

## **19BSSC401 : EXERCISE PRESCRIPTION, MEASUREMENT AND EVALUATION**

### **UNIT I: Exercise prescription for healthy populations**

1. Basic concepts – definitions, terminology, role of the exercise scientist-
2. Pre-exercise screening and fitness assessment-

- Introduction to model screening,
- purpose of fitness assessment
- procedures for fitness assessment , tools
- with tools model procedures
- personal profile, Past medical history,
- Posture assessment, girth measurement, Flexibility assessment,
- Body mass index, Body composition test, fitness evaluation,
- fitness goal setting, Corrective and fitness exercise programs,
- Reviews

3. Basic principles of training

Principles of Exercise and Sport Training (Individuality, Specificity, Progression, Overload, Adaptation, Recovery & Reversibility)

### **UNIT II: SPECIFIC TRAINING**

1. Training for endurance-: Aerobic Endurance Training Programme Design Variables

- Exercise Mode
- Training Frequency
- Exercise Duration
- Exercise Progression

2. Types of Aerobic Endurance Training Programs

- Long, slow distance
- Pace/tempo
- Interval
- Repetition
- Fartlek

3. Training for strength

Resistance Training Programme Design Variables

- Needs Analysis
- Exercise Selection
- Training Frequency

- Training Load and Repetitions
  - Volume
  - Rest Periods
4. Training for speed
- Movement Mechanics
  - Power
  - Running Speed (Sprints)
5. Periodisation and progression of physical training programs
- Periodization Cycles (Macrocycle, Mesocycle & Microcycles)
  - Periodization Periods (Preparatory, First Transition, Competition & Second Transition)

### **UNIT III: Theory of Exercise prescription for the development of specific physical capacities -**

Muscular strength and power:

- Periodization:
- Responses to training stress,
- Linear and non linear periodization models

Speed and agility:

- Running speed
- Agility
- Methods of developing speed and agility programs

Flexibility:

- Introduction
- Selection of muscles groups
- Types of stretches - Active, passive
- Programs for flexibility training
- Methods to improving flexibility

Cardio respiratory fitness:

- Factor related to cardio respiratory fitness
- Designing the programs for cardio respiratory fitness
- Types cardio respiratory fitness
- Special issue related cardio respiratory fitness

### **UNIT IV**

1. Monitoring and evaluating training
2. Implementing and evaluating health/fitness programs
3. Talent identification

## **UNIT V**

### **Fitness and physical performance assessment of healthy individuals**

## **UNIT VI**

### **Theory of Measurement and evaluation**

1. Anthropometry
  - Girth Measurements
2. Aerobic power assessment
  - 1.5 Mile Run
  - 12-Minute Run
3. Blood Pressure measurement
4. High intensity assessment
  - Reason for testing
  - Testing terminology
  - Evaluation of test quality
  - Test selection
    - a. 1RM power clean
    - b. Standing long jump
    - c. Vertical jump
    - d. Margarita kalamen test
5. Agility assessment
  - Introduction, purpose
  - Evaluation test quality
  - Procedures and preparation
  - Test selection
    - a. T-test
    - b. Hexagon test
    - c. Pro agility test
6. Flexibility assessment
  - Definition
  - types of flexibility
  - muscle response,
  - purpose for flexibility test
    - a. Sit and reach test- purpose, procedure, measurement and tools
    - b. Hamstring flexibility test - purpose, procedure, measurement
    - c. Quadriceps flexibility test – purpose, procedure, measurement
    - d. Faber test – purpose, procedure, measurement

- e. IT-band test – purpose, procedure, measurement
- f. Thomas test – purpose, procedure, measurement and tools
- g. Aply's test – purpose, procedures, measurement and tools
- h. King cobra – purpose, procedure, measurement and tools
- i. Calf flexibility test – purpose, procedure, measurement
- j. Chest flexibility test – purpose, procedure, measurement

## **7. Muscular strength, power and endurance assessment**

### Maximum Muscular Strength

- 1 RM Bench Press
- 1 RM Bench Squat

### Maximum Muscular Power

- 1 RM Power Clean
- Standing Long Jump
- Vertical Jump
- Margaria-Kalamen Test

### Local Muscular Endurance

- Partial Curl Up
- Push Up
- YMCA Bench Press Test

## **8. Isokinetic testing**

## **9. Sport-specific tests:**

- Athletics (track and field),
- Marathon,
- Cricket,
- Hockey,
- Soccer
- Tennis

