

UNIT - 1

Unit 1 (Class 1)

Principles of Motor Development

1. Key Concepts

- **Growth** → Structural & physiological changes (quantitative).
 - **Development** → Overall changes (physical, cognitive, emotional, social, moral).
 - **Maturation** → Natural unfolding of abilities, reaching full functionality.
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2. Characteristics of Growth & Development

- **Growth** → Physiological, quantitative, not continuous.
 - **Development** → Qualitative, continuous, lifelong.
 - Faster in early years, slows later.
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3. Issues in Development

- **Nature vs Nurture** → Heredity vs Environment.
 - **Continuity vs Discontinuity** → Gradual vs stage-like changes.
 - **Early vs Later Experience** → Both shape outcomes.
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4. Principles of Growth & Development

- (a) **Continuity** → Lifelong, “womb to tomb.”
 - (b) **Non-uniform Rate** → Rapid in infancy & puberty, slows later.
 - (c) **Uniform Pattern** → Definite sequence (e.g., motor, language).
 - (d) **General** → **Specific** → Broad actions before fine actions.
 - (e) **Integration** → Parts combine into coordinated whole.
 - (f) **Interrelation** → Physical, mental, social, emotional aspects linked.
 - (g) **Directional Trends** →
 - *Cephalocaudal*: head → feet.
 - *Proximodistal*: center → periphery.
 - (h) **Predictable** → Sequence fixed, rate varies.
 - (i) **Spiral, not Linear** → Progress + pauses + regressions.
 - (j) **Joint Product** → Heredity + Environment.
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5. Dimensions of Development

- **Physical** → Motor skills, body growth.
 - **Cognitive** → Thinking, reasoning, memory.
 - **Emotional** → Expression & regulation of emotions.
 - **Social** → Interaction, cooperation, responsibility.
 - **Moral** → Standards of right & wrong.
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6. Motor Development

- **Definition** → Growth in movement abilities (gross & fine motor).
- **Motor Learning** → Practice → permanent changes.

- **Motor Control** → Nervous system enabling coordinated movement.
- **Aging** → Decline in motor functions.

Types of Motor Skills

- **Gross** → Large muscles, big movements (running, jumping).
- **Fine** → Small muscles, precise actions (writing, buttoning).

7. Theoretical Perspectives

- **Maturational Perspective** → Driven by genetics/biology.
- **Dynamic Systems Theory** → Interaction of individual, environment, task.
- **Ecological Perspective** → Perception-action link; adapting to environment.

Newell's Model

- **Constraints on movement:**
 1. Individual (structural, functional)
 2. Environmental (gravity, surfaces, cultural norms)
 3. Task (rules, goals, equipment).

Unit 1 (Class 2)

Stages of Development | Motor Milestones | Phases of Motor Development

1. Stages of Human Development

- **Prenatal** → Germinal (0–2 weeks), Embryonic (3–8 weeks), Foetal (9 weeks–birth).
- **Neo-natal (0–1 month)** → Bonding, feeding, 14–17 hrs sleep, first growth spurt.
- **Infancy (2 months–2 yrs)** → Lift head, sit, crawl, walk; first words.
- **Childhood (2–11 yrs)**
 - *Early childhood (2–5 yrs)* → Language, toilet training, play, sex-role identity.
 - *Middle childhood (6–9 yrs)* → Independence, peer acceptance, basic motor skills.
 - *Late childhood (9–11 yrs)* → Gang age, troublesome, moral learning.
- **Adolescence (11–19 yrs)** → Puberty, hormonal changes, identity, abstract thinking.
- **Adulthood (20–60 yrs)** → Responsibilities, career, family.
- **Old Age (60+)** → Decline in physical & cognitive functions.

2. Developmental Milestones

- **0–2 months** → Lift head, grasp rattle briefly.
- **3–5 months** → Push up on forearms, grasp objects, roll over.
- **6–8 months** → Sit independently, crawl, pull to stand.

- **9–12 months** → Stand alone, first steps, clap hands.
 - **12–18 months** → Walk independently, stack 2–3 cubes, self-feeding begins.
 - **2–3 yrs** → Run, climb stairs, draw circles, stack 8–10 cubes.
 - **3–5 yrs** → Balance on one leg, hop, cut simple shapes, tripod grip.
 - **6–12 yrs (Middle Childhood)** → Ride a bicycle, skip, write neatly, organized play.
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3. Fine vs Gross Motor Skills

- **Gross Motor** → Large muscles (running, jumping, balancing).
 - **Fine Motor** → Small muscles (tying shoelaces, writing, buttoning).
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4. Phases of Motor Development

1. **Reflexive Phase** (birth–6 weeks) → Movement dominated by reflexes.
 2. **Rudimentary Phase** (6 weeks–2 yrs) → Basic motor control (crawling, walking).
 3. **Fundamental Phase** (2–7 yrs) → Running, hopping, throwing, catching.
 4. **Specialized Phase** (7–14 yrs) → Sport-specific, refined skills.
 5. **Application Phase** (Adolescence) → Refinement through practice, specialization.
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6. **Lifelong Utilization Phase** (Adulthood–old age) → Continued motor activity, exercise, health focus.
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5. WHO's Six Gross Motor Milestones

1. Sitting without support (~3.8 months).
 2. Standing with assistance (~4.8 months).
 3. Hands-and-knees crawling (~5.2 months).
 4. Walking with assistance (~6.0 months).
 5. Standing alone (~6.9 months).
 6. Walking alone (~8.2 months).
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Unit 1 (Class 3)

Motor Skills: Locomotor | Non-Locomotor | Manipulative

1. Motor Skills – Basics

- **Definition** → Movements involving muscle coordination.
 - **Types:**
 - **Gross motor** → Large muscles (running, jumping).
 - **Fine motor** → Small muscles (writing, buttoning).
 - **WHO Gross Motor Milestones:** Sitting (3.8 m), Standing w/ support (4.8 m), Crawling (5.2 m), Walking w/ assist (6.0 m), Standing alone (6.9 m), Walking alone (8.2 m).
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2. Locomotor Skills (Movement from one place to another)

- **Examples:** Walking, Running, Jumping, Hopping, Leaping, Galloping, Skipping.
- **Creeping & Crawling** → First locomotion in infants.
- **Walking** → Stance + Swing phases, early walking uses wide stance & arms high; proficient walking = narrow base, heel-to-toe, double-knee lock pattern.
- **Running** → Flight phase present; develops after walking. Early running = short strides, high-guard arms. Proficient = longer stride, trunk rotation, oppositional arms.
- **Jumping** → Propel with 1–2 feet, land on 2 feet. Proficient = crouch, arm swing, force directed appropriately.
- **Hopping** → Propel with 1 foot, land on same foot. Proficient = swing leg drives motion, oppositional arms.
- **Galloping/Sliding/Skipping** → Early = arrhythmic, stiff; Proficient = rhythmic, arm swing, smooth coordination.

3. Non-Locomotor (Stability) Skills

- Performed **without moving place**.
- **Examples:**
 - *Bending, Stretching, Twisting, Turning, Balancing, Swaying, Pushing, Pulling.*
- **Development:**
 - 2–4 m: Head control (turning).

- 6–9 m: Sitting balance.
- 1–2 yrs: Controlled pushing, swaying.
- 3–5 yrs: Refined balance & flexibility (yoga, single-leg balance).

4. Manipulative Skills (Object Control)

- Using body parts (hands/feet) to **control/move objects**.
- **Examples:** Grasping, Releasing, Throwing, Catching, Kicking, Striking, Rolling, Dribbling.
- **Development:**
 - 2–3 m: Reflexive grasp.
 - 6–8 m: Transfer objects hand-to-hand.
 - 9–10 m: Pincer grasp.
 - 12–18 m: Throw small objects, stack blocks.
 - 2–3 yrs: Catch large ball, basic utensil use.
 - 4–5 yrs: Kick/strike with coordination.
- **Progression:** Reflexive → Voluntary, Unilateral → Bilateral, Gross → Fine control.

5. Throwing, Kicking & Catching

- **Throwing:** Early = arm only; Proficient = trunk rotation, step, sequential motion.

- **Kicking:** Early = push forward; Proficient = wind-up, trunk rotation, opposition.
- **Punting:** Early = upward toss, toe contact; Proficient = ball drop, opposition arms, instep contact.
- **Catching:** Early = trap ball with body; Proficient = catch with hands, move to intercept, “give” with ball.

Unit 1 (Class 4)

Movement Concepts – BSER Framework (Body, Space, Effort, Relationship)

1. Rudolf Laban – Background

- **Founder:** Rudolf von Laban
- **Period:** 1920s–1940s
- **Concept:** Laban Movement Analysis (LMA) → later evolved into **BSER framework**.
- **Focus:** Observation & analysis of human movement in dance, daily life, and work.

2. BSER Components

A. Body (What the body can do)

- Body Parts Awareness – recognizing head, arms, legs.
- Body Shape Awareness – stretch, curl, twist.
- Body Positioning – upright, upside down.

- Body Movement – coordination of parts.
- Internal Sensation – balance, tension, relaxation.
- **Examples:** Balancing on one leg, twisting torso, pointing to knee.

B. Space (Where the body moves)

- Personal Space → bubble space, arm-span.
- General Space → gym, playground.
- Directions → forward, backward, sideways.
- Levels → low, medium, high.
- Pathways → straight, curved, zigzag.
- Extensions → stretch arms wide, reach up.
- Planes → sagittal, frontal, transverse.
- **Examples:** Walking in zigzag, dancing with scarves, shape walks.

C. Effort (How the body moves)

- **Time** → Fast/sudden (sprinting) vs Slow/sustained (Tai chi).
- **Weight** → Strong/heavy (punching) vs Light/gentle (floating).
- **Space** → Direct/straight (marching) vs Indirect/flexible (waving arms).

- **Flow** → Bound/controlled (yoga pose) vs Free/fluent (swimming).
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D. Relationship (With whom/what the body moves)

- With Self → crossing arms, curling up.
 - With Objects → jumping over cones, balancing beanbag.
 - With People → partner mirroring, group dancing.
 - With Rules/Formations → relay lines, square dance.
 - Direction & Distance → chasing, walking beside.
 - Opposition & Cooperation → tug of war, passing ball.
 - Leading & Following → follow-the-leader.
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3. Importance of BSER in Education

- Builds **coordination, balance, spatial awareness**.
 - Improves **physical confidence & injury prevention**.
 - Links **movement with cognitive development** (brain–body connection).
 - Develops **social & cooperative skills** through relationship element.
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Unit 1 (Class 5)

Movement Concepts | Planes & Axes | Synovial Joints & Movements

1. Movement Concepts – BSER Framework

- **Body (B)** → What the body does (bending, stretching, twisting, jumping).
 - **Space (S)** → Where the body moves (personal/general space, directions, levels, pathways).
 - **Effort (E)** → How the body moves (speed – fast/slow, force – strong/light, flow – free/bound).
 - **Relationship (R)** → With whom/what the body moves (objects, partners, equipment).
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2. Anatomical Planes of Movement

- **Sagittal Plane** → Flexion, Extension (e.g., bicep curl, squats).
 - **Frontal/Coronal Plane** → Abduction, Adduction (e.g., jumping jacks, side raises).
 - **Transverse Plane** → Rotation, Supination, Pronation (e.g., trunk twists).
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3. Anatomical Axes & Their Relationship

- **Frontal Axis (Medial-Lateral)** → Sagittal plane movements (flexion/extension).
- **Sagittal Axis (Anteroposterior)** → Frontal plane movements (abduction/adduction).

- **Vertical Axis (Longitudinal)** → Transverse plane movements (rotation).

4. Major Joint Movements

- **Flexion** – Decreasing angle (elbow bend).
- **Extension** – Increasing angle (knee straightening).
- **Hyperflexion/Hyperextension** – Beyond normal range.
- **Lateral Flexion** – Bending sideways.
- **Circumduction** – Circular motion (arm circles).
- **Rotation** – Twisting around axis.
- **Supination/Pronation** – Palm up/down.
- **Dorsiflexion/Plantarflexion** – Heel raise/toe point.
- **Inversion/Eversion** – Sole inward/outward.
- **Protraction/Retraction** – Shoulders forward/back.
- **Elevation/Depression** – Shoulder up/down.
- **Opposition/Reposition** – Thumb to fingertip/return.

5. Types of Synovial Joints & Examples

- **Pivot** – Rotation → Atlantoaxial joint, radioulnar.
- **Hinge** – Flexion/Extension → Elbow, knee, ankle.
- **Condyloid (Ellipsoid)** – Flexion/extension, abduction/adduction, circumduction → Wrist, knuckles.

- **Saddle** – Same as condyloid but greater freedom → Thumb (1st carpometacarpal).
- **Plane (Gliding)** – Sliding, inversion/eversion → Intertarsal joints, vertebral facets.
- **Ball & Socket** – Multiaxial; flexion, extension, abduction, adduction, rotation → Shoulder, hip.

Unit 1 (Class 6)

Sensory-Perceptual Development | Visual Development & Perception

1. Sensation vs Perception

- **Sensation** → Neural activity triggered by a stimulus (e.g., light on retina).
- **Perception** → Brain's process of selecting, organizing, and interpreting sensory input.
- *Example:* Same drawing can be seen as a vase or two profiles.

2. Sensory-Perceptual Development

- Integration of senses: sight, hearing, touch, movement.
- Crucial for interaction, learning, and motor development.

3. Visual Development – Milestones

Age Milestone

Birth	Sees blurry, detects light & motion
2–3 m	Tracks objects, prefers faces
5–6 m	Depth perception, hand–eye coordination
6–12 m	Near adult clarity, accurate reaching
1–3 yrs	Shape & size recognition, sorting
4–7 yrs	Spatial perception, visual memory, reading readiness
7–12 yrs	Fully integrated vision in learning & motor skills

4. Visual Sensation

- Newborns → ~5% adult acuity; clear up to 20 inches.
 - At 6 m → Visual detail adequate for locomotion.
 - Vision must mature to support motor activity.
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5. Visual Perception – Components

a) Perception of Space

- Depth, distance, spatial orientation.
- Cues: Motion parallax, Texture gradient, Overlap, Linear perspective.

b) Perception of Objects

- Size → relative comparison.
- Shape → contour recognition.
- Motion → direction, speed, acceleration.
- *Figure-ground perception* → focus object vs background.
- *Whole-part perception* → parts + whole integration.
- *Size & Shape constancy* → object remains same despite distance/orientation.
- *Habituation* → adaptation to repeated stimulus.

c) Spatial Orientation

- Laterality (left-right), Directionality (front-back, up-down), Position in space.

d) Perception of Motion

- Detecting movement: direction, speed, trajectory.
 - Neurological basis: **Visual cortex & MT/V5 area.**
 - Develops: Newborn (slow motion only) → 6–8 wks (direction) → 3–5 m (tracking) → 5–12 yrs (refined).
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6. Key Terminologies

- **Visual Acuity** → Sharpness of vision.
- **Depth Perception** → Perceiving 3D space.
- **Figure–Ground** → Distinguish object vs background.
- **Visual Closure** → Identify object even if incomplete.

- **Visual Memory** → Retain visual details.
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Unit 1 (Class 7)

Kinesthetic Development | Proprioception | Tactile Localization | Body Awareness | Spatial Orientation

1. Kinesthetic Perception

- **Definition** → Awareness of body position, movement, balance (the “sixth sense”).
 - **Components** → Proprioception + Vestibular sense.
 - **Receptors:**
 - Muscle spindles & Golgi tendon organs (muscles/tendons).
 - Joint receptors (joints, ligaments).
 - Somatosensors (skin – touch, pressure, vibration).
 - Vestibular apparatus (inner ear – balance, head position).
 - **Examples** → Touching nose with eyes closed, walking without looking, typing blindly.
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2. Kinesthetic Development

- Provides **internal feedback** → body position, movement speed/direction, interaction with objects.
- **Proprioceptors:**
 - *Somatic sensors* (muscles, tendons, joints, skin).

- *Vestibular apparatus* (inner ear → balance, orientation).
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3. Tactile Localization

- **Definition** → Ability to identify where the body is touched without vision.
 - **Development:**
 - Newborns: feel touch, but cannot locate precisely.
 - 4 yrs: Low accuracy.
 - 6–8 yrs: Improves, plateaus after 8 yrs.
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4. Body Awareness

- **Definition** → Ability to recognize & differentiate location/movement of body parts.
 - Includes:
 - **Laterality** → Awareness that body has 2 sides (left/right).
 - **Lateral Dominance** → Consistent preference (hand, foot, eye, ear).
 - **Importance** → Reading/writing readiness, coordinated movements.
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5. Limb Movement Perception

- Ability to sense, control, and reproduce joint movement **without vision**.
- Improves markedly **5–8 yrs**, plateaus after 8 yrs.
- Tested by reproducing limb movements blindly.

6. Spatial Orientation

- **Definition** → Perceiving body's position & direction in space without visual cues.
- Develops between **6–8 yrs**.
- Example → Blindfold walking.

7. Directionality

- Understanding directional terms: left, right, up, down, front, behind.
- Linked to laterality, but not a direct cause.
- Children with poor laterality often struggle with directionality.

8. Age-Related Changes (Older Adults)

- Reduced **skin sensitivity**, vibratory & temperature perception.
- Difficulty judging **passive limb movements**.
- However, ability to judge **muscle tension/weights** remains relatively preserved.

Unit 1 (Class 8)

Auditory Development | Auditory Perception | Intermodal Perception

1. Anatomy & Development of Auditory System

- **Inner Ear (Cochlea)** → Develops first; near adult form by **3rd prenatal month**.
- **External & Middle Ear** → Fully formed by **20 weeks (mid-fetal life)**.
- **By 2nd trimester** → Fetus can detect/respond to sound (heartbeat, mother's voice).

2. Importance of Auditory Cues in Skill Performance

- Initiating action → Start of sprint (gunshot).
- Timing → Hitting ball by sound.
- Environmental feedback → Crowd noise, coach's instructions.
- Group coordination → Drumming, marching.

3. Developmental Timeline of Abilities

- **Birth–1 yr** → Turns to sound, improves localization.
- **6–7 m** → Detects direction differences of 12–19°.
- **By 3 yrs** → Accurately locates distant sounds.

- **Adults** → Detects 2–7° difference in direction.
- **1–4 m** → Distinguish speech sounds (p, b).
- **3–5 yrs** → Accurate sound discrimination improves.
- **6–10 yrs** → Match & identify sounds (Temple & Birch).
- **8–13 yrs** → Continued refinement.

4. Aspects of Auditory Perception

- **Location** → Direction & distance.
- **Differences** → Pitch, loudness, speech.
- **Patterns** → Time, intensity, frequency-based.
- **Figure–Ground** → Focus on important sound, ignore background noise.

5. Intermodal Perception

Definition → Integration of information across multiple senses.

Types:

1. **Auditory–Visual** → Match sounds with visual cues (ball bounce + sound).
2. **Visual–Kinesthetic** → Match what is seen with what is felt.
 - Patterns: V–V, K–K, V–K, K–V.
3. **Auditory–Kinesthetic** → Coordinate heard sounds with felt movements.

- Temple et al. (1979) → *Witeba Test*; 8-year-olds > 6-year-olds.

4. **Spatial–Temporal** → Integrating space & time patterns.

- Example: Matching tone pauses with dot spacing.
- Sterritt, Martin & Rudnick (1971).

6. Developmental Insights

- **Infancy** → Basic sensory awareness, object tracking.
- **Toddlerhood** → Eye-hand coordination, exploration.
- **Early Childhood** → Fine motor + visual learning improve.
- **With age** → Intermodal coordination becomes more efficient.

Unit 1 (Class 9)

Constraints in Motor Development – Functional | Social | Psychological | Knowledge

Designed for PG TRB Physical Education, it highlights **exam-focused definitions and points**.

1. Functional Constraints

- **Definition** → Individual behavioral, psychological, or cognitive characteristics influencing motor development.
- **Examples:**
 - *Motivation* → eagerness to try.

- *Attention* → focus on task.
- *Fear/Anxiety* → reluctance to attempt.
- *Past Experiences* → prior learning aids new learning.
- *Confidence* → belief in ability.
- *Cognitive Development* → planning strategies.

- **Impact:**

- Positive → Enhances skill (e.g., high motivation → better practice).
- Negative → Hinders skill (e.g., fear → avoids activity).

- **Functional vs Structural:**

- Structural = physical traits (height, weight).
- Functional = emotional, cognitive traits (motivation, fear).

2. Social & Cultural Constraints

- **Definition** → External factors from environment, society, culture influencing motor development.
- **Examples:**
 - *Gender* → stereotypes of “masculine/feminine” sports.
 - *Race/Ethnicity* → access & attitudes.
 - *Religion* → dress codes, norms.
 - *Nationality* → traditional/national sports.
 - *Media* → promotes certain sports/body types.

