lab to Kitchen. Meyer & Meyer Sport.
10. Maughan, R. J., & Shirreffs, S. M. (Eds.). (2013). Food, Nutrition and Sports Performance III. Routledge.
11. Spano, M., Kruskall, L., & Thomas, D. T. (2017). Nutrition for Sport, Exercise, and Health. Human Kinetics.
12. Lanham-New, S. A., Stear, S., Shirreffs, S., & Collins, A. (Eds.). (2011). Sport and exercise nutrition (Vol. 8). John Wiley & Sons.
13. Lamprecht, M. (Ed.). (2014). Antioxidants in sport nutrition. CRC Press.

14. Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones & Bartlett Learning.
15. Wolinsky, I., & Driskell, J. A. (Eds.). (2005). Sports nutrition: vitamins and trace elements. CRC Press.

ASSESSMENT OF HEALTH AND FITNESS OF ATHLETES

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

2nd Semester

EXERCISE PHYSIOLOGY & METABOLISM

1. Christopher B. Scott. (2010). A Primer for the Exercise and Nutrition Sciences: Thermodynamics, Bioenergetics, Metabolism. Humana Press.
2. Raven, P., Wasserman, D., Squires, W., & Murray, T. (2012). Exercise Physiology: An Integrated approach. Nelson Education.
3. ACSM's Resources for Clinical Exercise Physiology: Musculoskeletal, Neuromuscular, Neoplastic, Immunologic and Hematologic Conditions by American College of Sports Medicine
4. Powers, S. (2014). Exercise physiology: Theory and application to fitness and performance. McGraw-Hill Higher Education.
5. Smith, D. L., & Fernhall, B. (2011). Advanced cardiovascular exercise physiology. Human Kinetics.
6. Farrell, P. A., Joyner, M., & Caiozzo, V. (2011). ACSM's advanced exercise physiology.
7. Cheung, S. (2010). Advanced environmental exercise physiology. Human Kinetics.
8. Hale, T. (2005). Exercise physiology: a thematic approach (Vol. 5). John Wiley & Sons.
9. Ehrman, J. K., Kerrigan, D., & Keteyian, S. (2017). Advanced Exercise Physiology: Essential Concepts and Applications. Human Kinetics.
10. McArdle, W. D., Katch, F. I., & Katch, V. L. (2015). Exercise physiology: nutrition, energy, and human performance. 8th Edition, Lippincott Williams & Wilkins.

SPORTS SPECIFIC NUTRITION

1. Maughan, R. J. (Ed.). (2008). Nutrition in sport (Vol. 7). John Wiley & Sons.
2. Fink, H. H., & Mikesky, A. E. (2017). Practical applications in sports nutrition. Jones & Bartlett Learning.
3. Eberle, S. G. (2013). Endurance Sports Nutrition, 3E. Human Kinetics.
4. Ryan, M. (2012). Sports nutrition for endurance athletes. Velo Press.
5. Campbell, B. (Ed.). (2013). Sports nutrition: enhancing athletic performance. CRC

- Press.
6. Reaburn, P. R. (Ed.). (2014). *Nutrition and Performance in Masters Athletes*. CRC Press.
 7. 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.
 8. Christoph Zinner and Billy Sperlich. (2016). *Marathon Running: Physiology, Psychology, Nutrition and Training Aspects*

CLINICAL SPORTS NUTRITION

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

RESEARCH METHODOLOGY & BIOSTATISTICS

1. Kumar, S., & Phrommathed, P. (2005). *Research methodology* (pp. 43-50). Springer US.
2. Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.
3. Neuman, W. L. (2013). *Social research methods: Qualitative and quantitative approaches*. Pearson education.
4. Marczyk, G., DeMatteo, D., & Festinger, D. (2005). *Essentials of research design and methodology*. John Wiley & Sons Inc.
5. Runyon, R. P., Coleman, K. A., & Pittenger, D. J. (2000). *Fundamentals of behavioral statistics*. McGraw-Hill.
6. Thompson, B. (2006). *Foundations of behavioral statistics: An insight-based approach*. Guilford Press.
7. Rastogi, V. B. (2009). *Fundamentals Of Biostatistics 2Nd Ed*. Ane Books Pvt Ltd.