## **19BSSC402 : APPLIED SPORTS BIOMECHANICS**

### **UNIT I**

#### **Biomechanics of anatomical materials**

- a. Bone-
  1. Bone Composition and Structure
  2. Biomechanical Properties of Bone
  3. Biomechanical Behaviour of Bone
- b. Tendons and ligaments
  1. Composition and Structure of Tendons
  2. Composition and Structure of Ligaments
  3. Biomechanical Properties of Tendons and Ligaments
  4. Factors That Affect the Biomechanical Properties of Tendons and Ligaments
- c. Cartilage ( The)
  1. Composition and Structure of articular Cartilage
  2. Structural and physical interaction among cartilage components
  3. Biomechanical behaviour of articular Cartilage
  4. Lubrication of articular Cartilage
  5. Biomechanics of Cartilage Degeneration
- d. Muscle
  1. Composition and Structure of Skeletal Muscle
  2. Molecular Basis of Muscle Contraction
  3. Mechanics of Muscle Contraction
  4. Force Production in Muscle
  5. Muscle Fibre Differentiation
  6. Muscle Remodelling
- e. Nerves
  1. Biomechanical behaviour of Peripheral Nerves
  2. Biomechanical behaviour of Spinal Nerve Roots

#### **UNIT II: Biomechanics of gait**

- Introduction, gait cycle
- Types,
- Stance phase and cycles
- Swing phase and cycles
- Gait pattern

### **UNIT III**

Biomechanics of joints (hip, knee, ankle and foot, shoulder, elbow, wrist and hand, lumbar and cervical spine)

#### 1. Biomechanics of hip joint

- i. Introduction
- ii. Anatomic Considerations

The Acetabulum, The Femoral Head, The Femoral Neck, The Hip Capsule and Muscles Surrounding the Hip Joint

- Kinematics

Range of Motion in Walking, Impact of Age on Range of Motion

- Kinetics

Indirect Measurement of Joint Forces, Direct Measurement: Using Surgical Implants, Joint Reaction Force during Activities, Impact of Gender on Hip Kinetics, Implants, Effect of External Support on Hip Joint Reaction Force

#### 2. Biomechanics of knee joint

- Introduction
- Kinematics

Range of Motion, Surface Joint Motion, Tibiofemoral Joint, Patellofemoral Joint

- Kinetics

Statics of the Tibiofemoral Joint, Dynamics of the Tibiofemoral Joint

Stability of the Knee Joint, Function of the Patella

#### 3. Biomechanics of foot and ankle

- Introduction
- Structural Organization of the Foot and Ankle

Rearfoot, Midfoot, Forefoot, The Medial Longitudinal Arch, Soft Tissues of the Foot

- Kinematics of the Foot and Ankle
- Terminology
- Ankle Joint

Subtalar Joint, Transverse Tarsal Joint

- Pronator and Supinator Twists of the Forefoot
- Metatarso-phalangeal Joint
- Inter-phalangeal Joint
- Passive Stability of the Ankle and Foot
- Muscle Control of the Ankle and Foot
- Foot and Ankle Motion during Gait
- Muscle Action during Gait
- Kinetics of the Ankle Joint, Kinetics of the Foot

- Effects of Shoe Wear on Foot/Ankle Biomechanics

#### 4. Biomechanic of lumbar spine:

- Introduction
- The Motion Segment: The Functional Unit of the Spine
- The Anterior Portion of the Motion Segment
- The Posterior Portion of the Motion Segment
- The Ligaments of the Spine
- Kinematics
  - a. Segmental Motion of the Spine, Range of Motion
  - b. Surface Joint Motion, Functional Motion of the Spine
  - c. The Muscles, Flexion and Extension, Lateral Flexion and Rotation, Pelvic Motion
- Kinetics
  - a. Statics and Dynamics
  - b. Mechanical Stability of the Lumbar Spine
  - c. Intra-abdominal Pressure
  - d. Trunk Muscle Co-contraction
  - e. External Stabilization

#### 5. Biomechanic of cervical spine

- Introduction
- Component Anatomy and Biomechanics
- Anatomy

Osseous Structures, Intervertebral Discs, Mechanical Properties

- Vertebrae

Intervertebral Discs, Ligaments, Muscle, Neural Elements

- Kinematics

Range of Motion, Surface Joint Motion, Coupled Motion of the Cervical Spine, Atlantoaxial Segment, Subaxial Spine, and Abnormal Kinematics

#### 6. Biomechanics of Shoulder joint

- Introduction
- Kinematics and Anatomy
- Range of Motion of the Shoulder Complex