- **Agents:** Family, peers, teachers, coaches.
- **Role:** Provide exposure, shape participation, may also reinforce biases.
- **Group Influence:** Family, school, cultural/national groups shape acceptable activities.

3. Psychological Constraints

- **Definition** → Emotional & cognitive states that influence willingness and ability in motor tasks.
- **Key Factors:**
 - *Self-Esteem* → one’s judgment of capability & worth.
 - High → persistence, participation.
 - Low → avoidance, quitting.
 - *Emotions* → pride/excitement (positive), fear/stress (negative).
 - *Perceived Ability* → belief in one’s skill = higher engagement.
 - *Motivation* → drives initiation & persistence.

4. Knowledge Constraints

- **Definition** → Effect of understanding, information, and prior learning on motor performance.
- **Examples:**

- Anticipating opponent's move in soccer.
- Recognizing basketball defense pattern.
- Preplanning responses in baseball.
- Organizing knowledge around tactical goals.
- **Expert Characteristics:** Faster reaction, better decisions, advanced problem-solving.
- **Lifespan Perspective:**
 - Children → small base, can become experts with practice.
 - Young Adults → fastest learning, adaptable strategies.
 - Older Adults → slower reaction, but compensate with experience/knowledge.

5. Interactions Between Constraints

- **Positive Example** → Supportive environment boosts self-esteem → encourages persistence.
 - **Negative Example** → Critical coach lowers confidence → child quits sport.
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***Write Down What You Usually Forget
For Last Minute Revision!***

UNIT - 2

Unit 2 (Class 1)

Basketball – History | Court & Equipment | Rules | Scoring | Officiating

1. History of Basketball

- Invented: **James Naismith, 1891, Springfield (USA).**
- **FIBA (International Federation):** 1932, Geneva.
- **Basketball Federation of India (BFI):** 1950.
- **First Indian National Championship:** 1934.
- **Olympics:** Demo sport – 1904, 1932; Official – 1936; Women – 1976.
- **Current FIBA President:** Sheikh Saud Ali Al Thani (2023–2027).
- **BFI President:** Aadhav Arjuna.

2. Court & Equipment Dimensions

- **Court:** 28m × 15m; Center circle radius: 1.80m; Three-point radius: 6.75m.
- **Board:** 1.80m × 1.05m; Height: 2.90m; Inner rectangle: 59 × 45 cm.
- **Ring:** Inside dia: 45 cm; Net length: 45 cm; 12 loops; 0.15m from board.
- **Ball:**
 - Men: 567–650 g, 74.9–78 cm dia.
 - Women: 510–567 g, 72.4–73.7 cm dia.

- Juniors: 470–500 g, 69–71 cm dia.

3. Players & Game Duration

- Team: **12 players** (5 on court + 7 substitutes).
- Chest numbers: 0, 00–99 (front: 10 cm, back: 20 cm).
- **Duration:** 4 quarters × 10 min.
- **Intervals:** 2 min (between quarters), 15 min (half-time).
- **Extra Time:** 5 min periods until tie is broken.
- **Timeouts:** 2 (1st half), 3 (2nd half, max 2 in last 2 min), 1 per extra time.

4. Scoring System

- **1 point** – Free throw.
- **2 points** – Field goal inside arc.
- **3 points** – Field goal beyond 3-point arc.

5. Violations & Fouls

- **3 seconds** → Player in restricted area too long.
- **5 seconds** → Closely guarded must pass/shoot/dribble.
- **8 seconds** → Ball must cross into frontcourt.
- **24 seconds** → Team must attempt field goal.

- **Fouls:**
 - 5 fouls → Player disqualified.
 - Double foul → Both opponents foul simultaneously.

6. Officiating & Signals

- **Officials:** 1 referee + 1–2 umpires.
- **Table Officials:** Scorer, assistant scorer, timer, 24-sec operator.
- **Commissioner:** Supervises officials.
- **Key Terms:** Jump ball, held ball, throw-in, screening, pivot, alternation possession.

7. Cups & Trophies (Basketball)

- Williams Cup
- Bangalore Blues Challenge Cup
- B.C. Gupta Trophy
- Todd Memorial Tournament

Unit 2 (Class 2)

Badminton – History | Court & Equipment | Rules | Scoring | Officiating

1. History of Badminton

- Ancient game **Battledore & Shuttlecock** → over 2000 years ago.
- Modern form “**Poon**” → India (1800s).

- British officers introduced it in **England** at Duke of Beaufort’s estate “**Badminton**” → name derived.
- **Commonwealth Games:** Introduced in 1966 (Jamaica).
- **Olympics:** Demo – 1972; Official – 1992 (Barcelona); Mixed doubles – 1996 (Atlanta).
- **BAI (India)** → est. 1934, HQ: New Delhi, Current President: **Dr. Himanta Biswa Sarma (2025)**.
- **BWF (World)** → est. 1934, HQ: Kuala Lumpur, Current President: **Poul-Erik Høyer Larsen**.

2. Court & Equipment

- **Court Dimensions:**
 - Singles: 13.40 × 5.18 m
 - Doubles: 13.40 × 6.10 m
 - Line thickness: 4 cm (white/yellow).
- **Net:** Length 6.10 m, Width 76 cm, Height 1.55 m (sides), 1.524 m (center).
- **Racket:** Max length 680 mm; Head 280 × 220 mm; Weight ~100 g.
- **Shuttle:** 16 feathers; Weight 4.74–5.50 g; Length 62–70 mm.

3. Game Format & Scoring

- **Singles, Doubles, Mixed Doubles.**

- **Match:** Best of 3 games.
 - **Game:** First to 21 points (win by 2; at 29–all, 30 wins).
 - **Intervals:** 60 sec (at 11 points); 120 sec (between games).
 - **Change of ends:** After each game; in deciding game, at 11 points.
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4. Rules & Violations

- Service diagonally across opponent's court.
 - **Faults:**
 - Delay of serve.
 - Feet on line/off ground.
 - Shuttle not struck at base.
 - Service above waist.
 - Racket handle facing up.
 - **Terminology:** Love-all, Deuce, Drop, Let, Fault.
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5. Officials

- **Referee** (overall in charge).
- **Umpire** – controls match.
- **Service Judge** – monitors service faults.
- **Line Judges** – 4 to 10 (short service, center line, side line, back boundary).

- **Cards:**
 - Yellow → Warning.
 - Red → Warning + point to opponent.
 - Black → Disqualification.
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6. Cups & Trophies

National

- Aggarwal Cup, Amrit Diwan Cup, Chaddha Cup, Harilela Cup, Konica Cup, Narang Cup, Sophia Cup, Thomas Cup (India level).

International

- **Thomas Cup** (Men's, since 1948).
 - **Uber Cup** (Women's, since 1956).
 - **Sudirman Cup** (Mixed, since 1989).
 - World Championships, Yonex Cup, Grand Prix, Bimantara Cup (Junior).
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7. Indian Players

- **Prakash Padukone**
- **Pullela Gopichand**
- **Aparna Popat**
- **Chetan Anand**
- **Saina Nehwal**

- **P. V. Sindhu**
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Unit 2 (Class 3)

Kho-Kho – History | Court & Equipment | Rules | Scoring | Officiating

1. History of Kho-Kho

- Origin: **India**; principle – “Active Chase” / “Game of Chase”.
 - First rules: **Deccan Gymkhana, Pune**.
 - **Akhil Maharashtra Sharirik Shikshan Mandal (1928)** popularized the game.
 - Included in **Inter Varsity Sports**: 1952.
 - **Kho-Kho Federation of India (KKFI)**: 1955; Current President – **Sudhanshu Mittal**.
 - First All India Championships: 1959–60 (Vijayawada).
 - **IKKF (International Kho-Kho Federation)**: 2018, HQ – Delhi.
 - **2025 Kho-Kho World Championships**: Delhi (India winner, Nepal runner).
-

2. Players & Officials

- Team: **12 players** (9 on field + 3 substitutes).
- **Substitutions**: Unlimited for chasers; only before entry for runners.
- **Jersey numbers**: 1–12 (20 cm back, 10 cm front).
- **Officials**: 1 Referee, 2 Umpires, 1 Timekeeper, 2 Scorers.

- **Cards**: Yellow = warning; Red = out + suspension.
-

3. Court & Equipment Dimensions

Senior (Men/Women/Junior)

- Length: 27 m; Breadth: 16 m.
- Distance between posts: 24 m.
- Post height: 120–125 cm; Diameter: 9–10 cm; Circumference: 28.25–31.4 cm.
- Center lane: 24 × 0.30 m; Cross lane: 16 × 0.35 m.
- Chaser block: 35 × 30 cm.
- Free zone: 1.5 m; Lobby: 30 × 1.5 m.

Sub-Junior

- Length: 23 m; Breadth: 14 m.
 - Distance between posts: 20 m.
 - Post to 1st cross lane: 2.15 m.
-

4. Duration of the Match

- **Two innings**; each with chasing & defending turns.
- Senior: $(9 + 3 + 9) \times 2 \rightarrow$ **48 minutes**.
- Sub-junior: $(7 + 3 + 7) \times 2 \rightarrow$ **39 minutes**.
- Rest: 3 min between innings; 5–6 min between turns.

5. Rules & Terms

- **Start/End:** Timekeeper whistle (on referee's signal).
 - **Tie** → Extra innings (9-3-9 min); if still tied → *Minimum chase method* (time to first out).
 - **Follow On** → If chasing side leads by 6–8 points, they can enforce follow-on; mandatory if lead > 8.
 - **Kho** → Touch + uttered word “KHO” before chasing.
 - **Fouls** → Crossing center line, improper “KHO”, early getting up, receding, shoulder foul, wrong direction.
-

6. Awards & Trophies

- **Ekalavya Award** (Men), **Jhansi Rani Laxmibai Award** (Women).
 - **Junior Nationals:** Boys (1970), Girls (1972).
 - **Veer Abhimanyu Award** (U-18 Boys), **Janaki Award** (U-16 Girls).
 - **Federation Cup** (Men & Women).
 - **Arjuna Awardees:** Shekhar Dharwadkar, Usha Nagarkar, Nilima Sarolkar, Achala Devare.
-

Unit 2 (Class 4)

Ball Badminton – History | Court & Equipment | Rules | Scoring | Officiating

1. History

- Origin: **India (Tanjore, Tamil Nadu, 1856)**; played by royal families.
 - **BBFI (Ball Badminton Federation of India)**: 1954, HQ – Mysore.
 - First Nationals: **1956, Hyderabad**.
 - Current BBFI President: **Nawal Kishore Yadav**.
-

2. Court & Equipment

- **Court:** 24 × 12 m (Five's), 24 × 6 m (Doubles).
 - **Lines:** 10 mm wide, white.
 - **Posts:** 2 m high; 1 m outside court; net fixed at 1.50 m hook.
 - **Net:** Tri-colored (red-white-blue), 1 m wide × 13.5 m length, mesh 2 cm.
 - Net height: 1.83 m (center), 1.85 m (sides).
 - **Racket:** Weight 200–250 g; Length 63–70 cm; Frame 20–22 cm (width), 24–27 cm (length).
 - **Ball:** Yellow wool; Weight 22–23 g; Diameter 5–5.5 cm.
-

3. Match Rules

- **Team:** 10 players (5 play + 5 substitutes).
- **Games:** Best of 3 (finals: best of 3 or 5).

- **Points:** Game up to 35 points (lead by 2).
 - At **38–38**, 39th point wins.
- **Court change:** After 9th, 18th, 27th point.
- **Intervals:** 2 min (G1–G2), 5 min (G2–G3).
- **Substitutions:** 3 per game.
- **Timeouts:** 1 per team per game (1 min).
- **No ball change** during match.

4. Discipline & Officiating

- **Warnings:**
 - Yellow card → Loss of 1 point.
 - Red card → Suspension.
- **Officials:** 1 umpire, 2+ line referees, 1 scorer.
- **Terminology:** Love-all, Drop, Tip, Clash, Fault, Double touch, Let.

5. Breaking Ties

- Based on games score; if tie persists → point score decides.

6. Awards & Recognition

- **Arjuna Awardees** in Ball Badminton:
 - J. Pitchyya (1970)

- J. Srinivasan (1972)
- A. Kareem (1973)
- L.A. Ibal (1975)
- Sam Christ Das (1976)
- D. Rajaraman (1984)

Unit 2 (Class 5)

Kabaddi – History | Court & Equipment | Rules | Scoring | Officiating

1. History

- Early rules → **Deccan Gymkhana (20th century)**.
- Forms: **Amar, Sanjeevani, Geminee**.
- Demonstrated at **1936 Berlin Olympics** by *Hanuman Vyayam Prasarak Mandal (Maharashtra)*.
- **All India Kabaddi Federation (1950)** → Standard rules.
- **Amateur Kabaddi Federation of India (AKFI, 1972)**.
- **IKF (International Kabaddi Federation, 2004)**.
- Included in **Asian Games: 1990 (Beijing)**.
- South India → *Chadugudu*; North India → *Kaunbada*; East India/Bangladesh → *Ha-do-do*; West India → *Hu-tu-tu*.

2. Achievements

- India won **Gold in Asian Games**: 1990 (Beijing), 1994 (Hiroshima), 1998 (Bangkok), 2002 (Busan), 2006 (Doha), 2010 (Guangzhou), 2014 (Incheon), 2018 (Jakarta), 2022/23 (Busan).
-

3. Court Dimensions

- **Men & Junior Boys** → 13 × 10 m; Lobby: 1 m; Bonus line: 1 m from midline.
 - **Women & Junior Girls** → 12 × 8 m.
 - **Sub-Junior Boys & Girls** → 11 × 8 m.
 - **Line thickness**: 3–5 cm.
 - **Sitting box**: 8 × 1 m.
-

4. Team Composition

- National: **10–12 players**.
 - International: **10–14 players**.
 - On court: **7 players** + substitutes (5).
-

5. Duration & Timeouts

- **Men**: 40 min (20+5+20).
 - **Women**: 30 min (15+5+15).
 - **Timeouts**: 2 per half (30 sec each).
-

6. Rules & Key Terms

- **Cant** → Continuous chanting of “Kabaddi” in one breath.
 - **Raider** → Enters opponent’s court with cant to tag.
 - **Anti-raider** → Defenders.
 - **Raid** → Act of raider entering opponent’s court.
 - **Pursuit** → Anti chasing raider into his court with cant.
 - **Bonus line** → Applicable if ≥6 players on court.
-

7. Scoring

- 1 point → Each opponent out.
 - **All Out** → 2 extra points.
 - **Bonus Point** → Crossing bonus line with cant.
 - Technical point → For fouls/violations.
-

8. Substitution

- 5 reserves; allowed during timeout/interval with referee’s permission.
 - Suspended/disqualified player → no substitution.
 - No substitution for “out” players.
-

9. Officials (6–8)

- 1 Referee, 2 Umpires, 1 Scorer, 2 Assistant Scorers, 2 Linemen.
 - Referee starts & ends match.
-

10. Cards & Discipline

- **Green** → Warning.
 - **Yellow** → 2 min suspension + technical point.
 - **Red** → Suspension for rest of match; no substitution allowed.
-

11. Symbols in Scoring

- Player point: “/”
 - All Out: “—”
 - Bonus point: “Δ”
 - Leading point: “□”
 - Technical point: “O”
 - Timeout: “T”
 - Super catch: “X”
-

12. Awards

- **Arjuna Awardees:** Ashan Kumar (1998), Biswajit Palit (1998), Balwinder Singh (1999), Tirath Raj Homonappa (2000), Ram Mehar Singh (2002), Sanjeev Kumar (2003), Sunder Singh (2004), Ramesh

Kumar (2005), Naveen Gautam (2006), Pankaj Navnath Shrisat (2008).

- **Dronacharya Awardees:** E. Prasad Rao (2002), Balwan Singh (2005), J. Uday Kumar (2009).
-

Unit 2 (Class 6)

Volleyball – History | Court & Equipment | Rules | Scoring | Officials | Awards

1. History

- Invented: **1895, William G. Morgan (USA)**; called *Mintonette*.
 - **FIVB:** 1947, Paris HQ Lausanne (President: Fabio Azevedo, 2024).
 - **VFI:** 1951, HQ Chennai (President: Prof. Achyuta Samanta).
 - **Asian Volleyball Confederation:** 1952.
 - **Olympics:** First included in **1964 Tokyo**.
 - **World League:** 1990.
 - **Beach Volleyball:** Olympic inclusion in 1996 (2-player).
-

2. Court & Equipment

- **Court:** 18 × 9 m; Free zone = 3 m (National), 5 m (sideline) & 8 m (end line) for FIVB.
- **Free playing space:** 7 m (National), 12.5 m (International).
- **Lines:** 5 cm, light color.

- **Attack line:** 3 m from center.
 - **Net height:** 2.43 m (Men), 2.24 m (Women).
 - **Posts:** 2.55 m height, 0.5–1 m outside sideline.
 - **Ball:** 65–67 cm circumference, 260–280 g, pressure 0.30–0.325 kg/cm².
 - **System:** 3-ball with 6 retrievers.
 - **Jersey numbers:** 1–18 (national), 1–20 (FIVB).
-

3. Players & Duration

- **Team:** 12 players (6 on court + 6 subs).
 - **Substitutions:** 6 per set.
 - **Timeouts:** 2 per team per set (30 sec).
 - **Technical Timeouts:** 2 per set (60 sec) at 8 & 16 pts (Sets 1–4 only).
 - **Sets:** Best of 5 (4 sets to 25 pts; 5th set to 15 pts; win by 2 pts).
 - **Intervals:** 3 min between sets; change courts after each set.
-

4. Zones & Areas

- **Front Zone:** Between center line & 3 m attack line.
- **Substitution Zone:** Extension of attack lines.
- **Service Zone:** 20 cm behind end line.
- **Warm-up Zone:** 3 × 3 m outside.

- **Penalty Area:** 1 × 1 m with chairs near end lines.
-

5. Officials

- 1st Referee, 2nd Referee, Scorer, 4 (or 2) Line Judges.
-

6. Sanctions

- **Warning:** Verbal/hand signal.
 - **Penalty:** Yellow card.
 - **Expulsion:** Red card.
 - **Disqualification:** Yellow + Red card.
-

7. Skills & Terms

- **Basic Skills:** Service, Passing, Setting, Spiking, Blocking, Digging.
 - **Common Terms:** Double fault, Double contact, Positional fault, Rotational fault, Ace.
-

8. Awards & Trophies

- **National:** Centennial Cup, Federation Cup, Indira Pradhan Trophy, Shivanthi Gold Cup.
- **Dronacharya Awardees (Volleyball):**
 - A. Ramana Rao (1990)
 - M. Shyam Sunder Rao (1995)

- G. E. Sridharan (2008)

Unit 2 (Class 7)

Football | Beach Volleyball

Football

1. History

- **FIFA:** Founded **1904**, HQ Zurich; President: **Gianni Infantino (2025)**.
- **AIFF (India):** 1937, HQ Delhi; President: **Kalyan Chaubey**.
- **Olympics:** Introduced 1908; dropped 1932, reintroduced 1936; Women's – 1996.
- **India:** IFA (1893, Bengal); 1956 Olympics – 4th place.

2. Field & Equipment

- **Field:** 100–110 m × 64–75 m (International).
- **Goal:** 7.32 m wide × 2.44 m high.
- **Ball:** Circumference 68–70 cm; Weight 410–450 g.

3. Players & Duration

- **11 players** + 5 subs (FIFA official = 3 subs; National A team = 6 subs).
- **Match:** 90 min (2 × 45 min) + stoppage; Extra time: 2 × 15 min.
- Min. 7 players required.

4. Key Rules

- **Offside** → No offside from goal kick, throw-in, corner.

- **Fouls & Misconduct** → Yellow card = warning; Red card = suspension (no sub).
- **Restarts** → Kick-off, throw-in, free kick, penalty, goal kick, corner.

5. Officials

- 1 Referee, 2 Assistant referees, 1 Fourth official, 2 Goal-line referees, 1 Reserved referee.

6. Trophies

- FIFA World Cup, Merdeka Cup, Durand Cup, Santosh Trophy, Subroto Cup, Rovers Cup, BC Roy Trophy, etc.

7. FIFA World Cup Winners (Recent)

- 2022 – Argentina
- 2018 – France
- 2014 – Germany
- 2010 – Spain

Beach Volleyball

1. History

- Origin: **1920, Santa Monica (USA)**.
- Included in **FIVB (1987)**.
- **Olympics:** Demo – 1992 (Barcelona); Official – 1996 (Atlanta).

2. Court & Equipment

- **Court:** 16 × 8 m; Free zone ≥ 3 m; Sand depth ≥ 40 cm.

- **Net height:** Men – 2.43 m; Women – 2.24 m.
- **Ball:** Circumference 66–68 cm; Weight 260–280 g; Bright colors.

3. Players & Duration

- **Team:** 2 players only; **No substitutions.**
- **Timeouts:** 1 per set (30 sec).
- **Change of sides:** After every 7 points (Sets 1–2), 5 points (Set 3).

