

POST GRADUATE DIPLOMA IN BIOMECHANICS AND
KINESIOLOGY IN SPORTS & FITNESS

Syllabus

YEAR - I

PAPER 1 - Biomechanics

UNIT 1

Foundations of Human Movement:

Basic movement terminology - Biomechanics vs Kinesiology - Anatomy Vs Functional Anatomy - Linear Vs Angular motion - Kinematics Vs Kinematics - Statics Vs Dynamics - Anatomical movement descriptors - Segment names - Anatomical names - Movement description - Basic movements - Specialised movement descriptors - Reference systems - Example of Joint movement characteristics

Mathematical overview - Units of measurements - Vector analysis - Coordinate systems. Forces and moments - Muscle forces Statics - Newton's laws - Solving problems - Simple musculoskeletal problems - Advance musculoskeletal problems Kinematics - Rotational and Translational motion - Displacement, Velocity and acceleration Kinetics - Inertial forces - Work Energy and power - Friction

UNIT 2

Biomechanics of Joints

Classification of Motion - Classification of joints - Factors influencing motion at a joint - The effect of joint structure or joint motion - External forces on a joint - Interaction between joints and the external environment.

Biomechanics of Cartilage:

Mechanical behaviour and modelling - Material properties - Relationship between mechanical properties and composition - Mechanical failure of cartilage - Joint lubrication - Models of Osteoarthritis

UNIT 3

Biomechanics of Skeletal Muscle:

Structure of an individual muscle fibre - The connective tissue system within the muscle belly Factors that influence a muscles ability to produce a motion - Effect of fibre length on joint excursion

Factors that influence a muscle strength - Muscle size and its effect on force production - Relationship between force production and instantaneous muscle length - Relationship between a muscles moment arm and its force production - Relationship between force

production and contraction velocity - Relationship between force production and level of recruitment of motor units within the muscle - Relationship between force production and fibre type.

Structure of connective tissue - composition of tendons and ligaments Mechanical properties - determination of stress and strain, stress - strain curve for tendons and ligaments - modes of failure - effects of physical conditions on mechanical properties - biological effects on mechanical properties

Response of tendons and ligaments to immobilisations - immobilisation and remobilisation of normal connective tissue - immobilisation and mobilisation in healing connective tissue
Response of tendons and ligaments to stress enhancement

Skeletal considerations for movement - Functions of skeletal system - Levers - Support - Types of Bones - Biomechanical characteristic of Bones - Bone tissue - Architecture of Bone - Strength and stiffness of Bone - Types of load - Bony articulations - Diarthrodial/Synovial joint - Types of Diarthrodial/Synovial joint and other types of joints.

Unit 4

Functional Anatomy:

The Upper Extremity - Introduction - The shoulder complex - The elbow and radioulnar joints - The wrist and fingers

The Lower Extremity - The pelvic and hip complex - The knee joint - The ankle and foot.

The trunk - The vertebral column - Cervical region - Thoracic region - Lumbar region - Combined movement of pelvis and trunk - Posture - Conditioning - Contribution of trunk muscles to Sports Skills or movements.

UNIT 5

Mechanical Analysis of Human Motion:

Linear kinematics - Linear kinematic analysis - Position and displacement - Velocity and speed - Acceleration - Differentiation and integration - Kinematics of running - Kinematics of projectiles - Equations of constant acceleration.

Angular kinematics - Angular motion - Measurements of angles - Types of angles - Representation of Angular motion vectors - Lower extremity joint angles - Relationship between angular and linear motion - Angular kinematics of running.

Linear kinetics - Force - Laws of motion - Types of Forces - Representation of Forces acting on a system - Forces occurring along a curved path - Special force applications.

Angular Kinetics - Torque - Centre of mass - Rotation and leverage - Moment of inertia - Angular momentum - Angular analogs to Newtons laws of motion - Special torque applications.

PAPER 2 - Kinesiology

UNIT 1

Fundamentals of Structure and Motion of the Human Body - Skeletal Osteology: Study of the Bones - Skeletal Arthrology: Study of the Joints - Parts of the Human Body - Mapping the Human Body - Skeletal Tissues - Bones of the Human Body - Joint Action Terminology - Classification of Joints - Joints of the Axial Body - Joints of the Lower Extremity - Joints of the Upper Extremity - Anatomy and Physiology of Muscle Tissue - How Muscles Function: the Big Picture - Types of Muscle Contractions - Roles of Muscles

UNIT 2

Kinesiology of the Upper Extremity:

Shoulder Unit - The shoulder complex - Structure and function of the bone and joints of the shoulder joint - Mechanics and Pathomechanics of Muscle activity at the shoulder complex - Analysis of forces on the shoulder elbow, wrist, hand during activity - Mechanics and Pathomechanics of the special connective tissues in the hand - Mechanics and Pathomechanics of intrinsic of the muscles of the hand - Mechanics and Pathomechanics of pinch and grasp.