Sterno-clavicular Joint, Acromio-clavicular Joint

Clavicle, Glenohumeral Joint and Related Structures, Glenoid Labrum, Joint Capsule Gleno-humeral and Coracohumeral Ligaments, Additional Constraints to Gleno-humeral Stability, Scapulo-thoracic Articulation, Spinal Contribution to Shoulder Motion

- Kinetics

## Muscular Anatomy

Integrated Muscular Activity of the Shoulder Complex, Forward Elevation, External Rotation, Internal Rotation, Extension, Scapulo-thoracic Motion

### 7. Biomechanics of Elbow joint

- Introduction
- Anatomy
- Kinematics
- Carrying Angle
- Elbow Stability
- Kinetics
- Electromyography
- Elbow Joint Forces
- Articular Surface Forces
- Calculation of Joint Reaction Forces at the Elbow

### 8. Biomechanics of Wrist and Hand

- Introduction
- Anatomy of the Wrist and Hand

Wrist Articulations, Hand Articulations, Arches of the Hand, Nerve and Blood Supply of the Wrist and Hand, Control of the Wrist and Hand, Passive Control Mechanisms

- Bony Mechanisms, Ligamentous Mechanisms, Tendinous Mechanisms, Active Control Mechanisms, Muscular Mechanisms of the Wrist, Muscular Mechanisms of the Hand
- Kinematics

Wrist Range of Motion, Flexion and Extension, Radial and Ulnar Deviation, Dart Thrower's Motion, Forearm Pronation and Supination

Functional Wrist Motion

#### a. Neuromuscular coordination

- Introduction,
- definition
- Description of co-ordination
- Conceptions of co-ordination
- Biomechanical and neuro-muscular constraints on Pattern stability and demands in coordination

#### b. Analysis



## **UNIT IV**

### **Biomechanics of injuries (causes and consequences)**

- a. Achilles tendonopathy
  1. Achilles tendinopathies in Runners
  2. Causes
  3. Grades of tendon injuries and phases of tissue repair and treatment
- b. Patellofemoral pain
  1. Muscular etiologies of Patellofemoral pain syndrome and their Pathophysiology
  2. Biomechanical problems and muscular dysfunction
- c. Hamstring tears
  1. Factors Predisposing to Hamstrings Injury
  2. Classification of Hamstrings tear
- d. Lower back pain
  1. Influence of biomechanical factors in low back pain
  2. Understanding Low Back biomechanics-Through the relation between spinal stiffness and back muscle activity
- e. Shoulder injuries (related to throwing)  
Sources of shoulder pain
- f. Elbow tendonopathy  
Lateral Epicondylitis in tennis-aetiology and biomechanics

## **UNIT V**

### **Biomechanics of cricket**

- a. Batting –
  - Introductions, batting styles, stroke, drives shot, pull, defence
  - Role - Good Concentration & Sound Stroke Execution,
  - Technique- set up, stance, grip, back lift, weight transfer,
  - (sss) step stop swing. Body lever,
- b. Bowling
  - Introduction, types of bowling, technique
  - Phase-run up, gather, feet alignment, back foot impact,
  - delivery stride, front arm pathway, release and follow
  - Types –fast, spine. Swing, medium
- c. Throwing
  - Introduction, types of throw, technique
  - under arm throw, over arm throw, hip throw

- Dive throw, flick throw, crow hop,
- d. Analysis

## **UNIT VI:**

### **Ergonomics**

1. Work load as a risk factor for musculoskeletal disorders.
2. Ergonomic aspects of biomechanics

## **19BSSC403 : APPLIED PHYSIOLOGY**

### **UNIT I: Physiological adaptations to endurance exercise**

#### **a) Cardiorespiratory adaptations to endurance training**

- Cardiac adaptations to endurance training  
Changes in stroke volume, myocardial contractility  
Changes in heart rate and blood pressure
- Respiratory adaptations to endurance training

#### **b) Neuromuscular adaptations to endurance training**

- Fibre type transitions
- Structural changes in skeletal muscle

#### **c) Physiological adaptations to high intensity interval training**

### **UNIT II: Physiological adaptations to resistance exercise**

#### **a) Cardiorespiratory adaptations to resistance training**

- Changes in stroke volume, myocardial contractility
- Changes in heart rate and blood pressure
- Respiratory adaptations to resistance training
- Specific training of respiratory muscles
- Respiratory system limitations to exercise performance

#### **Neuromuscular adaptations to resistance training**

- Structural and functional adaptations to resistance training
- Metabolic stress of resistance training
- Muscle soreness and stiffness