4. Scoring System

- Best of **3 sets**.
- **Set 1 & 2** → 21 points (win by 2).
- **Set 3 (decider)** → 15 points (win by 2).

5. Officials

- 1st Referee, 2nd Referee, Scorer, 2–4 Line Judges.

6. Key Features

- **No center line.**
- Surface: fine sand, safe for players.
- Side bands + Antennae on net for marking.

Unit 2 (Class 8)

Hockey

History

- Origin: **England, 19th century.**

- **FIH** (International Hockey Federation): 1924, Lausanne; President – **Tayyab Ikram.**
- **IHF (India):** 1925; replaced by **Hockey India (2009)**; Current President – **Bhola Nath Singh.**
- **Olympics:** Men – 1908 (London); Women – 1980 (Moscow).
- **Asian Games:** Men – 1958; Women – 1982.
- **Dhyan Chand** → Padma Bhushan (1956); Birthday (29 Aug) = **National Sports Day.**
- India = **8 Olympic Golds** (most successful).

Field & Equipment

- Field: 91.4 × 55 m; Lines 7.5 cm.
- Shooting circle: 14.63 m radius.
- Penalty mark: 6.4 m from goal line.
- Goal: 3.66 m × 2.14 m.
- Ball: 156–163 g, 224–235 mm circumference.
- Stick: ≤ 737 g, ≤ 105 cm length.

Match Format

- Duration: 4 × 15 min quarters (International); 35–5–35 min (Juniors).
- Players: 11 + 5 subs (max 16–18 with 2 GKs).
- Substitution: Rolling allowed.

Rules & Cards

- Start: Push back (earlier Bully-off).
- Cards: Green (2 min), Yellow (≥5 min), Red (match suspension).
- Terms: Bully, Flick, Scoop, Drag-flick, Penalty corner, Penalty stroke.

Trophies

- Aga Khan Cup, Beighton Cup, Dhyan Chand Trophy, Murugappa Gold Cup, Ranjit Singh Gold Cup, Nehru Trophy, Lady Ratan Tata Trophy, Begum Rasul Trophy.

Officials

- Tournament Director, 2 Umpires, 1 Technical Official, Scorer, Penalty Timekeeper.

Table Tennis

History

- Invented: **England, late 19th century**; known as Ping-Pong.
- **ITTF**: 1926, Lausanne; President – **Petra Sörling (1st woman)**.
- **TTFI (India)**: 1926, HQ Delhi; President – **Meghna Ahlawat**.
- **Olympics**: Since 1988 (Seoul). Singles, doubles → later replaced by team events.

Table & Equipment

- Table: 2.74 × 1.525 m; Height: 76 cm.
- Net: 15.25 cm height, 1.82 m length.
- Ball: 40 mm, 2.7 g, white/orange.

- Racket: 85% wood, red/black rubbers, ≤ 2 mm covering.

Game Format

- Game = 11 points (win by 2).
- Match = Best of odd games (usually 5 or 7).
- Change of serve every 2 points (after 10–all → every 1 point).
- Expedite system → after 10 min play (receiver scores if rally ≥13 returns).

Rules & Terms

- Service: Ball tossed ≥16 cm vertically, struck after free fall.
- Timeout: 1 per match (1 min).
- Cards: Yellow, Red.
- Alternate names: Whiff-Waff, Gosima, Pin-Pong.

Playing Space

- 14 m long × 7 m wide × 5 m high (official tournaments).

Trophies

- Corbillon Cup (Women), Swaythling Cup (Men), St. Bride Vase, W.J. Pope Trophy, Heydusek Cup (Mixed), Travancore Cup (Women), Rajkumari Challenge Cup (Juniors).

Indian Players

- Kamlesh Mehta, Chetan Baboor, S. Raman, Sharath Kamal, Sathiyam Gnanasekaran.
-

Unit 2 (Class 9)

Tennis | Handball

Tennis

History

- Roots: French game *Jeu de Paume* (indoor).
- Modern rules: **Major Walter Wingfield, 1874.**
- **ILTF (1913)** → renamed **ITF (1977).**
- **AITA (India, 1920)** – HQ Delhi; President: **Dr. Anil Jain.**
- **Olympics:** 1896 Athens → dropped (1924), reintroduced (1988 Seoul).
- **Current ITF President:** David Haggerty.

Surfaces

- Cement, Grass, Clay, Sand, Astro Turf.

Grand Slams

- **Australian Open (1905)** – Hard.
- **French Open (1891)** – Clay.
- **Wimbledon (1877)** – Grass.
- **US Open (1881)** – Hard.
- Winners of all 4 in same year = *Grand Slam*.

Court & Equipment

- Singles: 23.77 × 8.23 m; Doubles: 23.77 × 10.97 m.

- Net: 0.914 m (center), 1.07 m (posts).
- Ball: 56–59.4 g, dia 6.54–6.86 cm.
- Racket: ≤ 73.7 cm length, ≤ 31.7 cm width.

Scoring

- **Points:** Love → 15 → 30 → 40 → Game.
- **Deuce** → Win 2 consecutive points.
- **Set:** 6 games (lead by 2).
- **Match:** Men – best of 5 sets; Women – best of 3.
- Tie-break at 6–6 → first to 7 (win by 2).

Key Terms

- Ace, Deuce, Double Fault, Let, Drop, Advantage.

Trophies

- Davis Cup, Fed Cup, Hopman Cup, Wimbledon, US Open, French Open, Australian Open.

Handball

History

- Origin: **Germany (1936)** as 11-player outdoor.
- 1972 → 7-player indoor game.
- **IHF (1946)** – HQ Basel; President: **Dr. Hassan Mustafa.**

- **Handball Federation of India (HFI, 1971)** – HQ Indore; President: **Digvijay Chautala**.

Court Dimensions

- Court: 40 × 20 m; safety zone: 1–2 m.
- Goal area: 6 m from goal line (D-zone).
- Free throw line: 9 m; Penalty mark: 7 m.
- Goal: 3 × 2 m.
- Substitution zone: 9 m (either side of center).

Ball

- Men: 425–475 g; 58–60 cm circumference.
- Women: 325–375 g; 54–56 cm.
- Juniors: 290–330 g; 50–52 cm.

Team & Duration

- Team: 14 (7 play + 7 subs).
- Match: 60 min (30+10+30); Juniors 50 min; Sub-juniors 40 min.
- At least 5 players required to start.

Rules & Play

- Start: Throw-off.
- Steps: Max 3 steps without dribble.
- Fouls: Pushing, tripping, double dribble.
- Overtime: 2 × 5 min; if tie persists → penalty throws.

Officials

- 2 Referees, Timekeeper, Scorer.

Cards

- Green → Warning.
- Yellow → Suspension (2 min).
- Red → Disqualification (no sub).

Trophies

- Challenge Trophy, National Championships.

Unit 2 (Class 10)

Throwball | Silambam

Throwball

History

- Origin: Derived from a recreational game in **England & Australia (1930s)**.
- Introduced in India: YMCA, Chennai (1940s).
- Rules drafted: **1955 – Harry Crowe Buck, YMCA College of PE.**
- Federation: **TFI (1985)**, HQ New Delhi; President – **Dr. S.S.K.S. Reddy**.

Court & Equipment

- Court: 18.30 × 12.20 m (Seniors); 15.30 × 9.20 m (Sub-juniors).

- Free zone: 3 m.
- Neutral box: 1 m on either side of center.
- Net: 12.2 m × 1 m; Height – 2.30 m (Men/Women), 2.10 m (Juniors), 2.0 m (Sub-juniors).
- Antenna: 1.80 m (projects 80 cm above net).
- Ball: 400–450 g; Circumference: 70–72 cm.

Team & Duration

- Team: 14 players (9 play, 5 subs).
- Match: Best of 5 sets; 15 points each.
- Court change: After each set; deciding set after 8 points.
- Timeouts: 2 per set (30 sec).

Rules

- Service: Within 5 sec, from service zone, no jumping.
- Ball: Must be caught cleanly with both hands (no dubs, no shifting).
- Throw: Within 3 sec, above shoulder, one hand; may jump while throwing.
- No simultaneous catch by 2 players.
- Ball may touch net but not antenna.

Officials

- 6 officials → 1 Referee, 1 Umpire, 2 Linemen, 1 Scorer, 1 Assistant scorer.

Terminology

- Shifting, Body touch, Clash, Shooting, Zig-ling.

Silambam

History & Significance

- Origin: **Tamil Nadu, 2000+ years ago**; mentioned in Sangam literature (300 BCE).
- Weapon: **Silambam stick** (bamboo staff).
- Cultural role: Used in warfare, self-defense, festivals.
- Revival: Recognized as a sport in the 20th century; taught in schools & training centers.
- Symbol of **Tamil martial tradition & heritage**.

Measurements

- Stick length: 5–7 feet (based on practitioner's height).
- Grip: One-third from bottom → better control.
- Stance: Shoulder-width for balance.

Techniques

- **Footwork**: 3–5 ft movement drills.
- **Target areas**: Head, shoulders, legs.
- **Strikes & blocks**: Speed, agility, precision.

Styles

- **Silambam** → Staff combat.

- **Kuthu Varisai** → Basic footwork & stances.
- **Adimurai** → Hand-to-hand combat basics.
- **Muthirai** → Patterns of strikes/blocks.
- **Kali** → Sparring practice.
- **Varmam** → Targeting vital points.
- **Puli Varisai** → Emphasis on agility & speed.
- **Kuthu, Vazhi, Thodakkam, Kuthirai, Puthu, Kavadi** → Variations in strikes, guards, movements.

Competition Weight Categories

- **Boys (U-14, U-17, U-19)** → Below 30 kg up to 70+ kg.
- **Girls (U-14, U-17, U-19)** → Below 30 kg up to 70+ kg.

Unit 2 (Class 11)

Boxing – History | Dimensions | Rules | Scoring | Officiating | Skills

1. History

- Known as **Pugilism / Prizefighting**.
- **Marquess of Queensberry Rules** → basis of modern boxing.
- Accepted as **Olympic sport in 688 BC** (ancient Greece).
- **Modern boxing** → Great Britain & Germany.
- **Amateur Boxing Federation (FIBA)**: 1920 → dissolved in 1946 → replaced by **AIBA/IBA**.
- **IBA HQ**: Lausanne, Switzerland; President: **Umar Kremlev (2020–)**.

- **Olympics**: Introduced 1904 (St. Louis), not held in 1912.
- **Women's boxing**: Introduced in **2012 London Olympics**.
- **India**: BFI founded 1949, HQ New Delhi; President: **Ajay Singh**.
- Famous Indian boxers: **Mary Kom, Vijender Singh, Amit Panghal**.

2. Ring & Equipment

- **Ring**: 6.10 m square; height = 100 cm from ground.
- **Platform**: 5.82–7.80 m square.
- **Corner pads**: Red, Blue, White (two).
- **Ropes**: 4 ropes; heights = 40.6 cm, 71.1 cm, 101.6 cm, 132.1 cm.
- **Gloves**: 284 g (10 oz), leather ≤ ½ weight.
- **Steps**: 3 sets (boxers, officials, doctors).

3. Weight Categories

Elite Men & Youth Boys

- Light Fly: 46–49 kg
- Fly: 49–52 kg
- Bantam: 52–56 kg
- Light: 56–60 kg
- Light Welter: 60–64 kg
- Welter: 64–69 kg

- Middle: 69–75 kg
- Light Heavy: 75–81 kg
- Heavy: 81–91 kg
- Super Heavy: 91+ kg

Elite Women & Youth Girls

- Light Fly: 45–48 kg
- Fly: 48–51 kg
- Bantam: 51–54 kg
- Feather: 54–57 kg
- Light: 57–60 kg
- Light Welter: 60–64 kg
- Welter: 64–69 kg
- Middle: 69–75 kg
- Light Heavy: 75–81 kg
- Heavy: 81+ kg

4. Duration & Rounds

- **Elite Men/Youth Boys:** 3 rounds × 3 min.
- **Elite Women/Youth Girls:** 4 rounds × 2 min.
- **Juniors:** 3 rounds × 2 min.
- Rest: 1 min between rounds .

5. Officials

- **Referee** → inside ring, enforces rules.
- **Judges (3)** → score bout ringside.
- **Timekeeper** → manages rounds/time.
- **Doctor** → ringside safety.
- **Match Supervisor** → oversees event.
- **Total:** ~6–8 officials per match .

6. Defensive Skills

- **Head Movement** → slipping, bobbing, weaving, rolling.
- **Footwork** → lateral movement, pivoting, balance.
- **Blocking** → gloves/arms shield.
- **Parrying** → deflect punches with quick hand.
- **Reading Opponent** → anticipate moves.
- **Distance Management** → stay out of range.
- **Stay Relaxed** → reduces tension, increases reaction .

7. Offensive Skills

- **Jab** → quick straight punch; controls distance.
- **Cross** → powerful rear-hand punch.

- **Hook** → circular punch at head/body.
- **Uppercut** → upward punch to chin.
- **Combinations** → mix punches in succession.
- **Feints** → fake moves to create openings.
- **Counterpunching** → respond after evasion.
- **Angles** → attack from side positions.
- **Conditioning** → stamina & power .

Unit 2 (Class 12)

Fencing | Gymnastics

Fencing

History

- Olympic sport since **1896**.
- **FIE (International Fencing Federation)** – 1913; President: **Emmanuella Moreau**.
- **FAI (Fencing Association of India)** – 1974; President: **Rajesh Bhandari**.
- Weapons: **Foil, Épée, Sabre**.

Weapons & Target Areas

- **Foil** – Thrusting weapon; valid: torso only. Right of way rule applies.
- **Épée** – Heavy thrusting; valid: whole body. Simultaneous hits allowed.

- **Sabre** – Cutting & thrusting; valid: waist up (except hands).

Dimensions & Play

- Piste: 14 × 2 m; 2 m hash-mark warning zones.
- Team: 4 men + 4 women in each weapon (total 24).
- Match: 5 points (prelims), 15 points (eliminations); 3 × 3 min periods.

Categories

- Cadet (≤17 yrs), Junior (≤20 yrs), Senior (>30 yrs), Veterans (>40 yrs).

Officials

- Referee (Director of Bout), Judges, Timekeeper, Scoring officials, Technical Delegate.

Key Terms

- **Right of Way, Off-target, Double touch, Touche** (valid hit).

Gymnastics

History & Bodies

- **FIG (Fédération Internationale de Gymnastique)** – Founded 1881, oldest sport body; HQ Lausanne; President: **Morinari Watanabe**.
- **GFI (Gymnastics Federation of India)** – 1951; President: **Bachendri Pal**.
- First Indian Olympians: **Khushi Ram, Veer Singh (1952 Helsinki)**.

- First Indian international medal: **Ashish Kumar – 2010 CWG (Bronze, Floor)**.
- **Dipa Karmakar** – 2016 Rio Olympian.

Disciplines

1. **Artistic Gymnastics** (MAG – Men, WAG – Women).
2. **Rhythmic Gymnastics (RG)**.
3. **Aerobic Gymnastics (AER)**.
4. **Acrobatic Gymnastics (ACRO)**.
5. **Trampolining (TRA)**.

Men's Events

- Floor (12×12 m, 70 sec routine).
- Pommel Horse (1.15 m high).
- Rings (2.75 m high).
- Vault (135 cm table).
- Parallel Bars (1.95 m high).
- Horizontal Bar (2.75 m high).

Women's Events

- Vault (125 cm).
- Uneven Bars (170–250 cm).
- Balance Beam (5 m long, 10 cm wide, 125 cm high).
- Floor Exercise (12 × 12 m with music).

Rhythmic Gymnastics

- Rope, Ball, Hoop, Clubs, Ribbon (individual & groups).

Scoring

- **D-score (Difficulty), E-score (Execution), A-score (Artistry), S-score (Synchro), T (Time of flight)**.

Officials

- Judges (Difficulty & Execution), Chief Judge, Technical controllers, Scorekeepers, Meet Referee.

Unit 2 (Class 13)

Swimming – History | Dimensions | Rules | Scoring | Officiating | Events

1. History & Governing Bodies

- **FINA (Fédération Internationale de Natation)** – 1908, HQ Lausanne; President: **Hussain Al Mussalam**.
- Disciplines: Swimming, Diving, Water Polo, Artistic Swimming, Open Water.
- **SFI (Swimming Federation of India)** – 1948, HQ Ahmedabad; President: **R.N. Jeyaprakash**.
- **Olympics**: Introduced 1896; Women included 1912.
- First Olympic champion: **Alfred Hajos (Hungary)**.
- Diving added: **1904 Olympics**.

2. Swimming Pool Dimensions

- Standard: **50 m × 25 m**, depth: **≥2 m**.
 - Lanes: 8 (World Championships), 10 (Olympics).
 - Lane width: 2.5 m; Extra spaces outside lanes 1 & 8.
 - Starting block: Height 50–75 cm; Size 50 × 50 cm.
-

3. Categories & Events

- **Men:** Freestyle (50, 100, 200, 400, 1500 m); Backstroke, Breaststroke, Butterfly (100, 200 m each); IM (200, 400 m); Relays – 4×100 m, 4×200 m Freestyle, 4×100 m Medley.
 - **Women:** Same as men but Freestyle includes 800 m (instead of 1500 m).
 - **Medley:**
 - Individual order → Butterfly → Backstroke → Breaststroke → Freestyle.
 - Relay order → Backstroke → Breaststroke → Butterfly → Freestyle.
-

4. Rules of Start & Stroke

- **Freestyle** → Any style except backstroke, breaststroke, butterfly; must touch wall at turns.
- **Backstroke & Medley relay** → Start from water.
- Submergence allowed only up to **15 m** after start/turn.

5. Officials in Competition

- Referee (1)
 - Control-room supervisor (1)
 - Starters (2)
 - Judges of stroke (4)
 - Chief inspectors of turns (2) + Inspectors at each lane
 - Chief recorder (1), Clerks of course (2)
 - False start rope personnel (1)
 - Announcer (1)
-

6. Open Water Swimming

- Distances: **5 km, 10 km (marathon), 25 km**.
 - Conditions: Min depth 1.4 m, water temp $\geq 16^{\circ}\text{C}$.
 - Must be approved by local health & safety authority.
-

7. Types of Swimming Pools

- **In-ground pools** (Concrete, Fiberglass, Vinyl liner).
- **Above-ground pools** (Steel frame, Inflatable, Resin).
- **Special pools:** Lap pools, Infinity pools, Plunge pools, Spool (Spa+Pool), Eco/Natural pools, Roman/Grecian, Solar-powered.

8. Water Supply Methods

- Freshwater, Saltwater, Natural eco pools, Recycled/reclaimed water, Rainwater, Seawater, Chlorinated pools.
- **pH balance:** Ideal 7.2–7.6.

9. Skills & Strokes

- **Four main strokes** → Freestyle, Backstroke, Breaststroke, Butterfly.
- **Medley** → Combination of all four.
- Relay: 4 swimmers, timed to 1/100 sec.

10. Records & Famous Swimmers

- **Michael Phelps** (USA) → 28 Olympic medals (23 Gold, 3 Silver, 2 Bronze).
- Multiple World & Olympic records in Butterfly, Medley, Freestyle relays.

Unit 2 (Class 14)

Tennikoit | Judo

Tennikoit

History & Governing Bodies

- Also called **Ring Tennis, Deck Tennis**.
- Played **indoor & outdoor**, singles, doubles, mixed doubles.

- **TKFI (1965, India)** – President: **Rajeev Sharma**.
- **World Tennikoit Federation (2004)** – HQ Germany.

Court & Equipment

- Court: **12.2 × 5.5 m**.
- Net: **1.80 m (seniors), 1.67 m (sub-juniors)**.
- Ring (koit): **198–226 g**, Inside dia: 10 cm, Outside dia: 16 cm, Thickness: 3 cm.
- Posts: 1.9 m; Distance from sideline = 45 cm.

Match Format

- Best of **3 sets**; 21 points each (win by 2).
- At 20–20 → first to 22 wins.
- Decider (3rd set) → 11 points with court change.
- Timeout: 30 sec per set; Rest: 2–3 min.

Rules

- Singles & doubles allowed.
- No substitutions in singles.
- **Foul strokes (14)**: wobbling, shaking, throwing, carrying, body touch, pressing, stepping, jumping etc..

Officials & Cards

- Officials: 1 Referee, 1 Assistant, 1 Scorer, 2–4 Linemen.
- Cards: Yellow = warning; Red = point + service to opponent; Yellow+Red = suspension.

Judo

History & Governing Bodies

- Origin: From **Ju-jitsu**, founded as Judo in **1882 by Jigoro Kano** (Tokyo, Japan).
- Olympic inclusion: **1964 Tokyo (Men), 1992 Barcelona (Women)**.
- **IJF (1951)** – HQ Budapest, President: **Marius Vizer**.
- **JFI (1965, India)** – HQ Delhi, President: **Pankaj Naqvi**.