3rd Semester

DIETARY SUPPLEMENTS AND ERGOGENIC AIDS

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

COMMUNICATION SKILLS FOR SPORTS PROMOTION

1. Pedersen, P. M., Laucella, P., Kian, E., & Geurin, A. (2016). *Strategic Sport Communication*, 2E. Human Kinetics.
2. Littlejohn, S. W., & Foss, K. A. (2010). *Theories of human communication*. Waveland press.
3. Kumar, K. J. (2000). *Mass communication in India* (Vol. 741). Jaico publishing house.
4. Abraham, C., & Kools, M. (2011). *Writing health communication: An evidence-based guide*. Sage.

FOOD SERVICE MANAGEMENT AND ENTREPRENEURSHIP

1. Payne-Palacio, J. (2016). *Foodservice Management: principles and practices*. Pearson Education.
2. Motarjemi, Y., & Lelieveld, H. (Eds.). (2013). *Food safety management: a practical guide for the food industry*. Academic Press.
3. Sullivan, C. F., & Atlas, C. (1998). *Health care food service systems management*. Jones & Bartlett Learning.
4. Puckett, R. P. (2012). *Foodservice manual for health care institutions* (Vol. 150). John Wiley & Sons.
5. Ciletti, D., & Chadwick, S. (2012). *Sports Entrepreneurship: Theory and Practice*. Fitness information Technology.

4th Semester

SPORTS PSYCHOLOGY AND NUTRITION COUNSELLING

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

The regulations for Two-year M. Sc. Course in Sports Nutrition, University of Calcutta

ADMISSION CRITERIA

1. The University of Calcutta shall provide instructions leading towards two year M.Sc. degree.
2. **Eligibility for admission in M.Sc. Neuroscience:** At least 55% marks in B.Sc. Hons in all branches of Sciences including Physiology and all allied subjects of Life Sciences, Physics, Chemistry and Mathematics. All candidates should have Science subjects in Higher Secondary level. M.B.B.S/B.Sc. (Ag) and allied graduates are also eligible. Reservation of seats will be governed by the rules of Govt. of West Bengal at present.
3. Applicants from University of Calcutta will get admission to the sixty percent of seats (Category-A). Forty percent of the seats (Category-B) will be filled up from candidates from both CU and non CU from a common merit list prepared on the basis of a Common Entrance Test. The criteria for the preparation of the merit list will be determined by individual departments. Non-CU students, however, will have to satisfy the same eligibility criteria applicable to the students of the University of Calcutta. A **Common Entrance Test** will be conducted for the 4 (four) courses including i) Exercise Physiology (SE), ii) Sports Biochemistry (SB), iii) Sports Nutrition (SN), iv) Sports Physiotherapy (SP). The Common Entrance Test will be MCQ type covering the fields of Life Sciences and all Natural Sciences.
4. The duration of the course shall be two academic years and the examination for the M.Sc. degree shall be held over four semesters over a total of 1000 marks and 80 credits. The duration of the semesters shall be as follows:

1st Semester	July - December
2nd Semester	January - June
3rd Semester	July – December
4th Semester	January - June

5. The course curriculum includes **Core courses** (offered by the Department), **Discipline Specific Elective Courses** (offered by the Department) and **Generic Elective Courses** (offered by the other Department).
6. A student will have to take **two courses** from **Generic Elective Courses (GEC) offered by the other Departments in 3rd Semester curriculum** in addition to courses offered by the Parent Department. Each course will carry credits according to the number of theoretical classes required, study hours and laboratory hours.
7. A student will have to take **one course** from **Discipline Specific Elective Courses (DESC)** offered by the **Parent Department in 4th Semester curriculum** in addition to **Core Courses** offered by the Parent Department. The course will carry credits according to the number of theoretical classes required, study hours and laboratory hours.
8. A candidate shall be eligible for appearing at the examination provided he/she prosecutes a regular course of studies maintaining percentage of attendance as specified by the University.
9. Examinations would be held after the completion of curriculum at the end of each semester. However, evaluation of the practical will be based on continuous assessment as well as on the final Viva-Voce examination of the students on the experiments. The examination time allotted for each paper carrying 50 marks is 2 hours.

PASSING CRITERIA

10. A candidate is required to appear at the examination in each and every paper/course/module/part/group of the respective syllabus. A candidate in order to be declared to have passed an examination, must obtain at least 40% marks in each paper/course/module/part/group. In case of a paper/course/module/part/group containing both theoretical and practical portions, a candidate is required to secure at least 35% marks separately in the theoretical and practical portions and at least 40% marks in aggregate in that paper.
11. If a student gets 'F' in a particular course, he/she shall be deemed to have failed in that course only and shall be required to write a supplementary examination to be offered within six months.
12. The students will get a maximum of three academic years to complete the M.Sc. course.