### **UNIT III:**

#### **Intrinsic factors affecting performance**

- a. Genetics, adaptations and exercise performance
  - b. Growth, development and the young athlete
  - c. Ageing and the older athlete
  - d. Gender
  - e. Ethnicity
1. Influence of age on performance.
    - Growth, development and the young athlete.
    - Ageing and the older athlete
  2. Influence of genetics on performance

### 3. Influence of gender and ethnicity on performance

## **UNIT IV**

### **Extrinsic factors affecting performance**

- a. Environmental conditions affecting exercise capacity, consequences and adaptations to
- b. Hypobaric – altitude/hypoxia
- c. Hyperbaric – deep sea diving
- d. Low gravity and space flight

#### **1. High altitude physiology**

- Stress of high altitude
- Acclimatization
- Longer term adjustments to altitude
- Exercise capacities at high altitude
- Altitude training and sea level performance

#### **2. Physiology of deep sea diving**

- Problems due to breathing gases at high atmospheric pressure
- Problems during ascent
- Scuba diving- apparatus and breathing gases

#### **3. Physiology of microgravity**

- Cardiovascular adaptations to microgravity
- Pulmonary adaptations to microgravity
- Musculoskeletal adaptations to microgravity
- Sensory & body fluid adaptations to microgravity
- Countermeasure strategies
- Energy expenditure and balance dynamics in space shuttle

#### **4. Exercise in the heat**

- Mechanisms and regulation of sweating
- Role of hypothalamus in thermoregulation
- Mechanisms of heat preservation
- Circulatory adjustments during exercise in heat
- Water loss in heat
- Factors modifying heat tolerance
- Complications from excessive heat stress

#### **5. Exercise in the cold**

- Cold stress and body fat
- Factors predisposing to hypothermia in sport

- Treatment of hypothermia
- Physiologic response to cold water immersion

## **6. Tapering**

### **Unit V**

#### **Ergogenic aids**

- a. Hormones
  - b. Pharmacological agents
  - c. Physiological agents
  - d. Nutritional agents
  - e. Technology in performance enhancement
1. Ergogenic aids and performance- pharmacological agents.
  2. Ergogenic aids and performance- non pharmacological agents

## **19BSSC404 : SPORTS MANAGEMENT**

### **UNIT I: Introduction to sports management**

- a. Scope of sports management
- b. Understanding the role of the sports manager

### **UNIT II: Strategic planning**

- a. Tools for strategic planning
- b. Understanding the macro-environment
- c. Analysing the micro-environment
- d. Introduction to sports strategies and role-players in Indian sport
  - i. Government departments and strategies
  - ii. Sports business landscape

### **UNIT III: Marketing concepts**

- a. Introduction to marketing – the marketing concept
- b. Market segmentation, targeting and positioning
- c. Marketing principles – Product, price, placement and promotion
- d. Sponsorship and event rights in sport

### **UNIT IV: Financial management**

- a. General principles of accounting and financial record keeping
- b. Break-even analysis
- c. Understanding debt, equity and leverage
- d. Capital budgeting
- e. Budgeting decisions
- f. Corporate social investment in sport

### **UNIT V: The sport industry**

- a. Sport in India: the sport industry defined, the Indian sport industry and sport lobbying
- b. Origins of the sport industry in India / models of Indian Sport
- c. The role of volunteers in Indian sport
- d. Government systems in sport at federal, state and local level
- e. Corporate sport - commercial sport, the Olympic/Commonwealth Games movement in India
- f. Sports development - participation programs and elite sport
- g. Women's sport organisations
- h. A career in sports science- Educator
- i. A career in sports science -Working with individual sport athletes and sports teams
- j. A career in sports science - Working in the health and fitness industry
- k. A career in sports science - Researcher – clinical and basic sciences

## **19BSSE405 : HEALTH PROMOTION**

### UNIT I:

1. Introduction to health promotion

### UNIT II

1. Health behaviour change theories and strategies
2. Health promotion models and marketing
3. Public health policy

### UNIT III

1. Lifestyle management — health behaviour related to wellbeing including diet, physical activity and sleep
2. Health and wellness coaching

### UNIT IV

1. Health promotion program evaluation and management
2. Health promotion settings

### UNIT V:

1. Health promotion in children
2. Health promotion in elderly - Nutritional Guidelines
  - Home safety assessment
  - Exercise benefits and recommendations
3. Health promotion in disabled
4. Health promotion in females
5. Health promotion in pregnant females
6. Health promotion in children
  - Prevention of obesity
  - Promotion of breast feeding