Area & Dimensions

- Contest area: **8–10 m square**.
- Danger zone: **1 m wide (red)**.
- Safety area: **≥3 m all around**.
- Surface: **Tatami mats** (soft).

Match Rules

- Start = **Hajime**, Stop = **Mate**.
- Duration: Men – 5 min, Women – 4 min.
- Golden Score → sudden death overtime.

Scoring System

- **Ippon** – perfect throw, 20+ sec pin, or submission = win.
- **Waza-ari** – half point; two waza-ari = Ippon.
- **Yuko** – old, no longer used.

- **Penalties:** Shido = minor, Hansoku-make = disqualification.

Weight Categories

- Men: Extra light (≤60 kg) → Heavyweight (>100 kg).
- Women: Extra light (≤48 kg) → Heavyweight (>78 kg).
- School (U-14, U-17, U-19) categories also exist.

Fundamental Skills

- **Ukemi** (break fall)
- **Shizen-tai** (stance)
- **Kumi-kata** (grip)
- **Kuzushi–Tsukuri–Kake** (breaking balance, positioning, execution).
- **Osaekomi** (pinning), **Kansetsu-waza** (joint locks), **Shime-waza** (chokes).

Officials

- Referee (Shushin), Judges (Fukushin), Mat Chairman, Timekeeper, Scorer, Recorder, Medical staff.

Unit 2 (Class 15)

Taekwondo – History | Dimensions | Rules | Scoring | Officiating | Belts

1. History & Governing Bodies

- **Meaning:** *Way of the Foot and Fist*.
- Olympic debut: **1988 Seoul Games**.

- **ITF (1966, Vienna)** – Founder: Gen. **Choi Hong Hi**; President: Choi Jung Hwa.
- **WTF (1973, Seoul)** → renamed **World Taekwondo (WT)**; President: **Choue Chung Won**.
- **Taekwondo Federation of India (2019, Mumbai)** – President: **Namdev Shirgaonkar**.

2. Forms & Terminology

- **Forms:**
 - *Kyorugi* – Sparring.
 - *Poomsae* – Patterns.
- **Key Korean terms:**
 - *Charyeot* – Attention.
 - *Kyongrye* – Bow.
 - *Shijak* – Start.
 - *Kalyeo* – Stop.
 - *Haizo* – Restart.
 - *Gam-jeom* – Penalty.
 - *Ap Chagi* – Front kick; *Dollyo Chagi* – Roundhouse; *Yop Chagi* – Side kick; *Chirugi* – Punch.

3. Competition Area & Equipment

- **Arena:** Octagonal mat, 8 m diameter.
- **Uniform & Safety:** White uniform, trunk & head protector, shin/forearm guards, gloves, sensing socks, mouth guard, groin guard (men).
- **Olympic Sparring Zone:** Center referee (R), Corner judges (J1–J3), Coaches, Doctors, Technical delegate, IVR jury.

4. Basic Rules

- Bow to referee & opponent before match.
- Match: **3 rounds × 2 min** (1 min rest).
- Victory: Points, Knockout, Point Gap (12 points lead), Golden Point (sudden death), or by referee decision.

5. Scoring System

- **1 pt** – Punch to trunk.
- **2 pts** – Kick to trunk.
- **3 pts** – Kick to head.
- **4 pts** – Turning kick to trunk.
- **5 pts** – Turning kick to head.
- **+1 pt** – Opponent's penalty (*Gam-jeom*).

6. Penalties (Gam-jeom)

- Punch to face, below waist kicks.
 - Knee/head attack.
 - Leg blocking opponent's kick.
 - Pushing, grabbing.
 - Crossing boundary, falling, delaying.
 - Attacking fallen opponent.
 - Unsportsmanlike conduct.
-

7. Knockdown & Golden Point

- Knockdown → any body part except feet touches ground due to attack, or inability to continue.
 - Golden Point Round → sudden death, first valid score wins.
 - Point Gap → 12-point lead ends bout.
 - Referee Stops Contest (RSC), Withdrawal, Disqualification (DSQ), Punitive declaration (PUN), Doping/cheating (DQB).
-

8. Belt System

- **Grades (Gup):** White (10th) → Yellow → Green → Blue → Red → Black border (1st Gup).
 - **Black Belt (Dan):** 1st to 9th level.
 - **Beginners** start with White; **Experts** hold Black (Dan).
-

***Write Down What You Usually Forget
For Last Minute Revision!***

UNIT - 3

Unit 3 (Class 1)

Athletics – Governing Bodies | Events | Rules | Combined Events

1. Governing Bodies

- **AFI (India)**→ 1946; 1st President: G.D. Sondhi; Current: **Adille J. Sumariwalla (2012 – till date)** .
- **IAAF (1912, Stockholm)**→ Now **World Athletics (2019)**; Current President: **Sebastian Coe** .
- **AAA (Asia)**→ 1973, HQ Thailand; Current President: **Dahlan Jumaan Al-Hamad** .
- **IOA (India)**→ 1927; Current President: **P.T. Usha (2022–)** .
- **OCA (Olympic Council of Asia)**→ 1982, HQ Kuwait; Current President: **Raja Randir Singh (2023–)** .
- **IOC**→ 1894, HQ Lausanne; Current President: **christy koverty** .

2. Athletics Events

- **Track & Field:**
 - **Track (Runs)**→ Sprint, Middle Distance, Relays, Hurdles.
 - **Field (Jumps)**→ High Jump, Long Jump, Triple Jump, Pole Vault.
 - **Field (Throws)**→ Shot Put, Discus, Javelin, Hammer.

- **Other Events:** Road Running, Race Walking, Cross-country, Mountain & Trail Running .

3. Standard Track

- 400 m lap; 2 straights (84.39 m) + 2 curves (36.80 m radius).
- Lane width: 1.22 m ± 1 cm; Line width: 5 cm.
- Minimum **8 lanes**; Kerb height 5–6.5 cm.
- Run-out area: 17 m; Assembly: 3 m .

4. Starts & False Starts

- Commands:
 - Up to 400 m → “On your marks – Set – Gun”.
 - Over 400 m → “On your marks – Gun”.
- False start: Reaction < 0.100 sec → Disqualification (red/black card).
- Combined events → first false start = yellow/black warning .

5. Wind Measurement

- Used in **sprints, hurdles, long & triple jumps**.
- Limit: ≤2 m/s for record validity.
- Placement: 50 m from finish line, 1.22 m high .

6. Timing Systems

- **Hand timing:** 1/10 sec accuracy.
 - **Automatic (photo-finish):** 1/1000 sec → rounded to 1/100 sec.
 - Road races: **Transponder (chip system)** .
-

7. Combined Events

- **Pentathlon (Men)**→ Long Jump, Javelin, 200m, Discus, 1500m.
- **Decathlon (Men)**→ Day 1: 100m, LJ, SP, HJ, 400m; Day 2: 110mH, Discus, PV, JT, 1500m.
- **Decathlon (Women)**→ Day 1: 100m, Discus, PV, JT, 400m; Day 2: 100mH, LJ, SP, HJ, 1500m.
- **Heptathlon (Women)**→ Day 1: 100mH, HJ, SP, 200m; Day 2: LJ, JT, 800m.
- **Octathlon (Boys Youth)**→ Day 1: 100m, LJ, SP, 400m; Day 2: 110mH, HJ, JT, 1000m .

Tie-breaking in Combined Events

- Highest total points = winner.
 - If tied → greater points in more events → then higher score in individual events .
-

Unit 3 (Class 2)

Track & Field Events – Standard Track | Sprint | Relays | Hurdles | Steeplechase | Combined Events | Race Walking | Road & Cross-Country

1. Standard Track

- **400 m track**, 8 lanes (width $1.22 \text{ m} \pm 1 \text{ cm}$).
- Direction: North–South.
- **Curves:** Radius = 36.485 m; Straight = 84.39 m.
- Kerb: 0.05–0.065 m height; Width: 0.05–0.25 m.
- Mid area = Football field ($68 \times 105 \text{ m}$); cages for discus/hammer.
- All races → common finish point.

Stagger Start

- Used to equalize distances on curves.
 - Formula:
 - Half stagger = $W(N-1) - 0.10\pi$
 - Full stagger = $W(N-1) - 0.10 \times 2\pi$
 - $1\frac{1}{2}$ stagger = $W(N-1) - 0.10 \times 3\pi$.
-

2. Sprint Events

- Distances: **100 m, 200 m, 400 m.**
- Starting blocks compulsory ($\leq 400 \text{ m}$).

- Commands: *On your marks – Set – Gun.*
- Finish: Torso must cross finish line.

3. Relay Races

- Distances: **4×100 m, 4×400 m, 4×1500 m.**
- Baton: 28–30 cm, 40 mm diameter, ≥50 g.
- Takeover zone = **20 m in 4×400m relay** (center line = scratch).
- Acceleration zone = 10 m.
- Dropping baton = not disqualified if retrieved at same spot.
- **4×100 m**→ full lane; **4×400 m**→ break line after 1st curve.

4. Hurdles

- **Men (110 m, 400 m); Women (100 m, 400 m).**
- 10 hurdles per race.
- Spacing:
 - 110 m → Start to 1st hurdle = 13.72 m; Between = 9.14 m; Last to finish = 14.02 m.
 - 100 m (W) → 13 m; 8.5 m; 10.5 m.
- Height:
 - Men 110 m = 1.067 m; Women 100 m = 0.838 m.
- Intentional knockdown = disqualification.

5. Steeplechase

- Distances: **2000 m, 3000 m.**
- **3000 m**→ 28 hurdle jumps + 7 water jumps.
- **2000 m**→ 18 hurdles + 5 water jumps.
- Water jump pit: 3.66×3.66 m, depth 70 cm near hurdle.
- Hurdle height: Men = 0.914 m; Women = 0.762 m.

6. Combined Events

- **Pentathlon (Men)**→ LJ, JT, 200 m, DT, 1500 m.
- **Decathlon (Men)**→ 100 m, LJ, SP, HJ, 400 m, 110 mH, DT, PV, JT, 1500 m.
- **Decathlon (Women)**→ 100 m, DT, PV, JT, 400 m, 100 mH, LJ, SP, HJ, 1500 m.
- **Heptathlon (Women)**→ 100 mH, HJ, SP, 200 m, LJ, JT, 800 m.
- **Octathlon (Boys)**→ 100 m, LJ, SP, 400 m, 110 mH, HJ, JT, 1000 m.

7. Race Walking

- Defined: Continuous ground contact; lead leg straight till upright position.
- Olympic inclusion: Men (1908), Women (1992).

- Distances: Men – 20 km & 50 km; Women – 20 km.
- **marathon walk- 42.195 km,**
- Judges: 6–9 (road), 6 (track).
- **Caution:** Yellow paddle; **Disqualification:** 3 red cards.

8. Road & Cross-Country Races

- **Road races:** 10 km, 15 km, 20 km, Half marathon, Marathon (42.195 km), 100 km, Relays.
- **Cross-country:** Men 12 km, Women 8 km, Junior Men 8 km, Junior Women 6 km, Boys 6 km, Girls 4 km.
- **IAAF cross country-10km men and women**
- Refreshments: Every 2–3 km (≤ 10 km races); Every 5 km (> 10 km races).

Unit 3 (Class 3)

Throws – Shot Put | Discus | Javelin | Hammer

Shot Put

- **Circle:** 2.135 m diameter; rim white, 20 mm height.
- **Stop Board:** 1.21 m long, 10 cm high (wood).
- **Sector:** 34.92° ; landing marked with 5 cm lines.
- **Weight:** Men – 7.26 kg (110–130 mm); Women – 4 kg (95–110 mm).

- **Rules:** Put from shoulder with one hand, no cartwheel, exit behind circle.
- **Officials:** 9 (chief judge, tape, recorder, time, scoreboard, etc.).

Discus Throw

- **Circle:** 2.50 m diameter.
- **Sector:** 34.92° , length 80 m, width 48 m.
- **Discus Weight:** Men – 2 kg (219–221 mm); Women – 1 kg (180–182 mm).
- **Cage:** U-shaped, 6 m mouth, ≥ 4 m height min, **6m maximum in front.**
- **Technique:** Twisting & turning for release.
- **Officials:** 14 (circle judge, flag judges, recorder, EDM, etc.).

Javelin Throw

- **Runway:** 30–36.5 m, width 4 m.
- **Arc Line:** 7 cm wide; sector angle 28.96° .
- **Weight:** Men – 800 g (2.6–2.7 m long); Women – 600 g (2.2–2.3 m long).
- **Head:** Metal, 25–33 cm; Center of gravity ~ 0.9 –1.06 m from tip.
- **Rules:** Throw from behind arc, over shoulder, non-orthodox styles not allowed.

- **Officials:** 13 (chief judge, foul judge, EDM, recorder, scoreboard, athletes in-charge).

Hammer Throw

- **Circle:** Same as shot put – 2.135 m diameter.
- **Hammer:** Metal head + wire (≥ 3 mm) + rigid handle.
- **Weight:** Men – 7.26 kg (length 1.215 m); Women – 4 kg (1.195 m).
- **Sector:** 34.92° .
- **Cage:** U-shaped, 6 m mouth, ≥ 10 m net panels, danger sector $\approx 53^\circ$.
- **Officials:** Similar to discus (safety emphasized).

Unit 3 (Class 4)

Jumps – Long Jump | Triple Jump | High Jump | Pole Vault

Long Jump (LJ)

- Runway: 40–45 m; Width $1.22 \text{ m} \pm 0.01 \text{ m}$.
- Landing pit: 8–10 m long; 2.75–3 m wide; sand depth ≥ 30 cm.
- Take-off board: 1.22 m long $\times$ 20 cm wide $\times$ 10 cm deep, white in color.
- Plasticine indicator board: Width 10 cm; Height 7 mm; placed 30 cm from take-off line.

- Distance: From take-off line $\rightarrow$ nearest break in sand.
- Wind limit: 2 m/s for record validity .

Triple Jump (TJ)

- Runway: Same as LJ (40 m min).
- Sequence: **Hop** $\rightarrow$ **Step** $\rightarrow$ **Jump** (must land alternately).
- Pit dimensions: Same as LJ.
- Take-off distances: Men 13 m; Women 11 m from landing area.
- Wind measurement: 35 m from take-off line in 5 sec count.

High Jump (HJ)

- Runway: 15–20 m (International: 25 m).
- Uprights: Distance = 4.00–4.04 m.
- Crossbar: Length 4.0 m (± 2 cm); Diameter 30 mm (± 1 mm); Weight ≤ 2 kg.
- Supports: Flat, 60×40 mm; 1 cm space between bar and uprights.
- Landing mat: Min 5×3 m; International 6×4 m; Height 70 cm.
- Rule: 3 consecutive failures $\rightarrow$ disqualified.
- Tie-break: Fewest attempts at last cleared height $\rightarrow$ then total failures $\rightarrow$ Jump-off (bar raised/lowered 2 cm).

Pole Vault (PV)

- Runway: 40 m (International: 45 m); Width 1.22 m.
- Vaulting box: 1 m long × 60 cm wide × 15 cm bottom width; Angle = 105°.
- Uprights: Distance between pegs = 4.28–4.37 m; Peg diameter ≤13 mm.
- Crossbar: Length 4.5 m (±0.02 m); Weight ≤2.25 kg.
- Landing mat: 5×5 m (min), International 6×6 m; Height 80 cm.
- Sag: ≤3 cm (30 mm) allowed.
- Tie-break: Bar raised/lowered 5 cm in jump-off.

General Rules for Jumps

- Starting height & increments announced by Chief Judge.
- Bar must be raised ≥2 cm (HJ) or ≥5 cm (PV).
- Measurement: From take-off line (LJ/TJ) or perpendicular to ground from bar center (HJ/PV).
- Wind measurement: ≤2 m/s valid for records.
- Time limit per attempt: 30–60 sec depending on competitors.

Unit 3 (Class 5)

Chess – History | Board & Pieces | Rules | Scoring | Officials | GK

1. History & Governing Bodies

- **FIDE (World Chess Federation)** – Founded **1924, Paris**; Motto: *Gens unasumus* (“We are one people”).
- **AICF (All India Chess Federation)** – Founded **1951**.
- 2022 → 44th Chess Olympiad hosted in **Chennai**.
- 2024 → **45th Olympiad, Budapest** – India won Gold (Men & Women).
- 2024 World Chess Championship (Singapore) → **D. Gukesh (India, 18 yrs)** defeated **Ding Liren**.

2. Chessboard & Pieces

- **Board:** 64 squares (8×8), alternating light/dark; White square at player’s near-right corner.
- **Pieces per side:** 16 (1 King, 1 Queen, 2 Rooks, 2 Bishops, 2 Knights, 8 Pawns).

Piece Values

- Pawn = 1, Knight = 3, Bishop = 3, Rook = 5, Queen = 9, King = invaluable.

3. Rules & Objectives

- Goal = **Checkmate** → trapping king with no escape.
- Other endings → Resignation, Draw, or Stalemate.

- **Stalemate**→ No legal moves + King not in check → Draw.
 - **En Passant**→ Special pawn capture.
 - **Castling**→ Only move where 2 pieces move (King + Rook).
-

4. Castling (Conditions)

1. King & rook unmoved.
 2. No pieces between them.
 3. King not in check.
 4. King cannot pass through/land in check.
- **Kingside Castling**: King e1 → g1; Rook h1 → f1.
 - **Queenside Castling**: King e1 → c1; Rook a1 → d1.
-

5. Officials

- **Tournament Directors** – Organize event.
 - **Arbiters** – Enforce rules, manage disputes.
 - **Federation Officials** – Oversee large competitions.
 - **Duties**→ Pairing, time control, player conduct, smooth & fair play.
-

6. Key Terms

- **Check** – King under attack.

- **Checkmate** – King trapped.
 - **Stalemate** – Draw with no legal move.
 - **Gambit** – Sacrifice for advantage.
 - **Fork** – Single piece attacks two at once.
-

7. Recent GK

- **Chess Olympiad 2022** – Chennai, India.
 - **Olympiad 2024** – Budapest → India won Gold (Men & Women).
 - **Candidates 2024** – Toronto, Canada.
 - **World Champion 2024** – D. Gukesh (India).
-

UNIT - 4

Unit 4 (Class 1)

National Sports Events – Khelo India | SAI | SDAT | NCOE | TOPS

Khelo India

- **Launch:** 31 Jan 2018, Indira Gandhi Stadium, New Delhi.
- Inaugurated by: **PM Narendra Modi**.
- Aim: Revive sports culture, promote rural/indigenous/tribal games.
- HQ: **New Delhi**.
- **State Level Centres:** 453 (₹2 lakh per discipline) .
- Sports included: Archery, Athletics, Badminton, Basketball, Boxing, Football, Gymnastics, Hockey, Judo, Kabaddi, Kho-Kho, Shooting, Swimming, Volleyball, Weightlifting, Wrestling .

Editions

- **Khelo India School Games (2018, Delhi)** – U-17, Haryana topped medals .
- **Khelo India Youth Games (2019–present)**
 - 2019 Pune → 1st, Maharashtra topped.
 - 2020 Guwahati → Maharashtra 1st.
 - 2021 Panchkula → Haryana 1st.
 - 2022 Bhopal → Maharashtra 1st.
 - 2023 TN → Maharashtra 1st.

- 2024 TN (Chennai, Madurai, Trichy, Coimbatore) → Maharashtra 1st, TN 2nd .
- 2025 → Bihar (upcoming).

- **Khelo India University Games (KIUG)** → 2020 Odisha, 2022 Karnataka, 2024 NE States .
- **Khelo India Winter Games (KIWG)** → Leh & Gulmarg (2020, 2021, 2023, 2024, 2025).
- **Khelo India Para Games (KIPG)** → 1st edition 2023 Delhi; 2nd edition 2025 Delhi (slogan: *Champions Beyond Limit*) .

Sports Authority of India (SAI)

- Established: **1984**, under Ministry of Youth Affairs & Sports.
- Origin: Committee for **1982 Asian Games**.
- HQ: New Delhi.
- Key Centres: Bengaluru, Kolkata, Gandhinagar, Kandivali, Bhopal, Sonapat, Lucknow, Chandigarh, Guwahati, Imphal, Patiala (NSNIS), Thiruvananthapuram (LNCPE) .
- **Objectives:** Talent identification, scientific training, infrastructure, national team support, sports education, schemes (SAG, Khelo India, TOPS, Fit India) .

National Centres of Excellence (NCOE)

- Cover **23 disciplines:** Archery, Athletics, Boxing, Cycling, Fencing, Football, Gymnastics, Hockey, Handball, Judo,

Kabaddi, Kho-Kho, Rowing, Shooting, Swimming, Taekwondo, TT, Volleyball, Weightlifting, Wrestling, Wushu, etc. .

- Aim: Provide high-performance training, field-of-play facilities, and medal potential focus.