CRITERIA FOR RE-APPEARING AT SUPPLEMENTARY EXAMINATION

13. All supplementary examinations shall be held after six months of the original examination. Having **failed** or **absent** in maximum two papers/courses a candidate shall be eligible to appear at the supplementary examination. A candidate who has **failed** in more than two papers will have to appear at the same semester without appearing at the higher semester and without attending the classes. Candidate who fails in one or two papers can clear the paper/s in two more consecutive chances (**excluding the main examination**) along with higher semester examination. If the candidate is unable to clear the same within two consecutive chances, he shall be dropped from the concerned course. A failed candidate, intending to re-appear in a subsequent semester has to take permission from the concerned Faculty Secretary through the Head of the Department immediately after publication of result.

ABSENT CRITERIA

14. Failure to fill up the examination form shall be considered as missing a chance and such candidates who have not filed up the examination form shall have to appear at the same semester examination. A candidate who has filled up the examination form but remains absent in the entire examination or more than two courses will be considered to have lost a chance and shall be required to re-appear at the same semester examination. A candidate remaining absent in one or two papers/courses but clearing the other papers/courses shall be considered to have failed in those papers/courses in which he remains absent and shall be eligible to clear those as stated above.
15. If all the chances of a candidate (Main + 2) has been exhausted, he has to drop or leave the course. He may apply for re-admission in the same course of study in the 1st Semester of the next academic session along with the fresh applicants.

Results Determination criteria

CALCULATION OF GRADE POINTS, SGPA AND CGPA

Credit-weighted grade point system will be followed and therefore only the grade points but not the overall percentage of marks either in individual paper or in aggregate marks will be provided. The grade points will be given according to the following computation.

Grading of students' performance:

Grade scores will be calculated in a scale of 6 (six) as per the following table:

Marks (%)	Grade Score Brackets	Grade Score added per each additional mark to minimum grade score in the bracket
80-100	5.00 - 6.00	0.05
70-79	4.50 – 4.99	0.05
60-69	4.00 – 4.49	0.05
55-59	3.75 – 3.99	0.05
50-54	3.50 – 3.74	0.05
40-49	3.00 – 3.49	0.05
00-39	Below 3.00	0.075

Award of Grade Points:

For example, if a student scores 53% in theory and 68% in practical in a 3-credit course (2+1), his/her grade point for the course will be as follows:

$$\text{Grade point} = \frac{2 \times (3.5 + 0.05 \times 3) + 1 \times (4.0 + 0.05 \times 8)}{2+1} = 3.90$$

For a credit course with no practical component, for example a 2-credit course, if a student scores say, 56%, then the grade point will be:

$$\text{Grade point} = \frac{2 \times (3.75 + 0.05 \times 1)}{2} = 3.80$$

Semester Grade Point Average (SGPA):

The computation of average grade point of a student in a semester will be worked out as follows:

Nth Semester

<u>Course</u>	<u>Credits</u>	<u>Grade Scored</u>
1	3+1	5.65
2	3+1	5.33
3	2+0	3.99
4	2+0	5.05
5	3+1	4.22
6	3+1	4.46

Semester Grade Point Average (SGPA) = 4.836

$$\text{SGPA} = \frac{(5.65 \times 4) + (5.33 \times 4) + (3.99 \times 2) + (5.05 \times 2) + (4.22 \times 4) + (4.46 \times 4)}{20} = 4.836$$

Cumulative Grade Point Average (CGPA) over four semesters:

Working out simple average of SGPA obtained over four semesters, cumulative grade point average will be given after four semesters.

Significance of grades:

On the basis of the cumulative results of the student's performance, the following grades will be given in each semester as well as over four semesters.

Grade points	Grades	Class
5.00 - 6.00	Outstanding (O)	First (I)
4.50 – 4.99	Excellent (A+)	First (I)
4.00 – 4.49	Very good (A)	First (I)
3.75 – 3.99	Good (B+)	Second (II)
3.50 – 3.74	Fair (B)	Second (II)
3.00 – 3.49	Satisfactory(C)	Second (II)
Below 3.00	Fail (F)	Fail