UNIT 3

Structure and function of the articular structure of the TMJ - Analysis of the forces on the TMJ during activity.

Spine unit:

Structure & function of the bone and joints of Cervical spine, Thoracic spine & Lumbar spine and Pelvis.

UNIT 4

Structure and function of Bones and Non Contractile Elements of hip, Knee, Ankle & Foot complex and its analysis of forces.

UNIT 5

Posture & Gait:

Characteristics of Normal posture and common postural abnormalities - Characteristics of Normal Gait and factors influencing it - Characteristics of Normal Running/jogging Gait and factors influencing it - Characteristics of Normal sprinting and factors influencing it.

INTERNAL PAPER 1

Sports and Fitness Biomechanics

UNIT 1

Muscle Action in Sport and Exercise - Biomechanical view

Neural Contributions to Changes in Muscle Strength - Mechanical Properties and Performance in

Skeletal Muscles - Muscle-Tendon Architecture and Athletic Performance - Eccentric Muscle Action in Sport and Exercise - Stretch–Shortening Cycle of Muscle Function - Biomechanical Foundations of Strength and Power Training

Locomotion

Factors Affecting Preferred Rates of Movement

in Cyclic Activities - The Dynamics of Running - Resistive Forces in Swimming - Propulsive Forces in Swimming -Performance-Determining Factors in Speed Skating - Cross-Country Skiing: Technique, Equipment and Environmental Factors Affecting Performance,

UNIT 2

Jumping and Aerial Movement - Aerial Movement - The High Jump - Jumping in Figure Skating - Springboard and Platform Diving - Determinants of Successful Ski-Jumping Performance

Throwing and Hitting - Principles of Throwing - The Flight of Sports Projectiles - Javelin Throwing: an Approach to Performance Development - Shot Putting - Hammer Throwing: Problems and Prospects - Hitting and Kicking.

UNIT 3

Injury Prevention and Rehabilitation - Mechanisms of Musculoskeletal Injury - Musculoskeletal Loading During Landing - Sport-Related Spinal Injuries and their Prevention - Impact Propagation and its Effects on the Human Body - Neuromechanics of the Initial Phase of Eccentric Contraction-Induced Muscle Injury.

Special Olympic Sports - Manual Wheelchair Propulsion, Sports after Amputation.

Biomechanics of Dance

Biomechanics of Martial arts

UNIT 4

Biomechanics of YOGA

Introduction, Definition of Yoga, Origin of the word Yoga -Yuj', Meaning of the word Hatha, Stages of Yoga, Types of Yoga, Karma yoga, Gnana Yoga, Bhakti Yoga, Kriya Yoga, Buddhism and Yoga, Yoga as a Universally accepted term,

Schools of Yoga, - Ashtanga yoga as 8 stages of Yoga, Ancient Texts and Yoga Scriptures, Mudras, Kriya & Bhandas - Benefits and contraindications Hatha Yoga, Breathing, The design of the Respiratory System — the Somatic and Autonomic Nervous system — the Physiology of Respiration — Thoracic Breathing — Paradoxical Breathing —Supine Abdominal Breathing — Abdominal Breathing in Sitting Postures — Diaphragmatic Breathing, Postures targeting Abdominopelvic Region — difference between yoga and Tantra, Analysis of Yogic postures – Standing, sitting, Prone, Supine, Lying Prone, Inverted Postures — Nadis and Chakras — Guru and Sisya — The effect of Pranayama, Contribution by Patanjali, Thirumularand18 Siddhars.