Target Olympic Podium Scheme (TOPS)

- Launched: **2014**, improved in 2018.
- Aim: Support elite athletes for **Olympics & Paralympics**.
- Benefits: ₹50,000 monthly stipend + expert training, exposure, and technical support team .

SDAT (Sports Development Authority of Tamil Nadu)

- Established: **1992**.
- Key initiative: **TALENT programme** (Tamil Nadu Leadership and Excellence to Nurture Talent).
- Sports Hostels (SH) → school students (class VII–X).
- Centres of Excellence (CoE) → class VI–VIII, advanced training.
- Sports Hostels of Excellence (SHE) → for college students .

Unit 4 (Class 2)

Olympics | CWG | Asian & South Asian Games | National Games | CM Trophy | World Cups | Sports Federations

Olympic Games

- **Ancient Olympics:** 776 BC, Olympia (Greece), in honor of Zeus & Hera.
- Banned: 394 AD by Theodosius I.
- **Modern Olympics:** 1896 Athens, by *Pierre de Coubertin*.
- **IOC:** Formed 23 June 1894; HQ Lausanne; Current President: **Thomas Bach**.
- Olympic Motto: *Citius, Altius, Fortius – Communiter* = Faster, Higher, Stronger – Together.
- Olympic Flag (1914, started 1920): 5 rings (Blue–Europe, Yellow–Asia, Black–Africa, Green–Australia, Red–America).
- Olympic Flame: First in 1928 Amsterdam.
- India's IOA: Founded 1927; First President: **Dorabji Tata**; Current: **P.T. Usha**.
- **Paris 2024:** Manu Bhaker – 2 Bronze (10m pistol); Neeraj Chopra – Silver (Javelin); Men's Hockey – Bronze.

Commonwealth Games (CWG)

- Started 1930, Hamilton (Canada); Motto: *Humanity – Equality – Destiny*.
- Known earlier as **British Empire Games** (renamed 1958).
- HQ: London, UK; Every 4 years.
- India first participated: 1934.

- Next edition: **2026, Glasgow (Scotland)**.

Asian Games

- First: **1951, New Delhi** (Father: Prof. G.D. Sondhi).
- Governing Body: Olympic Council of Asia (1982).
- Motto: *Ever Onward*.
- Emblem: Red Sun with 16 rays + White circle.
- First Indian female gold: **Kamaljeet Sandhu (400m), 1970 Bangkok**.

South Asian Games

- First: 1984, Kathmandu (Nepal).
- Governing body: South Asian Olympic Council (1983).
- Motto: *Peace, Prosperity, Progress*.
- Held every 2 years.
- India = highest overall medal tally.

IN National Games of India

- Origin: **Indian Olympic Games, 1924**.
- Organized by: IOA + host state.
- Recent: **38th Games 2025, Uttarakhand**; Services Sports Control Board topped (121 medals).

- Next: **39th Games 2027, Meghalaya**.
- 37th: Goa (2023).

CM Trophy (Tamil Nadu)

- Organized by SDAT (Sports Development Authority of Tamil Nadu).
- Open to: School, College, Govt. employees, Differently-abled, General public.
- Aim: Promote fitness & identify grassroots talent.
- 2024: TN hosted successfully.

Major Sports Trophies

- **Football**: FIFA WC (1930–, next 2026 in USA/Mexico/Canada), Durand Cup, Santosh Trophy.
- **Hockey**: Sultan Azlan Shah Cup, Rangaswami Cup, Murugappa Gold Cup, Dhyan Chand Trophy.
- **Basketball**: NBA (Larry O'Brien), WNBA, FIBA WC.
- **Cricket**: ICC World Cup, T20 WC, Champions Trophy (2025 India), IPL, Ranji, Vijay Hazare, Syed Mushtaq Ali.
- **Tennis Grand Slams**: Aus Open (Jan, Hard), French Open (May, Clay), Wimbledon (June, Grass), US Open (Aug, Hard).

Sports Federations in India

- **BCCI (1928)** – Cricket.
- **AIFF (1937)** – Football.
- **Hockey India (2009)**; earlier IHF (1925).
- **BAI (1934)** – Badminton.
- **AITA (1920)** – Tennis.
- **BFI (1949)** – Boxing.
- **IWLF (1935)** – Weightlifting.
- **TTFI (1926)** – Table Tennis.
- **VFI (1951)** – Volleyball.
- **SFI (1948)** – Swimming.
- **JFI (1965)** – Judo.
- **AICF (1951)** – Chess.
- **AFI (1946)** – Athletics.

Unit 4 (Class 3)

State Govt. Schemes | SDAT | Sports Hostels | Centres of Excellence

Organizational Setup

- **Central:** Ministry of Youth Affairs & Sports, AIU, University/College Physical Education Dept.
- **State/District:**

- **DIPE (District Inspector of Physical Education, TN)**
→ Implements PE & sports at district level.
- **SDAT (Sports Development Authority of Tamil Nadu, 1992)** → Apex body for state sports development; Chairman = Chief Minister.

Major Schemes (SDAT)

1. Special Scholarship for Elite Sports Persons Scheme

- For medal-potential athletes (Olympics & international).
- Assistance up to **₹30 lakh/year/person**.
- 27 athletes benefitting (2024); also supported Paralympic medalists.

2. Dr. Kalaignar Sports Equipment Scheme (2023–24)

- In honor of M. Karunanidhi's centenary.
- Distributed sports kits to **12,600 village panchayats**, cost ₹85.99 crore.
- Inaugurated in Madurai on 18.02.2024.

3. Mission International Medals Scheme (MIMS 2024)

- Up to **₹12 lakh/year per player**.
- Covers equipment, training abroad, international exposure.
- 71 sportspersons (incl. 5 para-athletes) benefitting.

4. Champions Development Scheme (CDS)

- For **National-level gold medal winners <20 yrs.**
- Assistance: **₹2 lakh/year** for kits, training, competitions.
- Currently 102 athletes supported.

5. **World Beaters Talent Spotting Scheme (WBTSS)**

- School-based motor ability tests (speed, endurance, agility, coordination, strength, flexibility).
- Talented students inducted into **specialized sports academies**.

6. **High Cash Incentive Scheme**

- Rewards medal winners at National & International competitions.

Sports Hostels & Centres of Excellence

- **Sports Hostel (SH)** → Nurtures young athletes (school-level).
- **Sports Hostel of Excellence (SHE)** → Advanced training for college students.
- **Centres of Excellence (CoE):**
 - Tennis Stadium, Nungambakkam (Boys & Girls)
 - TNPESU, Chengalpattu (Boys & Girls)
 - Aquatic Complex, Velachery (Boys & Girls)
 - Jawaharlal Nehru Stadium, Chennai (Boys)
 - JN Indoor Stadium, Chennai (Girls).

Unit 4 (Class 4)

School Tournaments in Tamil Nadu

- **Group A (Team Games)**
 - *Higher Secondary* → **Bharathiar Day Games (BDG)**.
 - *High School* → **Republic Day Games (RDG)**.
- **Group B (Other Sports)** → Conducted as **BDG/RDG competitions** at HS & HSS levels.
- **Group C (Athletics)** → **Republic Day Sports (RDS)**.

Levels of Competitions

1. **Zonal Level**
2. **Educational District Level**
3. **Revenue District / Divisional Level**
4. **State Level**

Organizing Committees

At School Level

- **President** → Headmaster.
- **Sports Secretary** → PD/PET (or senior PET if no PD).
- **Joint Secretary** → Other PETs.

- **Members** → 3 teachers + 4 student players.

At Zonal Level

- **Admin President** → DEO.
- **Technical President** → DIPE.
- **Secretary** → HM of organizing school (authorized by DIPE).
- **Joint Secretary** → PD/PET of organizing school.
- **Monitoring Committee** → DEO, DIPE, 2 HMs, 2 PETs.

At District Level

- **Admin President** → DEO.
- **Technical President** → DIPE.
- **Secretary** → HM of organizing school (by DIPE).
- **Joint Secretary** → PD/PET.
- **Monitoring Committee** → DEO, DIPE, 2 HMs, 2 PETs.

At Divisional Level

- **Admin President** → CEO.
- **Vice President** → DEOs & IMS.
- **Technical President** → DIPE.
- **Organizing Sec.** → DIPE/authorized school.
- **Monitoring Committee** → CEO, DEO, IMS, DIPE, 2 HMs, 1 PD, 2 PETs.

At State Level

- **Chairman** → DSE.
- **Vice Chairman** → JD (NSS).
- **Technical Presidents** → CIPEs.
- **Organizing Secretary** → CEO of concerned district.
- **Technical Secretary** → DIPE of district.
- **Monitoring Committee** → DSE, JD, CIPEs, CEO, DEOs, IMS, DIPE, 4 HMs, 4 PETs.

General Rules

- **Mode** → Knockout at all levels.
 - **Rules** → As per federation rules (updated 1 July each year).
 - **Seeding** → Winners & runners seeded for higher competitions.
 - **Certificates** → Only officials can sign BDG/RDG/RDS certificates.
-

Functions of SCERT (TNSCERT)

- Formulates **curriculum, textbooks (I–XII)**, norms & teacher education policies.
- Conducts **pre-service & in-service training**.
- Research & evaluation for **quality school education**.
- Admission process for **D.El.Ed** through Single Window.
- Publishes **teacher education source books**.

Functions of DIET

- Train **elementary school teachers**.
 - Oversee **village & block-level education**.
 - Support **adult education programs**.
 - Monitor education levels and provide training modules.
-

Unit 4 (Class 5)

Tournament – Meaning

- A **contest of skill** among participants/teams, conducted as per a **fixed schedule** to decide a winner.

Organization

- Requires **planning, preparation & cooperation**.
 - **Organizing Committee**: Patron-in-Chief, Chairman, Organizing Secretary, Members.
 - **Sub-committees**: Reception, Lodging/Boarding, Decoration, Transport, Equipment, Refreshment, Prize Distribution, Publicity, Medical, Technical.
-

Tournament Systems

1. Knock-out (Elimination)

- Teams eliminated after first loss.
- Matches = $N - 1$ (for N teams).

- Example: 16 teams $\rightarrow$ 15 matches.
- **Byes**: If N not a power of 2 $\rightarrow$ Byes = Next power of 2 – N .
- **Merits**: Quick, economical, intense competition.
- **Demerits**: Strong team may exit early; weaker may reach finals.

2. League (Round Robin)

- Each team plays with all others once.
- **Merits**: Decides true winner, more matches, proper ranking.
- **Demerits**: Time-consuming, costly, weaker teams lose interest.

3. Combination

- **Knock-out cum Knock-out**
- **Knock-out cum League**
- **League cum League**
- **League cum Knock-out**
- **League cum League cum Knock-out**.

Principles of Knock-out Fixtures

- Teams divided into **upper & lower halves**.
 - **Even teams** $\rightarrow n/2$ each; **Odd teams** $\rightarrow (n+1)/2$ upper, $(n-1)/2$ lower.
 - Byes distributed alternately (e.g., 13 teams $\rightarrow$ 3 byes).
-

State & District Associations

- State & district-level associations supervise **athletics & sports administration**, organize tournaments, and coordinate with federations.

Editions of Asian Games

1. 1951 – New Delhi, India
2. 1954 – Manila, Philippines
3. 1958 – Tokyo, Japan
4. 2018 – Jakarta & Palembang, Indonesia
5. 2022 – Hangzhou, China
6. 2026 – Nagoya, Japan
7. 2030 – Doha, Qatar
8. 2034 – Riyadh, Saudi Arabia.

Editions of South Asian Games

- **1st (1984)** – Kathmandu, Nepal.
- 7th (1995) – Madras, India.
- 12th (2016) – Guwahati & Shillong, India.
- 14th (2026) – Lahore/Islamabad, Pakistan.

IN Editions of National Games (Olympic Format)

- **Started as Indian Olympic Games (1924).**

- 38th (2025) – Uttarakhand.
- 39th (2027) – Meghalaya.

Unit 4 (Class 6)

Arjuna Award

- **Instituted:** 1961.
- **For:** Consistent outstanding performance (last 4 years) at international level.
- **Includes:** Bronze statuette of Arjuna, Certificate, Dress, ₹15 lakh cash.
- **Eligibility:** Olympic/Asian/Commonwealth/World Cup/World Championship disciplines, Indigenous games, Para-sports.
- **Conditions:** No repeat awards; can be posthumous; not eligible if penalized by **WADA/NADA**.
- **Selection:** Scrutiny by **Screening Committee** (JS Sports, SAI Secy, Director Sports, ED TEAMS).
- **Recent (2024 Hockey awardees):** Sanjay Rana, Sukhjeet Singh, Jarmanpreet Singh, Abhishek Nain, Salima Tete.

Dronacharya Award

- **Instituted:** 1985.
- **For:** Coaches producing medal winners at international events.
- **Categories:** Regular (₹10 lakh), Lifetime (₹15 lakh).

- **Includes:** Statuette of Dronacharya, Certificate.
- **Nomination:** By Rajiv Gandhi Khel Ratna, Arjuna, Dronacharya, Dhyan Chand awardees, and DG-SAI.
- **Disciplines:** Olympic, Non-Olympic recognized sports, Indigenous sports.
- **Objectives:** Honor & motivate coaches, raise India's performance standards.

Maulana Abul Kalam Azad (MAKA) Trophy

- **For:** Best performing University in sports (inter-university, national, international).
- **Eligibility:** UGC-recognized universities; Olympic/Asian/CWG disciplines + Chess, Kho-Kho, Cricket.
- **Prize:** Rolling trophy + Cash award – 1st: ₹15 lakh, 2nd: ₹7.5 lakh, 3rd: ₹4.5 lakh.
- **Utilization:** For CoE, infrastructure, training, athlete welfare.

Rashtriya Khel Protsahan Puruskar

- **For:** Organizations (public/private) promoting sports.
- **Categories:** Corporate encouragement, Talent identification, Sports promotion via education, Sports welfare.
- **Objective:** Encourage CSR in sports, employment of athletes, and sports development.
- **Includes:** Citation + Trophy (no cash).

- **Limit:** Only one award per category per year.

Tenzing Norgay National Adventure Award

- **For:** Adventure sports excellence (Land, Sea, Air).
- **Instituted:** Named after *Tenzing Norgay* (first Everest summiteer, 1953).
- **Eligibility:** Performance, leadership, discipline, continuous achievements.
- **Categories:** Land, Water, Air, Lifetime Achievement.
- **Includes:** Bronze statuette, Certificate, Blazer + tie/saree, ₹15 lakh cash.
- **Conferred:** Annually on **29th August (National Sports Day)** at Rashtrapati Bhavan.

Unit 4 (Class 7)

Major Dhyan Chand Khel Ratna Award

- **Formerly:** Rajiv Gandhi Khel Ratna (instituted 1991–92).
- **Highest sporting honour in India.**
- **Criteria:** Outstanding performance in **Olympics, Asian Games, CWG, World Cup/Championships** over last 4 years.
- **Award Includes:** Medal, Certificate, Dress, **₹25 lakh** (tax-free).
- **Frequency:** One award per year (to an individual sportsperson).
- **Nominations:**

- Ministry of Youth Affairs & Sports.
- National Sports Federations (NSFs), IOA, Sports Boards, State/UT Govts.
- Past Khel Ratna awardees (1 nomination each).
- **Presentation:** By President of India, **29th August** (Dhyan Chand's birth anniversary).
- **Recent Winners (2024):** D. Gukesh, Harmanpreet Singh, Manu Bhaker, Praveen Kumar.
- **Cricket Awardees:** Virat Kohli (2018), Rohit Sharma (2020).

Dhyan Chand Award (Lifetime Achievement)

- **Instituted:** 2002.
 - **Highest lifetime sporting honour** in India.
 - **For:** Lifetime achievements + contribution to sports promotion after retirement.
 - **Includes:** Statuette, Certificate, ₹10 lakh.
 - **Eligibility:** Not for recipients of Khel Ratna/Arjuna/Dronacharya.
-

Important Events in Indian PE & Sports

Year	Event / Committee
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1844	YMCA founded (Sir George Williams, London).
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Year	Event / Committee
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1870	Indian Education System reference.
1909	First Scout Troop in India.
1914	HVPM (Hanuman Vyayam Prasarak Mandal), Amravati.
1916	Scout Association – Dr. Annie Besant.
1920	YMCA College, Madras (by H.C. Buck).
1925	Association of Indian Universities (AIU).
1927	Indian Olympic Association (IOA).
1931	Govt. College of Physical Education, Hyderabad.
1936	HVPM team demo at Olympics.
1945	All India Services Sports Control Board.
1946	National Association of PE & Recreation.
1948	NCC established (<i>Motto: Unity & Discipline</i>).
1953	Rajkumari Amrit Kaur Coaching Scheme.
1954	AIU Games, SGFI, All India Council of Sports.
1956	National Plan & Syllabus for PE.
1957	LNPIE founded.
1959	National Physical Efficiency Drive, Kunzru Committee.

Year	Event / Committee
1961	National Institute of Sports (Patiala).
1964	Kothari Commission.
1969	NSS launched.
1970-71	Sports Talent Search & Rural Sports Programmes.
1975	National Sports Festival for Women.
1982	Education Commission recognized PE.
1984	National Sports Policy + SAI.
1985	National Sports Talent Contest.
1986	Special Area Games (SAG).
1987	IGIPSS, Delhi.
1995	National Sports Day started (29 Aug).
2003	Afro-Asian Games (Hyderabad).
2008	Physical Education Foundation of India (PEFI).

Write Down What You Usually Forget

For Last Minute Revision!

UNIT - 5

Unit 5 (Class 1)

Test | Measurement | Evaluation | Anthropometry | BMI | Somatic Types | Fitness Tests

Test

- **Meaning:** Tool/questionnaire/exam to measure a characteristic of an individual/group.
- **Definitions:**
 - *Sheehan*: Instrument to ascertain attributes.
 - *Barrow & McGee*: Specific tool of measurement requiring response.
 - *Johnson & Nelson*: Questioning/measuring to assess knowledge/ability.

Measurement

- **Meaning:** Collection of data using tests; part of evaluation.
- **Definitions:**
 - *Sheehan*: Evaluative procedure for data collection.
 - *Barrow & McGee*: Precise & objective, results in numerical data.
 - *Johnson & Nelson*: Aid to evaluation through tools & techniques.

Evaluation

- **Meaning:** Process of judging attainment of educational goals.
- **Definitions:**
 - *Sheehan*: Comparing attributes of students/teachers/environments.
 - *Barrow & McGee*: Both qualitative & quantitative, subjective + objective.
 - *Johnson & Nelson*: Beyond measurement → subjective judgment on objectives.

Need for Test, Measurement & Evaluation

- Assess student performance.
- Motivate & classify players/teams.
- Diagnose needs (fitness, mechanics, motor skills).
- Evaluate teaching methods & objectives.
- Establish age/sex/grade norms.

Importance

- To frame objectives.
- To evaluate learners & teaching program.
- To know abilities & needs of participants.

Anthropometry

- **Measurements:** Height, Weight, Arm/Leg Length, Waist Circumference, Skinfolts.
- **Procedures:**
 - Height → stadiometer.
 - Weight → weighing machine.
 - Arm length → shoulder tip to little finger.
 - Leg length → foot to greater trochanter.
 - Skinfold sites → Triceps, Subscapula, Suprailiac, Abdomen, Thigh.
- **Diameters:**
 - Biacromial (shoulder width).
 - Bicristal (iliac crests – hip width).

BMI (Body Mass Index)

- Formula: **Weight (kg) ÷ Height² (m²)**.
- Normal range: **18.5–24.9**.
- Waist–Hip Ratio → indicator of fat distribution.

Somatic Types (W.H. Sheldon)

1. **Endomorph** → Rounded physique, suitable for Weightlifting/Powerlifting.

2. **Mesomorph** → Muscular, broad chest/shoulders, excels in all sports.
3. **Ectomorph** → Slim, long limbs, low strength, excels in endurance.

Fitness Tests

Indiana Physical Fitness Test (College Men)

- Chin-ups, Straddle Chin, Push-ups → Upper body strength.
- Vertical Jump, Standing Broad Jump → Leg power.
- Scale score = overall fitness rating.

Oregon Motor Fitness Test (School Boys)

- Standing Broad Jump → Leg power.
- Floor Push-ups → Arm/shoulder strength.
- Knee Touch Sit-ups → Abdominal strength.
- Focus on **strength, endurance, explosive power**.

Unit 5 (Class 2)

Criteria for Selecting Tests | Johnson's Basketball Test | Barrow Motor Ability Test

Criteria for Selecting Tests :

1. Scientific Authenticity

- **Validity** → Test measures what it claims (e.g., chin-ups = arm strength).
- **Reliability** → Consistency of results across time.
- **Objectivity** → Freedom from bias, uniform scoring.
- **Norms** → Based on large group performance.
- **Duplicate Form** → Parallel forms available for comparison.

2. Administrative Feasibility

- **Economy** (Cost-effective).
- **Time** (Efficient conduct & evaluation).

3. Educational Application

- Tests in major recreational sports.
- Sports skills.
- Physical fitness.
- Screening tests.
- Social fitness.

Classification of Tests

1. **Teacher-made Tests** → Local, immediate needs.
2. **Standardized Tests** → With validity, reliability, norms.
3. **Objective Tests** → No scorer bias.
4. **Subjective Tests** → Based on scorer's judgment.

5. Knowledge Tests →

- *Objective*: True/False, MCQ, Matching, Completion.
- *Subjective*: Short answer, Essay.

6. Skill Tests → Assess motor/sport skills.

Johnson's Basketball Test (1934, L. William Johnson)

Aim: Assess general basketball playing ability.

- **Field Goal Speed Test** → Max baskets in 30 sec.
- **Throw for Accuracy** → Target on wall, 40 ft away; Scoring = 3 pts (inner), 2 pts (middle), 1 pt (outer).
- **Dribble Test** → Zig-zag around 4 cones in 30 sec; Score = no. of zones covered.
- **Final Score** = Sum of the three items.

Barrow Motor Ability Test (Harold M. Barrow, 1953)

Aim: Assess motor fitness (college men & HS boys).

- **Standing Broad Jump** → Leg power, agility, strength.
 - **Zigzag Run** → Agility, speed (figure of 8, 3 laps).
 - **Medicine Ball Put (6 lb)** → Arm/shoulder strength, coordination, balance.
 - **Scoring** = Best performance in each, added together.
-

Unit 5 (Class 3)

Validity | Health-related Fitness | JCR | SDAT World Beaters Battery Test | Margaria-Kalamen Test

Validity – Methods of Establishing

- **Definition:** Degree to which a test measures what it claims.
- **Methods:**
 1. **Subjective Rating** – Expert grading.
 2. **Previously Validated Tests** – Compare old & new forms.
 3. **Composite Scores** – Correlation of combined test scores.
 4. **Tournament Standings** – Player rankings vs test scores.
 5. **Face Validity** – Logical judgment (e.g., 50m dash = speed).
- **Reliability:** Consistency of results.
- **Objectivity:** Freedom from bias.

Health-related Fitness Components

1. **Cardio-respiratory Endurance** → Treadmill, Bicycle ergometer, distance run/walk.

2. **Muscular Endurance** → Sit-ups, flexed arm hang, repeated bench press.
3. **Muscular Strength** → Dynamometer, 1RM bench/leg press, Cybex test.
4. **Body Composition** → Skinfolds, Underwater weighing.
5. **Flexibility** → Goniometer, Sit-and-reach, Trunk extension.

JCR Test (B.E. Phillips, 1947)

- **Purpose:** Assess motor skills – strength, speed, power, agility, endurance.
- **Population:** Males, 18–45 yrs.
- **Reliability:** 0.91; **Validity:** 0.84.
- **Test Items:**
 1. **Vertical Jump** → Leg power.
 2. **Chinning (Pull-ups)** → Arm & shoulder strength.
 3. **Shuttle Run** → Agility & speed.

SDAT World Beaters Battery Test (2002, TN Govt.)

- **Aim:** Talent identification for 6th–8th Std students.
- **Components:**
 - Speed → 50m dash.
 - Strength → 4 kg Shot Put.

- Explosive Power → Long Jump.
- Agility → 6×10 m Shuttle Run.
- Endurance → 600 m run.

Margaria-Kalamen Test (1968)

- **Purpose:** Measure **anaerobic power** of lower body.
- **Equipment:** 12-step staircase, stopwatch, tape.
- **Procedure:**
 - Athlete sprints 6 m, steps on 3rd, 6th, 9th step.
 - Time measured from 3rd to 9th step.
 - Three trials with 2–3 min rest.
- **Scoring Formula:**

$$P = \frac{M \times D \times 9.8}{t}$$

where M = body mass (kg), D = vertical distance (m), t = time (s).

Unit 5 (Class 4)

Components of Physical Fitness & Tools

- **Body Weight** – Weighing Machine.
- **Height** – Stadiometer.
- **Sitting Height** – Anthropometric Rod.
- **Blood Sugar** – Glucometer.

- **Heart Beats** – Stethoscope / HR Monitor.
 - **Bone Length** – Bone Caliper.
 - **Strength** – Dynamometer.
 - **Muscular Endurance** – Flex Arm Hang, Bent Knee Sit-ups.
 - **Flexibility** – Sit & Reach (Wells & Dillon, 1952), Goniometer, Flexometer, Tiechy Test, Bridge Up Test.
 - **Balance** – Stork Stand, Bass Stick, Flamingo, Nelson Test.
 - **Explosive Power** – Standing Broad Jump, Vertical Jump, Medicine Ball Throw, Margaria Test.
 - **Agility** – Shuttle Run, Dodging Run, Semo Test, Boomerang Test.
 - **Speed** – 30m Sprint, 50 Yard Dash.
 - **Reaction Time** – Ruler Drop, Nelson Test.
 - **Coordination** – Scott Obstacle, Eye-Hand Coordination Test.
-

AAHPERD Youth Physical Fitness Test

- Origin: **AAHPER (1958)**, revised 1976 by Paul Hunsicker & Guy Reiff.
- Now called **SHAPE America** (2013).
- **Population:** School students up to 17 years.
- **Six Test Items:**
 1. Pull-ups (Boys) / Flexed Arm Hang (Girls) → Arm & Shoulder Endurance.

2. Bent Knee Sit-ups → Abdominal/Hip Endurance.
3. Shuttle Run → Agility & Speed.
4. Standing Broad Jump → Explosive Power.
5. 50-Yard Dash → Speed.
6. 600-Yard Run/Walk → Cardiorespiratory Endurance.

Kraus-Weber Muscular Fitness Test (1954)

- Developers: **Dr. Hans Kraus & Dr. Sonja Weber.**
- Purpose: Measure **minimum muscular fitness strength.**
- Applied to 4458 US & 3156 European children → Failure: **57.9% US vs 8.7% Europe.**
- **6 Test Items:**
 1. Strength of Abdominal + Psoas muscles.
 2. Strength of Abdominal – Psoas muscles.
 3. Strength of Psoas + Lower Abdominal muscles.
 4. Strength of Upper Back muscles.
 5. Strength of Lower Back muscles.
 6. Floor Touch Test (Flexibility of lower back & hamstring).
- **Scoring:** Pass/Fail; 0–10 scale per item.

Skeletal Diameters

- **Biacromial** → Shoulder width.

- **Bicristal** → Hip width (iliac crests).
- **Bitrochanteric** → Hip width (greater trochanters).
- **Humerus Bicondylar** → Elbow width.
- **Femur Bicondylar** → Knee width.

Unit 5 (Class 5)

Barrow Motor Ability Test (1953)

College Men – 6 items

- Standing Broad Jump → Leg power.
- Softball Throw → Arm strength & coordination.
- Zigzag Run → Agility & speed.
- Wall Pass → Eye–hand coordination.
- Medicine Ball Put (6 lb) → Arm/shoulder strength.
- 60 Yards Dash → Speed & acceleration.

High School Boys – 3 items

- Broad Jump, Zigzag Run, Medicine Ball Put.

Newton Motor Ability Test (1939, Elizabeth Powell & Eugene Howe) – Girls

- **Standing Broad Jump** → Leg power.
- **Baby Hurdles** → Agility, coordination, leg strength.

- **Scramble Test** → Balance, coordination, reaction time.

Cooper's 12-Minute Run/Walk Test (1968, Kenneth H. Cooper)

- Purpose → Measure **aerobic fitness & VO₂ max**.
- Procedure → Cover max distance in 12 min (running/walking allowed).
- Equipment → Track, cones, stopwatch.
- Scoring → Total distance; VO₂max estimated:
 - Miles: $VO_{2\max} = (35.971 \times \text{miles}) - 11.288$
 - Km: $VO_{2\max} = (22.351 \times \text{km}) - 11.288$
- **Advantages:** Cheap, group testing.
- **Limitations:** Motivation & pacing affect reliability.

Harvard Step Test (1943, Lucien Brouha, WWII Harvard Lab)

- Purpose → **Cardiovascular endurance**.
- Equipment → 20 in. bench (men), 16 in. (women), metronome.
- Procedure → Step up-down, 30 steps/min, for 5 min or till exhaustion.
- Recovery Pulse → Count at 1–1.5, 2–2.5, 3–3.5 min.
- Scoring → Fitness Index (PEI):
 - Short form = $(100 \times \text{duration sec}) \div (5.5 \times \text{HR at 1–1.5 min})$.

- Long form = $(100 \times \text{duration sec}) \div (2 \times \text{sum of HR in 3 recovery periods})$.

- Validity → Correlation with VO₂max ($r = 0.6–0.8$).

Sit and Reach Test (Wells & Dillon, 1952)

- Purpose → Flexibility of **lower back & hamstrings**.
- Procedure → Sit with legs extended, feet flat on box, knees locked; reach forward steadily.
- Scoring → Best of 3 trials, cm or inches beyond feet (modified version adjusts for limb length).
- Advantage → Simple, widely used.

Unit 5 (Class 6)

Domains of Human Performance

1. Affective Domain (Attitude-based)

- Focus: Attitudes, values, emotions, teamwork, sportsmanship.
- Levels:
 - Receiving (interest in learning)
 - Responding (active participation)
 - Valuing (accepting importance, e.g., fair play)
 - Organizing (integrating new values, e.g., regular exercise)

- Characterizing (living by value system, e.g., following safety rules)

- **Tools:** Observation, checklists, peer/self-evaluation, rating scales.

2. Psychomotor Domain (Skills-based)

- Focus: Physical skills – strength, speed, agility, coordination, balance, flexibility.
- Levels: Perception → Set → Guided Response → Mechanism → Complex Overt Response → Adaptation → Origination.
- **Examples:** Shuttle run, push-ups, vertical jump, sit & reach, dribbling in games.

3. Cognitive Domain (Knowledge-based)

- Focus: Knowledge of rules, strategies, anatomy, physiology, safety.
- Levels: Remembering → Understanding → Applying → Analyzing → Evaluating → Creating.
- **Examples:** Written/oral exams, tactical quizzes, rule-based questions.

Measurement Scales

- **Nominal** → Categories only (e.g., gender, jersey no.).
- **Ordinal** → Ranking order, unequal intervals (1st, 2nd, 3rd).
- **Interval** → Equal intervals, no true zero (e.g., °C temperature).

- **Ratio** → Equal intervals, absolute zero (height, weight, time).

Types of Testing

- **Formative** → Ongoing, during instruction.
- **Diagnostic** → Identifies weaknesses.
- **Benchmark** → Compares to standards.
- **Summative** → End-of-program evaluation.

Guidelines: Standardize procedures, ensure safety, give clear instructions, record accurately.

Soccer Skill Assessment Tests

McDonald Soccer Skill Test (1951)

- Purpose: Assess **kicking accuracy, ball control, moving ball judgment**.
- Setup: Kickboard (11.5 ft × 30 ft), restraining line at 9 ft.
- Procedure: Kick ball repeatedly for **30 sec**; 4 trials, best 3 scores added.
- Validity: 0.63–0.94; Reliability: 0.57–0.62.
- **Advantage:** Simple, quick, quantitative.
- **Limitation:** Limited to kicking only.

Mor-Christian Soccer Ability Test (1979)

- Purpose: General soccer ability (College males).

- Components:
 - **Dribbling Test** → through cones, best 2 times recorded.
 - **Shooting Test** → From 16 yards, points for target accuracy (10 pts = upper target, 4 pts = opposite zone). 16 trials total.
 - **Passing Test** → 15 yards, 3 angles, into small goal; 4 trials each, 1 pt each success, -1 if cone hit.
- Validity: Dribbling 0.73, Shooting 0.78, Passing 0.91.
- Reliability: 0.80–0.98.

Unit 5 (Class 7)

Soccer & Basketball Skill Tests – Johnson | Mitchell–McDonald | SAI | AAHPERD | Harrison

Soccer Skill Tests

1. Johnson Soccer Test (1963)

- **Purpose:** General soccer skills (ball control, kicking accuracy).
- **Reliability:** 0.92.
- **Procedure:** Kick ball at target on wall/kickboard; 3 trials × 30 sec each; best trial = score.
- **Equipment:** Wall/kickboard, soccer balls, stopwatch .

2. Mitchell–McDonald Soccer Test (1963)

- **Purpose:** Dribbling, control, judgment of moving ball.
- **Target Group:** Youth players.

- **Procedure:** Kick ball repeatedly on wall from 9 ft line; 3 trials × 20 sec; best 3 trials = score.
- **Key Focus:** Controlled kicking, rebound ball control.
- **Variations:** Modified for school boys (20 sec, smaller board) .

3. SAI Football Skill Test (1992)

- **Purpose:** Evaluate dribbling, passing, shooting (talent ID).
- **Test Items:**
 1. **30 m Dribbling with Ball** → Time.
 2. **Kicking Accuracy Test.**
 3. **Ball Juggling Test.**
- **Scoring:** Time- and accuracy-based. Reliable for youth players .

Basketball Skill Tests

4. AAHPERD Basketball Skill Test (1984)

- **Developed by:** AAHPERD (now SHAPE America).
- **Skills Tested:** Shooting, passing, dribbling, defensive movement.
- **Test Items:**
 - Speed Spot Shooting (5 spots, 60 sec, 3 trials).
 - Passing to wall targets (8 ft away, 3 × 30 sec).
 - Control Dribble Test (cones course, timed).
 - Defensive Movement Test.

- **Reliability:** 0.84–0.98 .

5. SAI Basketball Skill Test (1992, 10–14 yrs)

- **Test Items:**
 1. Wall Pass Test (30 sec, count successful passes).
 2. Dribbling Test (lane dribble × 2 rounds, best timing).
 3. Jump & Turn Test (angular body flexibility in degrees).
- **Purpose:** Assess passing, dribbling, agility, flexibility .

6. Harrison Basketball Test (1969, Univ. of Florida)

- **Purpose:** Holistic evaluation of basketball (shooting, passing, dribbling, jumping).
- **Target Group:** HS junior & senior boys (also suitable for girls).
- **Procedure:** 8 stations, 2 trials each; minimum time scoring.
- **Uses:** Player development & skill improvement .

Unit 5 (Class 8)

French Short Service Test

- **Purpose:** Serve accuracy (short & low).
- **Target Group:** Junior, HS, College women.
- **Setup:** Rope 20 in. above net, concentric quarter circles on right service court.
- **Procedure:** 20 serves → shuttle must pass between rope & net and land in target area.

- **Scoring:** Court divided into 5 zones (5–1 pts); on-line = higher points. Invalid = 0.
- **Focus:** Placement & control.

Miller Wall Volley Test (1951)

- **Purpose:** Clear shot skill (high & deep).
- **Target Group:** College/secondary school students.
- **Setup:** Wall with 7.5 ft line, 10 ft distance, racket, shuttle.
- **Procedure:** “Ready, Go” → shuttle struck repeatedly at/above line.
- **Rules:** Must stay behind 10 ft line; one restart allowed.
- **Duration:** 3 trials × 30 sec.
- **Scoring:** Total valid hits.
- **Measures:** Accuracy, consistency, foot control.

Lockhart–McPherson Badminton Test

- **Purpose:** Fundamental badminton proficiency (college women).
- **Components:**
 1. **Wall Rally Test** → Shuttle hit against wall (FH/BH), timed 30–60 sec.
 2. **Target/Accuracy Test** → Shuttle aimed at wall/court targets, higher points for center.

- **Scoring:** Points per successful hit (inner = 5, outer = 3).
- **Benefits:** Easy, minimal equipment, quantifiable.
- **Limitations:** No footwork/tactics measured.
- **Use:** Baseline skill assessment.

Badminton Smash Test

- **Purpose:** Overhead smash skill (accuracy, power, consistency).
- **Target Group:** Jr. HS → College boys & girls.
- **Equipment:** Johnson Badminton Set-up Machine, racket, birdies, court markings.
- **Procedure:**
 - 7 practice trials, then 10 scoring attempts.
 - Shuttle dropped by machine, player smashes into scoring zone.
- **Scoring:** 1 pt per valid smash; Max = 10.
- **Variants:** Smash accuracy, power (speed), and consistency tracked.

Unit 5 (Class 9)

Volleyball Skill Tests – Russell-Lange | Brady | Modified Brady | VSAT

Russell-Lange Volleyball Test

- **Developed by:** French & Cooper (1937); modified by Russell & Lange (1940).
- **Purpose:** To measure **serving ability** of junior high school girls.
- **Equipment:** Volleyball, Court, Net, Measuring tape, Lime/Magnesium powder, Whistle, Score card .
- **Administration:**
 - Serve from service area behind end line.
 - 3 trials × 10 legal serves each.
 - Marking shown in figure (target zones).
- **Scoring:** Best score from 3 trials taken .

Brady's Volleyball Skill Test (1945)

- **Developer:** E.K. Brady.
- **Purpose:** For **college men**, to:
 - Classify players,
 - Measure improvement in skill,
 - Assist in grading & coaching evaluation.
- **Validity:** 0.86; **Reliability:** 0.949 .
- **Test:** Volley ball against wall for **1 min** within marked rectangle.
- **Procedure:**

- Wall line: 5 ft long, **11½ ft high**; vertical lines form rectangle.
- Player volleys continuously within 1 min.
- **2 trials**, only legal volleys (ball hits inside rectangle) counted.
- **Scoring:** Number of successful legal volleys .

Modified Brady Volleyball Test (1962, Clifton)

- **Purpose:** Test **overall volleyball ability**.
- **Target Group:** College women & secondary school boys.
- **Setup:**
 - Wall target rectangle: 10 ft long × 7.5 ft high.
 - Restraining line at 7 ft from wall.
- **Procedure:**
 - 3 trials × **30 sec** each.
 - Player volleys continuously within target.
 - If ball drops, restart immediately.
- **Scoring:** Total **legal volleys across 3 trials**.

Volleyball Skill Assessment Test (VSAT)

- **Purpose:** Assess skill for different levels of play.
- **Levels:**

- **Level 2A** → Regulation ball & court.
- **Level 2B** → Serve from 10 ft line or baseline.
- **Level 3** → Larger ball + smaller court; 6 zones (1–4 pts each); large 2-point zone near net not used.

- **Test Items:**

1. **Return of Service** – 10 trials, scoring based on landing area.
2. **Forearm Bump** – 10 trials, scoring like Return of Service.
3. **Serve Test** – 10 serves; points only if shuttle/ball lands in scoring area; Total score = points × 5 .

Unit 5 (Class 10)

Psychological Measures | Types of Anxiety | Dyer Tennis Test | Hewitt Tennis Service Test

Psychological Measures

Definition: Tools/methods to assess **mental functions & behaviors** in sports/education.

Key Areas

Motivation , Anxiety , Stress , Self-esteem , Confidence, Mental toughness , Personality traits , Mood states

Types

1. **Questionnaires & Surveys** – e.g., SCAT, POMS.
2. **Interviews** – Structured/semistructured.
3. **Observations** – Behavioral analysis.

4. **Psychophysiological** – HR, GSR, biofeedback.
5. **Performance-based Tasks** – Reaction time, decision-making.

Importance: Helps in talent identification, designing interventions, monitoring progress, supporting mental health.

Types of Anxiety in Sports

1. **State Anxiety** → Temporary, situation-specific (Spielberger).
2. **Trait Anxiety** → Personality trait; tendency to perceive threats.
3. **Competitive Anxiety** → Negative emotional state (worry, arousal, tension).
4. **Competitive State Anxiety** → Immediate before/during competition (cognitive + somatic).
5. **Unconscious Anxiety** → Exists without awareness, revealed in defense mechanisms.
6. **Free-Floating Anxiety** → Generalized, not tied to event/object.
7. **Cognitive Anxiety** → Negative thoughts, fear of failure.
8. **Somatic Anxiety** → Physical symptoms (↑HR, sweating, muscle tension).

Relationship with Performance

- **Inverted-U Hypothesis:**
 - Low anxiety → low performance.
 - Moderate anxiety → optimal performance.

- High anxiety → poor performance.

Anxiety Management

- **Psychological** → Visualization, goal-setting, mindfulness.
 - **Physiological** → Deep breathing, PMR, biofeedback.
 - **Behavioral** → Pre-performance routines, simulation.
 - **Support-based** → Social support, counseling.
-

Dyer Tennis Skill Test (1935, Joanna T. Dyer)

- **Purpose:** Classify **college women** by playing ability.
 - **Equipment:** Wall (10 ft × 15 ft), racket, balls, stopwatch.
 - **Markings:** Net line 3 ft high, restraining line 5 ft from wall.
 - **Procedure:**
 - Hit ball continuously against wall for 30 sec.
 - Must strike on/above net line, behind restraining line.
 - 3 trials, 30 sec rest between.
 - **Scoring:** 1 pt per legal hit (best of 3 trials).
 - **Men's version:** 20 ft restraining line, serve to start volley.
-

Hewitt Tennis Service Placement Test (1966, J.E. Hewitt)

- **Purpose:** Assess **service placement accuracy**.
- **Equipment:** Court, 25 balls, net + rope at 7 ft height.