UNIT 5

Biomechanics in Ergonomics

Theories of occupational musculoskeletal injury causation - anthropometry and biomechanics : anthropomechanics - mechanical exposure assessment in the design of work - tissue mechanics of ligaments and tendons - sprains and healing - bone biomechanics and fractures - determinants of muscle strength - functional anatomy of the upper limb - hand grasping, finger pinching and squeezing - hand tools - biomechanics of gloves - work and activity related musculoskeletal disorders - biomechanics models of the hand, wrist and elbow in ergonomics - biomechanical modelling of the shoulder anatomy - whiplash injuries - low back disorders - manual materials handling - whole body vibration - cumulative load and models - posture - static posture - dynamic posture - biomechanics in work seating design - biomechanics during ladder and stair climbing and walking on ramps and other irregular surfaces - slips, trips and falls

INTERNAL PAPER 2

Sports and Fitness Kinesiology

UNIT 1

Muscle Action in Sport and Exercise

Neural Contributions to Changes in Muscle Strength - Mechanical Properties and Performance in

Skeletal Muscles - Muscle-Tendon Architecture and Athletic Performance - Eccentric Muscle Action in Sport and Exercise - Stretch–Shortening Cycle of Muscle Function - Biomechanical Foundations of Strength and Power Training

Locomotion - Kinesiological view

Factors Affecting Preferred Rates of Movement

in Cyclic Activities - The Dynamics of Running - Resistive Forces in Swimming - Propulsive Forces in Swimming -Performance-Determining Factors in Speed Skating - Cross-Country Skiing: Technique, Equipment and Environmental Factors Affecting Performance,

UNIT 2

KINESIOLOGY of **Jumping and Aerial Movement** - Aerial Movement - The High Jump - Jumping in Figure Skating - Springboard and Platform Diving - Determinants of Successful Ski-Jumping Performance

Throwing and Hitting - Principles of Throwing - The Flight of Sports Projectiles - Javelin Throwing: an Approach to Performance Development - Shot Putting - Hammer Throwing: Problems and Prospects - Hitting and Kicking.

UNIT 3

Application of Kinesiology in **Injury Prevention and Rehabilitation** - Mechanisms of Musculoskeletal Injury - Musculoskeletal Loading During Landing - Sport-Related Spinal Injuries and their Prevention - Impact Propagation and its Effects on the Human Body - Neuromechanics of the Initial Phase of Eccentric Contraction-Induced Muscle Injury. Kinesiology in **Special Olympic Sports** - Manual Wheelchair Propulsion, Sports after Amputation.

Kinesiology of Dance

Kinesiology of Martial Arts

UNIT 4

KINESIOLOGICAL STUDY OF YOGA

Kinesiological Analysis of Yogic Postures : Standing, sitting Prone Lying, Supine Inverted Postures from all schools of Yoga.

UNIT 5

Kinesiological Study of Abnormal Posture and Corrective exercise prescription - Lordotic posture - Kyphotic posture - Upper crossed syndrome - Lower crossed syndrome - Flat back or Posterior pelvic tilt posture - anterior pelvic tilt - forward head posture - winging of scapula - protracted shoulder girdle or “the rounded shoulder” - Scoliosis - Kinesiological analysis of Injury - Kinesiology in Injury Prevention.

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI -600 032

**REGULATIONS FOR THE POST GRADUATE DIPLOMA IN
BIOMECHANICS AND KINESIOLOGY IN SPORTS & FITNESS**

1. SHORT TITLE AND COMMENCEMENT : These regulations shall be called **THE REGULATIONS FOR THE POST - GRADUATE DIPLOMA IN BIOMECHANICS AND KINESIOLOGY IN SPORTS & FITNESS.**

2. REGISTRATION: A candidate admitted into Post-Graduate Diploma Courses in any of the affiliated Institutions of the Tamil Nadu Dr. M.G.R. Medical University, Chennai shall register with the University by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to the Controller of Examinations of this University through the Head of the affiliated institution within the stipulated date. The candidate's name must be registered in the University within 3 months from the date of his/her admission.

3. ELIGIBILITY: Candidates for admission to the **One year Post-Graduate Diploma in Biomechanics and Kinesiology in Sports & Fitness**

shall be required MBBS / Bachelors of Physiotherapy (BPT) / B.E. Mechanical Engineering from a recognised University acquired as a full-time student.

4. .AGE LIMIT:

No upper age limit for Admission

5. ELIGIBILITY CERTIFICATE:

Candidates who have passed any qualifying examination as stated in (1) other than the Tamil Nadu Dr. M.G.R. Medical University shall obtain an “Eligibility Certificate” from this University by remitting the prescribed fees along with the application form and required documents before seeking admission to any one of the affiliated institutions. The application form is available in the University website :web.tnmgrmu.ac.in.