- **Test Items (4):**

1. Forehand Drive Placement
2. Backhand Drive Placement
3. Service Placement
4. Speed of Service

- **Procedure:**

- 10 min warm-up.
- 10 serves; must pass between net & rope into marked box.
- Ball over rope = 0.

- **Scoring:** Total = points of 10 serves.

- **Validity:** 0.625–0.93; **Reliability:** 0.94.

Unit 5 (Class 11)

Hockey Tests | Basketball Test | Sports Analysis Tools

Friedel Field Hockey Test

- **Purpose:** Assess *pass receiving, fielding & drive while moving* (HS girls).
- **Equipment:** Hockey stick, balls, stopwatch.
- **Procedure:**
 - Subject starts at signal “Ready–Go”.

- Ball rolled from corner → received in target → dribbled → driven back.
- Time ends when ball crosses start line.

- **Scoring:** 10 trials (right + left); **mean of total time = score** .

Schimithal French Hockey Test

- **Developers:** Margaret Schimithal & French.
- **Purpose:** *Overall playing ability in Hockey* (Men/Women).
- **Equipment:** Leveled floor (20×45 ft), stopwatch, tape, hockey stick, ball.
- **Procedure:**
 - Player dribbles through obstacles (2 placed after restraining line).
 - Drives ball back to start line.
- **Scoring:** 10 trials (right & left); **average = score** .

Leilich Basketball Test (College Women)

Aim

Assess **motor ability, speed, passing accuracy & goal shooting**.

Components

1. **Bounce & Shoot** – Start behind 24-inch line, bounce once, shoot, rebound, pass to catcher, alternate sides (10 attempts).

- **Scoring:**
 - *Time Score:* Duration + penalties for fouls.
 - *Accuracy Score:* 2 pts (basket), 1 pt (rim), 0 (miss).

2. **Half-minute Shooting** – Max baskets in 30 sec (2 trials).
3. **Push-pass Test** – 3 concentric rings on wall (10/20/30 in. radius).

- **Scoring:** Inner = 5 pts, Middle = 3 pts, Outer = 1 pt .

Sports Analysis Tools

Technology	Function	Application	Example
GPS	Tracks speed, distance, workload	Soccer, football, cycling	NFL shoulder GPS trackers
Wearable Sensors	HR, stress, motion	Fatigue, injury prevention	WHOOP strap
Advanced Analytics	AI/ML-based insights	Recruitment, performance	Real-time AI feedback
Video Analysis	Motion & strategy tracking	Performance & tactics	Computer vision tools
VR/AR	Simulated & live data overlay	Training & tactical planning	STRIVR (NFL QBs)
Hawkeye	Ball tracking	Cricket, Tennis	Line decisions

Technology	Function	Application	Example
Force Plates	Ground reaction forces	Running, jumping	Explosive testing
Heart Rate Monitors	Effort & CV response	All sports	HR chest straps

UNIT - 6

Unit 6 (Class 1)

Sports Training | Aims | Training Cycles | Periodization

Sports Training

- **Definition:** Pedagogical process based on **scientific principles** to prepare sportspersons for **higher performance** in competitions.
- **Nature:** Scientific, systematic, progressive.

Aim of Sports Training

1. **Improvement of Physical Fitness** – sport-specific fitness needs.
2. **Acquisition of Motor Skills** – techniques → perfected as skills.
3. **Improvement of Tactical Efficiency** – best use of abilities & external factors.
4. **Education & Mental Development** – personality, sincerity, confidence, aspiration.

Training Cycles

- **Macro-cycle** → 3–12 months (Yearly = 12 months, e.g., Olympic year).
- **Meso-cycle** → 3–6 weeks.
- **Micro-cycle** → 3–10 days.

Periodization

- **Meaning:** Organized division of training year for **optimal performance**.
- **Phases:**
 - **Preparatory** → Longest, base development, general → specific fitness.
 - **Competition** → Achievement & maintenance of top form.
 - **Transition** → Recovery & relaxation, 4–6 weeks.

Types of Periodization

- **Single Periodization** → 1 macro-cycle (Prep → Comp → Transition).
- **Double Periodization** → 2 macro-cycles (Prep + Comp twice).
- **Triple Periodization** → 3 macro-cycles (Prep + Comp repeated thrice).
- Transitional always at **end of last macro-cycle**.

Top Form

- Concept by **L.P. Matveyew (1956)**.
 - **Definition:** Optimum state of performance capacity.
 - **Nature:** Achieved each training cycle, but temporary.
-

Key Performance Terms

- **Reflex Time** → Nerve impulse travel in reflex action.
 - **Reaction Time** → Interval between stimulus & response detection.
 - **Movement Time** → From movement start to end.
 - **Response Time** → Reaction + Movement + Reflex time.
-

Unit 6 (Class 2)

Principles of Sports Training & Conditioning

Basic Principles

1. **Specificity** – Training must match the sport/event demands.
 2. **Overload** – Training intensity > normal → adaptation occurs.
 3. **Reversibility** – Training effects lost if stopped (strength ↓ in 15–20 days, endurance ↓ in 25–30 days, sprint ↓ in 1 week).
 4. **Training Load** – Defined by:
 - **Intensity** = Rate of work (e.g., 100m in 10.5s).
 - **Density** = Work–rest relationship.
 - **Volume/Extent** = Total work (e.g., 4×400m = 1600m).
-

General Principles

1. **Overload** – Fitness improves only when load > habitual level.

2. **Progressive Development** – Gradual increase (linear/step method).
3. **Continuity** – Regular & uninterrupted training avoids fitness loss.
4. **Individuality** – Training should consider age, gender, physique, recovery pace.
5. **Specificity** – Training tailored to event-specific needs (e.g., runner → speed + endurance).
6. **Awareness** – Athletes should know purpose/benefits of training.
7. **Variety** – Different methods to avoid boredom/staleness.
8. **Active Participation** – Athletes must engage sincerely, not passively.
9. **Periodization** – Macro (3–12 months), Meso (3–6 weeks), Micro (3–10 days).
10. **Increasing Load** – Gradual, progressive to aid adaptation.
11. **Planned & Systematic** – Structured planning essential.
12. **General & Specific Training** – General builds base; Specific refines sport skills.
13. **Clarity** – Clear goals, tactics, and methods needed.
14. **Ensuring Results** – Planned to peak for competitions.
15. **Critical Training Load** – Higher load to meet elite competition demands (4–5 times yearly).
16. **Adaptability** – Balance between load & recovery.

17. **Feasibility** – Practical, beneficial training; avoid too much/little.

18. **Uniformity & Differentiation** – Uniform schedule, but loads individualized.

Unit 6 (Class 3)

Endurance | Types | Factors | Training Methods

Endurance – Meaning

- Ability to perform **physical activity repeatedly for maximum duration** without fatigue.
- Ability to perform movements with desired quality & speed **without early fatigue**.

Types of Endurance

1. By Nature of Activities

- **Basic Endurance** → Slow pace, large muscle use, prolonged (Jogging, Swimming >30 min).
- **General Endurance** → General sports movements without fatigue (Football, Hockey).
- **Specific Endurance** → Sport-specific (Marathon, 5000m, 10000m).

2. By Duration of Activity

- **Speed Endurance** → ≤ 45 sec (e.g., 400m sprint).
- **Short-term Endurance** → 45 sec–2 min, HR 185–200 bpm.
- **Medium-term Endurance** → 2–11 min, HR 190–200 bpm.

- **Long-term Endurance** → >11 min, 4 subtypes:

- I: 10–35 min (HR 180–190)
- II: 35–90 min (HR 175–190)
- III: 90–360 min (HR 150–180)
- IV: >360 min (HR 120–170)

3. By Oxygen Involvement

- **Aerobic Endurance** → With oxygen (VO_2 max, long events).
- **Anaerobic Endurance** → Without oxygen, lactic acid buildup (≤ 120 sec).

4. Other Types

- **Strength Endurance** → Maintain muscular contractions under fatigue (Circuit training, Weights).
- **Speed Endurance** → Maintain near-maximal speed (400m).
- **Cardiorespiratory Endurance** → Efficient circulatory & respiratory function (Cooper's Test, Harvard Step).
- **Muscular Endurance** → Repeated contractions against resistance (Sit-ups, Flex arm hang).

Factors Determining Endurance

1. **Aerobic Capacity** (VO_2 max).
2. **Anaerobic Capacity** (tolerance to lactic acid).
3. **Oxygen Transport** (O_2 + CO_2 efficiency).

4. **Oxygen Uptake** (improved in high-altitude training).
 5. **Energy Reserves** (muscle glycogen, carbohydrate loading).
-

Methods to Improve Endurance

1. **Continuous Method (Ernst van Aaken, 1920)**
 - *Slow Continuous*: HR 140–160 bpm, ≥ 30 min.
 - *Fast Continuous*: HR 160–180 bpm, ≤ 20 min.
2. **Varied Pace Method**
 - HR 140–180 bpm; duration 15–60 min.
 - Alternating speeds (coach/athlete decided).
3. **Fartlek Method (Speed Play, Sweden)**
 - HR 140–180 bpm; 15–60 min.
 - Variable pace decided by athlete.
4. **Interval Training Method**
 - HR ~ 180 bpm during work; recovery till HR 120–130 bpm.
 - Partial recovery, then repeat.
5. **Repetition Method**
 - High intensity (90–100%), complete recovery between efforts.
 - Best for **speed endurance**.
6. **Competition Method**

- Real competition/trials for best improvement.

7. Nutritional Strategy

- Carbohydrate loading (3–4 days before event).
- Bicarbonate loading (1–2 hrs before event) to delay fatigue.

Unit 6 (Class 4)

Speed | Types of Speed Ability | Methods of Speed Development | Agility

Speed

Definition: Ability to perform motor actions in minimum possible time (e.g., 100m sprint).

- Quickness of limb movement.
- Cover maximum distance in shortest period.
- **Assessment:** Short sprint (50m dash) .

Factors Determining Speed

1. Nervous system mobility.
2. Explosive strength.
3. Technique.
4. Biochemical reserves & metabolic power.
5. Flexibility.
6. Physique .

Five Types of Speed Ability

1. **Reaction Ability** – Quick response to signals (e.g., gunshot in sprint).
 - Tests: Chronoscope, Stick drop test.
2. **Movement Ability** – Single movement in shortest time.
3. **Acceleration Ability** – Achieve top speed quickly from rest/slow pace.
4. **Locomotor Ability** – Maintain max speed for max duration.
5. **Speed Endurance** – Sustain high speed under fatigue .

Training for Speed Development

- **Reaction Ability** – Practice quick starts.
- **Acceleration Ability** – Increase speed in short bursts.
- **Locomotor Ability** – Train for sustaining top speed.
- **Movement Speed** – Improved in competitions.
- **Speed Endurance** – Time trials, competition runs .

Methods of Speed Development

1. **Acceleration Run Method**
 - Emphasis on *acceleration phase*.
 - Athlete accelerates quickly, slows down after top speed.
 - **Phases:**

- Acceleration → Racing → Deceleration.

- Reps: 8–12, Rest: 60–120 sec .

2. Pace Run Method

- **Racing Pace Runs** – Maintain race pace (longer than competition).
- **Varied Pace Runs** – Alternate speeds, effective for advanced athletes.
- Reps: 6–8, Rest: 90–120 sec .

Agility

Definition: Ability to **change direction, speed, and movement quickly** in response to stimuli.

Factors Determining Agility

1. Speed.
2. Reaction time.
3. Coordination.
4. Balance .

Training Methods

- **Agility drills:** Cone runs, ladder drills, shuttle runs.
- **Plyometrics:** Jump squats, box jumps.
- **Reaction training:** Respond to cues.
- **Speed training:** Sprint & hill sprints .

Training Techniques

- Change of direction (zig-zag runs).
- Acceleration & deceleration (shuttle runs).
- Lateral movements (side shuffles).
- Agility ladder drills .

Principles

- Progressive overload.
- Specificity (sport-based drills).
- Variety (avoid plateaus) .

Benefits

- Improved athleticism.
- Injury prevention.
- Enhanced performance .

Unit 6 (Class 5)

Coordination | Types | Characteristics | Training | Psychological Preparation

Coordination

- **Definition:** Ability to perform movements with **perfection, efficiency, smoothness & accuracy**.
- Combines **strength, speed, endurance, flexibility** .

Types of Coordinative Abilities

1. **Adaptive** → Adjusting movement to changes.
2. **Balance** → Maintain stability.
3. **Rhythm** → Observe rhythm & regain balance.
4. **Reaction** → Immediate response to signals.
5. **Coupling** → Combine body part movements.
6. **Differentiation** → Harmony of phases & body parts.
7. **Orientation** → Sense body position in time & space .

Characteristics of Coordination

- Dependent on **CNS & movement perception**.
- Linked with **conditional & psychic abilities**.
- Necessary for **skill acquisition**.
- Each ability has **general & specific aspects**.
- Appear in different combinations across sports .

Improvement Principles (Blume, 1978)

1. Practice & physical exercise = main method.
2. Exercises must be **correctly executed** with conscious control.
3. Improve sense organ function (vision, balance, etc.).
4. Use exercises targeting single or multiple abilities (e.g., obstacle runs).
5. Gradually **increase difficulty** via:

- Movement variation, external conditions, combining movements, time pressure, fatigue .

Benefits of Coordination

- Better motor control & balance.
- Faster reaction time.
- Greater efficiency, less energy use.
- Improved sports performance.
- Useful in **injury prevention & rehabilitation** .

Coordination Training Methods

- **Agility drills** (cone, ladder runs).
- **Balance training** (balance boards).
- **Reaction training** (reaction ball).
- **Plyometrics** (jump squats, box jumps).

Principles: Progressive overload, Variety, Specificity .

Psychological Preparation for Competition

Long-Term

- Develop positive **attitudes, motives, volitional qualities** (persistence, self-control, concentration).
- Build specific **psychic abilities** (sense of time, rhythm, tactical awareness).

- Improve **tolerance to psychic load** .

Short-Term (Meso-cycle → during/after event)

- 4–6 weeks before → Information on competition, opponents, environment.
 - 1–2 days before → Manage **pre-start states** (optimum readiness, start fever, depression).
 - During warm-up → Familiarization with venue/equipment.
 - During competition → Anxiety reduces; coach guides via breathing, relaxation.
 - After competition → Self-talk, positive attitude, mental imagery for confidence .
-

Unit 6 (Class 6)

Sports Injury Prevention | Factors | Warm-up | Stretching | Taping & Bracing | Protective Equipment

Sequence of Injury Prevention

1. Establish **extent** of injury (incidence, severity).
 2. Establish **etiology & mechanism**.
 3. Introduce **preventive measures**.
 4. Re-assess effectiveness.
-

Risk Factors

Intrinsic Factors

- **Non-modifiable** → Age, Gender, Ethnicity, Genetics.
- **Modifiable** → Muscle strength, Flexibility, Skill level, Previous injuries.

Extrinsic Factors

- Training, Nutrition, Equipment, Environment, Others.

Factors in Prevention

1. Warm-up

- Increases blood flow, oxygen delivery, nerve impulse speed.
- Reduces stiffness, connective tissue injury, and sudden strain.
- Should last until mild sweating without fatigue (≈30 min effect).

2. Stretching

- Before & after exercise; gentle & slow.
- **Types:**
 - *Static* (safe, 30–60 sec hold).
 - *Ballistic* (bouncing, risky, used in gymnastics/dance).
 - *PNF* (contract-relax; best for flexibility, risk of overstretch).

3. Taping & Bracing

- Restrict undesired motion, support joints (ankle, wrist, knee).
- Indications → *Prevention* (basketball ankles) & *Rehabilitation*.
- Risks → Reduced circulation, skin irritation, slipping.

4. Protective Equipment

- Helmets, face shields, pads, guards, gloves, gum shields.
- Prevent direct contact with injured parts.

5. Suitable Equipment

- Age/size appropriate (junior rackets, smaller bats).
- Sport-specific footwear & gear; defective equipment ↑ risk.

6. Environmental Factors

- Extreme heat → Heat cramps/prostration.
- Cold → Frostbite, hypothermia.
- Uneven, wet, icy surfaces → Falls & collisions.

7. Appropriate Training

- Sport-specific, with adequate rest & recovery.
- Individualized based on age, skill, tolerance.

8. Psychology

- Excess arousal → Loss of focus, ↑ injury.
- Under-arousal → Neglect of warm-up & readiness.

9. Nutrition

- Poor glycogen repletion → Fat/protein breakdown → Soft tissue injury.
- Inadequate protein → Muscle breakdown.
- Poor hydration → Reduced blood flow, ↑ cramps.
- Low micronutrients (Ca, P) → Bone weakness.

Unit 6 (Class 7)

Sports Injuries | Rehabilitation | Recovery & Regeneration Techniques

Sports Injuries

- **Definition:** Injuries during athletic activities or physical exertion.
- **Causes:** Accidents, poor training, faulty equipment, overuse.
- **Common Injuries:** Ankle sprain, Groin pull, Hamstring strain, Shin splints, ACL tear, Patellofemoral syndrome, Tennis elbow.

Injury Assessment

1. ABC

- **Airway** – Ensure clear airway.
- **Breathing** – Check respiration.
- **Circulation** – Ensure blood flow.

2. TOTAPS

- **Talk** – Ask what happened, where it hurts.
- **Observe** – Swelling, deformity, discoloration.
- **Touch** – Check tenderness, temperature.
- **Active** – Movement done by athlete.
- **Passive** – Movement assisted by assessor.
- **Skills** – Sport-specific skill test (run, hop, jump).

Treatment of Injuries

PRICER

- **Protection** – Remove from play.
- **Rest** – Immobilize.
- **Ice** – 15 min × 5/day to reduce swelling.
- **Compression** – Bandage for external pressure.
- **Elevation** – Injured part above heart level.
- **Referral** – To doctor/physio for diagnosis.

No HARM (first 48–72 hrs)

- **No Heat** – ↑ bleeding.
- **No Alcohol** – ↑ swelling, ↓ judgment.
- **No Running** – ↑ tissue damage.
- **No Massage** – ↑ bleeding & damage.

Rehabilitation of Injury

- Goal: Prevent re-injury, ensure safe return to play.
 - Components:
 - **Strengthening exercises.**
 - **Flexibility & mobility training.**
 - **Balance & proprioception drills.**
 - **Gradual return to skill-specific drills.**
-

Recovery & Regeneration Techniques

1. **Active Recovery** – Low-intensity exercise post-training.
 2. **Stretching** – Static & dynamic; yoga, pilates.
 3. **Hydration & Nutrition** – Carbs + proteins post-training.
 4. **Sleep & Rest** – 7–9 hrs/day, naps if needed.
 5. **Massage Therapy** – Relaxation, reduce muscle tension.
 6. **Cold Water Immersion** – Reduce inflammation.
 7. **Compression Therapy** – Enhance blood flow.
 8. **Foam Rolling** – Reduce tightness, ↑ flexibility.
 9. **Breathing/Relaxation** – Meditation, mindfulness.
 10. **Periodization** – Planned recovery cycles to prevent overtraining.
-

Unit 6 (Class 8)

Training Load | Components | Adaptation Process | Principles

Training Load

- **Definition:** The amount of **work/stress** (psychological & physiological) put on the body through training that leads to improved performance.
 - **Key Point:** Constant load → stagnation; progressive load → adaptation & improvement .
-

Components of Load

1. **Intensity** → Rate of work (e.g., sprint speed).
 2. **Density** → Ratio of load to recovery (rest between sets).
 3. **Volume** → Total work done (distance, reps, time).
-

Types of Load

- **External Load** → Work performed (e.g., 100m run, skipping).
 - **Internal Load** → Psychophysiological reaction (HR, lactic acid, fatigue) .
-

Factors Affecting Training Load

- **Movement Quality** – Degree of technical perfection.
- **Type of Exercise** – General, Specific, Competitive.

- **Load Intensity** – Stimulus pace (intensity) + stimulus density (rest ratio).
- **Load Volume** – Duration (time/distance) + Frequency (reps/sets) .

Adaptation Process

- **Definition:** Adjustment of **physical & psychological systems** to external load.
- **Mechanism:**
 - Exercise → Fatigue (lactic acid build-up).
 - Recovery → Restores energy & removes lactic acid.
 - Supercompensation → Performance capacity increases.
- **Requirement:** Regular training + proper load–recovery balance .

Principles of Training Load

1. **Continuity & Long-Term** – No long breaks; sustained load.
2. **Progression** – Gradual increase (volume → intensity).
3. **Variation** – Linear or step-wise increments.
4. **Adaptation** – Increase load only after recovery.
5. **Optimum Load** – According to individual capacity.
6. **Rest & Recovery** – Essential between sessions.