6. DURATION OF THE COURSE : The period of certified study and training for the Post - Graduate Diploma in Biomechanics and Kinesiology in Sports & Fitness course shall be **ONE YEAR**.

7. COMMENCEMENT OF THE COURSE:

The course shall commence from **1st September** of the academic year. Cut off date for Admission is **30th September every year**.

8. .MEDIUM OF INSTRUCTION:

English shall be the Medium of Instruction for all the Subjects of study and for examinations for the **POST-GRADUATE DIPLOMA IN BIOMECHANICS AND KINESIOLOGY IN SPORTS & FITNESS**.

9. CURRICULUM:

The Curriculum and the syllabus for the course shall be as prescribed in these regulations and are subject to modifications by the Standing Academic Board from time to time.

10. CUT-OFF DATE OF THE COURSE:

- i) **30th September of the year concerned**
- ii) The candidates admitted upto **30th September** of the Academic Year shall be registered to take up the **1st year examination during October of the next year**.

11. COMMENCEMENT OF THE EXAMINATION:

15th October / 15 April

If the date of commencement of Examination falls on Saturdays, Sundays or declared Public Holidays, the examination shall begin on the next working day.

12. WORKING DAYS IN AN ACADEMIC YEAR. : The academic year shall consist of not less than **270 working days**.

13. ATTENDANCE REQUIREMENTS FOR ADMISSION TO EXAMINATIONS:

No candidate shall be permitted to appear for the Examination unless he/she put in 85% attendance during his/her period of study and training in the affiliated institution recognized by this University and produces the necessary certificate of study, attendance and progress from the Head of the Institution by maintaining log book.

14. MAINTAINENCE OF LOG BOOK:

- Every Post-graduate Diploma candidate shall maintain a record of skills he has acquired during the one year training period certified by the various Heads of Departments he has undergone training.
- The candidates should also be required to participate in the teaching and training programme of the institute.
- In addition, the Head of the Department shall involve their post-graduate candidates in Seminars, Journal Clubs, Group discussions and conferences.
- The Head of the Department shall scrutinize the Log Book once in every three months.
- At the end of the course, the candidate should summaries the contents and get the Log Book certified by the Head of the Department.
- The Log Book should be submitted at the time of practical examination for the scrutiny of the Board of Examiners.

15. MIGRATION/TRANSFER OF CANDIDATES:

- A student studying in **POST-GRADUATE DIPLOMA IN BIOMECHANICS AND KINESIOLOGY IN SPORTS & FITNESS COURSE** can be allowed to migrate/transfer to another institution of Allied Health Science under the same or another University.
- Under extraordinary circumstances, the Vice Chancellor shall have the powers to place any migration/transfer he/she deems fit before the Governing Council

and get its approval for grant of permission/ratification for Migration/Transfer to the candidates undergoing the course of study in affiliated institutions of this University.

16. RE-ADMISSION AFTER BREAK OF STUDY: The regulations for re-admission are as per the University Common Regulation for Re-admission after break of study for all courses.

17. VACATION:

There is no vacation

18. Scheme of Examination

Paper	Subjects	Internal Assessment (IA)		Theory		Practical		Viva Voice	
		Max	Min	Max	Min	Max	Min	Max	Min
I.	Biomechanics	50	25	100	50	100	50	50	25
II	Kinesiology	50	25	100	50	100	50	50	25

DISTRIBUTION OF THE THEORY MARKS

Type of Questions	Distribution of Marks	Total Marks
Long Essays	2 x 20	40
Short Notes	10 x 6	60

Total 100 mark and Minimum pass mark 50

PRACTICAL & VIVA

Practical		Viva Voce		Total	
Max.	Min.	Max.	Min.	Max.	Min.
100	50	50	25	150	75

Practical's should include the following:

Case Discussion / Flash Card / Spotters / Instruments / Specimens (Where ever it is applicable)

19. Submission of Project:

1. Project with Compulsory _____ should be in a bound volume of a minimum of 30 - 50 pages of typed in Double line spacing and on one side only.
2. It is mandatory to have the “_____” in the final research project
3. The Project should be submitted to the Institution 3 months before the Third Year Examination.
4. The student should prepare a PPT presentation of the project at the time of Viva – Voce Examination.

20. Log Book:

Based on the curriculum Log Book to be maintained and the same are periodically, assessed by the HOD and presented at the time of discussion of project in Practical Examination.