7. **Intensity vs Volume Balance** – High intensity = low volume & vice versa.
8. **General vs Specific Load** – General for beginners; Specific for advanced athletes.
9. **Training Cycles** – Macro, Meso, Micro cycles for adaptation .

Overload & Symptoms

- **Overload** = Load > recovery capacity.
- **Symptoms:** Fatigue, ↓ performance, loss of motivation, poor concentration, appetite loss, sleep disorder, ↑ injury risk .

Unit 6 (Class 9)

Sports Training | Technique Development | Adaptation | Load & Recovery

Sports Training

- **Style** → Individual expression of motor action.
- **Technique** → Motor procedure to tackle tasks.
- **Skill** → Effectiveness of executing a movement.

Technical Development

- Aim: **Tackle motor tasks effectively**; varies with sport type.
- **Types of Sports Techniques:**

1. Endurance Sports → Economy & effectiveness of movements.
2. Sprint Sports → High frequency & force, cover max distance in min time.
3. Explosive Strength Sports → Max momentum (e.g., Shot put, High jump).
4. Aerobic Sports → Precision, grace, beauty (e.g., Gymnastics).
5. Regulatory Sports → Control external objects (e.g., Sailing, Equestrian).
6. Combative Sports → Multiple techniques under changing conditions.
7. Games → Ball control, tactics, teamwork.

Technical Preparation

Rational Technique Method

1. **Assessment & Analysis** → Video, biomechanics, skill drills.
2. **Goal Setting** → SMART (specific, measurable, achievable, relevant, time-bound).
3. **Training Plan** → Structured drills, progressive overload, varied training.
4. **Practice & Repetition** → Deliberate, high-quality practice.
5. **Feedback** → Immediate, video review, peer input.
6. **Mental Training** → Visualization, focus, concentration.

7. **Evaluation & Adjustment** → Regular review, flexible plans.
8. **Injury Prevention** → Warm-up, cool-down, recovery strategies.

Stages of Technical Training

1. Skill learning.
2. Skill acquisition.
3. Skill execution.

Laws of Adaptation

1. Optimum load → Better adaptation.
2. Correct proportion of load & recovery = essential.
3. Faster in beginners vs trained sportsmen.
4. New/unusual exercises → Faster adaptation.
5. Specific load → Specific development.
6. Adaptation not permanent; declines if training stops.
7. Max load 2–3 times/year → Optimum adaptation.
8. Balance of intensity & volume → Faster adaptation.
9. Continuity required; sporadic training = no adaptation.
10. Adaptation time depends on training structure.
11. Variation helps create quicker supercompensation.

Load & Recovery

Factors Affecting Recovery

1. Intensity → High = fast fatigue & recovery.
2. Volume → High = slower fatigue & delayed recovery.
3. Nature of Load → ATP-CP system = faster recovery; glycogen = slow.
4. Health → CNS & hormones influence recovery.
5. Physical Fitness → Fit athletes recover faster.
6. Nutrition → Balanced diet + hydration accelerates recovery.
7. Sleep → 7–8 hrs essential.
8. Daily Routine → Regular rhythm aids recovery.
9. Total Load → Beyond capacity delays recovery.
10. Age → Younger recover faster.
11. Sex → Men faster than women.
12. Experience → Skilled athletes recover quicker.
13. Climate → Cold = faster recovery vs hot.

Unit 6 (Class 10)

Sports Training – General Objectives

- Process of preparing an athlete for **highest performance**.
- Develops:
 - Multilateral physical development
 - Sport-specific physical skills

- Technical skills
- Tactical abilities
- Psychological qualities
- Health maintenance
- Injury resistance
- Theoretical knowledge

Tactics & Strategy

Strategy

- *Definition:* Organization of training, play, or competition based on a philosophy or approach.
- *Meaning:* *Art of projecting & directing plans.*
- Focus: **Long-term**, broader aspects (space, time, overall performance).
- Example: Planning tournaments & training for **international success**.

Tactics

- *Definition:* Organization of sportsman's competitive actions; **art of competing**.
- *Meaning:* From Greek *taktika* = arrangement.
- Focus: **Short-term actions** in actual game situations.
- Means: Motor actions, gestures, behavior, language.

- Types of tactics:
 1. **Offensive** – create scoring chances.
 2. **Defensive** – prevent opponent's success.
 3. **High-performance** – advanced competitive strategies.
-

Tactical Training & Efficiency

- **Aim:** Improve strategy & tactical use of abilities.
- Requires: Knowledge of rules, repeated practice, observation & analysis.
- Example in Soccer: Passing, dribbling, tackling, pace variation.

Determinants

- High technical proficiency.
 - Efficient physical & psychological adaptation.
 - Ability to maintain performance under fatigue & pressure.
-

Tactical Preparation

- **Definition:** Specific actions & plans to realize strategy.
- **Focus:** Practical implementation of strategies in competition.
- **Types:**
 - Individual tactics.
 - Group tactics.

- Team tactics.
- Offensive & Defensive applications.

Principles (Blume, 1978)

1. Unity of theory & practice.
 2. Quick & correct perception of tactical situations.
 3. Planning for competitions.
 4. Formulating competition plan independently.
 5. Developing cognitive & emotional readiness.
 6. Regular evaluation of tactical behavior.
 7. Exposure to new & unexpected situations.
 8. Creative self-effort.
-

Unit 6 (Class 11)

Multilateral Physical Development | Sport-Specific Development | Offensive & Defensive Strategies

Multilateral Physical Development

Definition: Training approach focusing on **overall development** of strength, endurance, speed, flexibility, coordination, and fundamental skills.

Key Components

1. **Strength** – Core + resistance training.
2. **Endurance** – Running, swimming, cycling.

3. **Speed & Agility** – Sprints, ladders, cone drills.
4. **Flexibility** – Stretching, yoga, mobility drills.
5. **Coordination & Balance** – Balance boards, hand–eye tasks.
6. **Skill Development** – Throwing, catching, kicking.

Benefits

- Reduced injury risk.
- Enhanced athletic performance.
- Increased enjoyment, prevents burnout.
- Long-term athlete adaptability.
- Promotes teamwork & social skills.

Sport-Specific Physical Development

Definition: Training **tailored to demands of a particular sport.**

Focus Areas

1. **Assessment** → Sport analysis + athlete assessment.
2. **Strength Training** → Targeted muscles & functional drills.
3. **Speed & Agility** → Sprints, plyometrics.
4. **Endurance** → Interval training, aerobic fitness.
5. **Flexibility** → Dynamic & static stretching.
6. **Recovery & Injury Prevention** → Rest, active recovery, preventive drills.

7. **Nutrition** → Sport-specific diet & hydration.

8. **Mental Preparation** → Visualization, goal-setting.

Conclusion: Enhances **specialized fitness, reduces injury, and ensures peak performance.**

Strategies in Sports

Strategy

- Long-term **plan for achieving goals.**
- Example: Olympic training plan.

Tactics

- **Short-term competitive actions** to solve in-game situations.
- Means: Movements, communication, behavior.

Offensive vs Defensive Strategies

Offensive Strategy

- Quick movement to create space.
- Spread out attack, shield ball.
- Tight passing, use depth (forward/backward).
- **Soccer:** Passing, dribbling, shielding, attacking depth.
- **Basketball:** Speed game, passing, pick & roll.

Defensive Strategy

- Guard between opponent & goal.
- Force play to sides, reduce shooting angle.
- **Soccer**: Zone + man-to-man defense.
- **Basketball**: Man-to-man, Zone, Combination (Box & one).

Unit 6 (Class 12)

Strength | Training Methods | Periodization | Talent Identification

Strength – Definition & Characteristics

- **Strength**: Ability of a muscle/group to generate **force against resistance**.
- **Characteristics**:
 - Conditional ability.
 - Involves **single or group muscle contraction**.
 - Measured in **kilograms**.
 - **Lab tests** → *Dynamometer, Sensitometer, Cybex*.
 - **Field tests** → *1RM Bench Press, 1RM Leg Press, 1RM Squat*.

Types of Strength

1. **Static (Isometric)** → Tension ↑ but muscle length unchanged (e.g., pushing wall).
2. **Dynamic (Isotonic)** → Tension ↑ + change in length.

- **Eccentric**: Muscle lengthens (elbow extension).
- **Concentric**: Muscle shortens (elbow flexion).
- **Isokinetic**: Constant speed contraction (Cybex machine).
- Sub-types:
 - *Maximum strength* – lift max load (e.g., weightlifting, shot put).
 - *Explosive strength* – Strength × Speed (e.g., jumps, sprints).
 - *Strength endurance* – Sustain moderate/high force under fatigue.

3. **Specific Strength** – For particular sport.

4. **Relative Strength** – Max strength ÷ body weight.

5. **General Strength** – Overall body strength.

Development of Strength

- **Maximum strength** → Weight training.
- **Explosive strength** → Plyometrics, medicine ball, weight training.
- **Strength endurance** → Circuit training, hill running, dumbbells, repetitions.

Methods of Strength Improvement

1. **Isotonic Method** – *Delorme (1954)*, muscle contraction with length change.

2. **Isometric Method** – *Hettinger & Müller (1953)*, static contraction.
3. **Isokinetic Method** – *Perrine (1960)*, constant speed contraction.
4. **Sub-maximal Resistance Method** – Builds max + explosive strength.
5. **Reactive Method (Depth Jumps)** – For explosive strength (40–120 cm height).
6. **Circuit Training** – *Morgan & Anderson (1953)*; 8–12 stations, 60–80% intensity, 30–45 sec work, 5–15 sec rest.
7. **Fartlek Training** – *Gosta Holmer (1937)*; endurance, 15+ min, HR 140–160 bpm.
8. **Interval Training** – *Gerschler & Reindell (1930)*;
 - *Intensive*: 80–90% intensity.
 - *Extensive*: 60–80% intensity.

Weight Training Guidelines

Type	Load %	Reps	Sets	Rest
Maximum Strength	85–100%	1–5	6–8	3–5 min
Explosive Strength	75–85%	6–10	8–10	3–5 min
Strength Endurance	40–60%	≥12 (many reps)	3–5	30–45 sec

Periodization

- **Definition:** Systematic planning of training for **peak performance**.
- **Phases:**
 1. **Preparatory Phase** – Build general fitness.
 2. **Competition Phase** – Maintain top performance.
 3. **Transition Phase** – Recovery & relaxation.
- **Cycles:**
 - **Macro-cycle** → 3–12 months.
 - **Meso-cycle** → 3–6 weeks.
 - **Micro-cycle** → 3–10 days.

Talent Identification

- **Definition:** Discovering individuals with **physical, technical, psychological traits** for success.
 - **Methods:** Physical tests, skill evaluation, psychological tests.
 - **Focus:** Potential for long-term development.
 - **Excludes:** Career counseling.
-

Professor academy

UNIT – 7 Sports Nutrition

Unit 7 (Class 1)

Health | Nutrition | Food | Nutrients | Macro vs Micro Nutrients

Health

- “Health is a state of **complete physical, mental, and social well-being**, not merely absence of disease/infirmity”

Nutrition (உணவுச்சத்து)

- Process of obtaining and using food & nutrients for **growth, health & proper body function**.
- **Balanced Diet** : Contains all nutrients in right proportion .

Key Components

1. **Nutrient Intake**
2. **Digestion**
3. **Absorption**
4. **Metabolism** – converts nutrients into energy.
5. **Excretion/Egestion**– removes waste .

Food

- Any substance consumed to provide **nutritional support**.
- Origin: **Plant or Animal** .

Nutrients - Compounds required for **growth, metabolism, body functions** .

6 Classes of Nutrients

1. **Macronutrients** (needed in large amounts):

- Carbohydrates
- Proteins
- Fats
- Water

Caloric Values/ Atwater Factors (energy yield values):

- Carbohydrates = 4 kcal/g
- Proteins = 4 kcal/g
- Fats = 9 kcal/g
- Alcohol = 7 kcal/g

RQ (Respiratory Quotient): Tells which fuel is used

$$RQ = \frac{VCO_2}{VO_2}$$

VCO_2 = Volume of carbon dioxide produced.

VO_2 = Volume of oxygen consumed.

- Carbs = 1.0, Protein = 0.8, Fat = 0.7.

2. **Micronutrients** (needed in small amounts):

- Vitamins (Fat-soluble & Water-soluble)
- Minerals

Unit 7 (Class 2)

Water-Soluble Vitamins | Minerals | Deficiency, Signs & Sources

Water-Soluble Vitamins

Vitamin	Functions	Deficiency Disease	Symptoms
B1 (Thiamine)	Energy metabolism, nerve & muscle function	Beriberi	Weakness, fatigue, nerve damage
B2 (Riboflavin)	Energy production	Ariboflavinosis	Cracks at mouth corners, sore throat, magenta tongue
B3 (Niacin)	Energy production, DNA repair, skin & digestion	Pellagra	4 D's → <i>Diarrhea, Dermatitis, Dementia, Death</i>
B5 (Pantothenic acid)	Coenzyme in metabolism	Rare deficiency	Fatigue, digestive issues

B6 (Pyridoxine)	Protein metabolism, immune function	Anemia	Weakness, depression, irritability
B7 (Biotin)	Coenzyme, fat & carb metabolism	Rare; Dermatitis	Skin issues, hair loss
B9 (Folate)	DNA synthesis, cell division, fetal development	Megaloblastic anemia, neural tube defects in fetus	Fatigue, neural tube defects
B12 (Cobalamin)	RBC formation, nerve function, DNA synthesis	Pernicious anemia	Fatigue, weakness, neurological issues
Vitamin C (Ascorbic Acid)	Antioxidant, collagen synthesis, immunity	Scurvy	Bleeding gums, weakness, poor wound healing

Essential Minerals

Mineral	Functions	Deficiency Disease	Symptoms	Sources
Calcium	Bones/teeth, muscle contraction, nerve transmission, blood clotting	Osteoporosis, Rickets	Weak bones, fractures, cramps	Dairy, leafy greens, fortified foods

Phosphorus	Bones/teeth, energy metabolism, DNA/RNA synthesis	Demineralization	Bone pain, weakness, fatigue	Meat, dairy, fish, eggs, nuts
Magnesium	Enzyme action, muscle/nerve function, protein synthesis	Deficiency → cramps, arrhythmia	Fatigue, nausea	Greens, nuts, seeds, legumes
Sodium	Fluid balance, nerve/muscle function, BP regulation	Hyponatremia	Confusion, seizures, headache	Salt, pickles, soups
Potassium	Fluid balance, nerve function, muscle contraction	Hypokalemia	Weakness, irregular heartbeat	Banana, potato, spinach
Chloride	Acid-base & fluid balance, stomach acid	Hypochloremia	Dehydration, cramps, vomiting	Salt, seaweed, celery
Iron	Hemoglobin synthesis, O ₂ transport Iron absorption enhancer: Vitamin C.	Iron-deficiency anemia	Fatigue, pale skin, dizziness	Meat, spinach, beans

	Iron absorption inhibitor: Phytates (grains), tannins (tea), calcium.			
Zinc	Immunity, wound healing, protein synthesis	Growth retardation	Loss of appetite, poor healing	Meat, nuts, legumes
Copper	Iron metabolism, collagen	Menkes/Wilson's disease	Weakness, brittle bones	Shellfish, nuts, liver
Iodine	Thyroid hormones, metabolism	Goiter, Hypothyroidism	Neck swelling, fatigue	Iodized salt, seafood
Selenium	Antioxidant, immunity	Keshan disease	Muscle pain, heart issues	Brazil nuts, seafood
Fluoride	Tooth enamel, bone health	Dental caries / Fluorosis	Weak teeth, bone pain	Fluoridated water, tea
Manganese	Enzyme function, bone formation	Bone deformities	Growth retardation	Nuts, seeds, greens
Chromium	Insulin action, glucose metabolism	Impaired glucose tolerance	High blood sugar, fatigue	Broccoli, grains, eggs

Sports anemia/pseudo anemia: Temporary drop in Hb concentration due to plasma expansion in endurance athletes (not true iron deficiency).

Key difference: Iron deficiency anemia = ↓ Hb + ↓ ferritin/iron stores.

Sports anemia = ↓ **Hb only** (due to plasma expansion).

Unit 7 (Class 3)

Ergogenic Aids | Female Athlete Triad | Doping & Anti-Doping Agencies

Ergogenic Aids

- “Ergon = Work” + “Gen = Produce” → Any aid that enhances **performance, endurance, or recovery**.
- **Types:**
 1. **Mechanical** – Shoes, swimsuits, prosthetics, bikes, racquets.
 2. **Nutritional** – Caffeine, Creatine, Protein, Carbs, BCAAs, Beetroot juice, Iron, Vit D.
 3. **Pharmacological** – Substances altering physiological processes (many banned).
 4. **Physiological** – Blood doping, oxygen tents, altitude training.
 5. **Psychological** – Mental training, visualization, relaxation.

Examples:

- *Caffeine* → alertness, endurance.
- *Creatine* → short, high-intensity bursts.
- *Beta-alanine* → buffers lactic acid.
- *Protein* → muscle recovery.
- *Beetroot juice* → blood flow.

Caffeine dose for performance: 3–6 mg/kg BW (ergogenic effect).

Creatine loading phase: 20 g/day for 5–7 days → maintenance 3–5 g/day.

Female Athlete Triad

- Interrelated condition common in sports emphasizing **leanness**.
- **Three Components:**
 1. **Energy Deficiency** → Due to inadequate intake/excessive training.
 2. **Menstrual Dysfunction** → Amenorrhea, Oligomenorrhea.
 3. **Low Bone Mineral Density (BMD)** → Osteopenia, Osteoporosis.

Causes: Intense training, body image issues, eating disorders, psychological stress.

Symptoms: Fatigue, irregular/absent periods, stress fractures, mood swings, poor performance.

Management:

- Nutrition rehabilitation.

- Training modification (reduce intensity).
- Medical intervention (hormone therapy).
- Psychological support (CBT).
- Education for athletes, coaches, parents.

Doping & Anti-Doping

WADA (World Anti-Doping Agency)

- Founded: 1999, HQ: Montreal.
- Motto: *Play True*.
- President: Witold Bańka (2024).
- Funded by IOC + Governments.

NADA (National Anti-Doping Agency – India)

- Founded: 2005, HQ: New Delhi.
- Motto: *Dope Free Sports*.
- DG: Ritu Sain (2024).
- Funded by Ministry of Youth Affairs & Sports.

Prohibited List (WADA)

- **Always Prohibited:**
 - S0: Non-approved substances.
 - S1: Anabolic agents.
 - S2: Peptide hormones (EPO).

- S3: Beta-2 agonists.
- S4: Hormone modulators.
- S5: Diuretics/masking agents.
- M1–M3: Blood, chemical, gene doping.

- **In Competition Only:**

- S6: Stimulants.
 - S7: Narcotics.
 - S8: Cannabinoids.
 - S9: Glucocorticoids.
 - P1: Beta-blockers (in precision sports).
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Unit 7 (Class 4)

Macronutrients | Carbohydrates | Proteins | Functions & Importance

Carbohydrates

- **Composition:** C, H, O → General formula = $(CH_2O)_n$.
- **Primary Energy Source** for ATP production.

Types

1. **Monosaccharides** → Glucose, Fructose, Galactose.
2. **Disaccharides** → Sucrose (Glucose+Fructose), Lactose (Glucose+Galactose), Maltose (Glucose+Glucose).
3. **Polysaccharides** →

- Starch (plants, storage).
- Glycogen (animals, storage).
- Cellulose (plants, structural).

Functions

- Energy supply to muscles & brain.
- Regulates blood sugar.
- Spares protein from being used as energy.
- Dietary fiber aids digestion.

GI & GL

Glycemic Index (GI): Speed of rise in blood glucose after food (Scale 0–100).

Glycemic Load (GL): $GI \times \text{Carbohydrate content} / 100 \rightarrow \text{better indicator than GI alone.}$

Proteins

- Made of **20 amino acids** → building blocks of life.
- **Levels of Structure:** Primary → Secondary → Tertiary → Quaternary.

Types of Proteins (Examples & Functions)

- **Structural** → Collagen, Keratin (support, strength).
- **Enzymes** → Amylase, Pepsin (speed reactions).

- **Transport** → Hemoglobin, Albumin (carry O_2 , nutrients).
- **Hormonal** → Insulin, GH (regulate body).
- **Defensive** → Antibodies (fight infection).
- **Contractile** → Actin, Myosin (movement).
- **Storage** → Ferritin, Casein (nutrient storage).

Amino Acids

- **Essential (9)** → Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan, Valine.
- **Non-essential** → Synthesized by body.
- **Conditionally Essential Amino Acids (CEAAs):**
 - ✓ **Arginine**
 - ✓ **Cysteine**
 - ✓ **Glutamine**
 - ✓ **Tyrosine**
 - ✓ **Glycine**
 - ✓ **Proline**

Note: **Branched-Chain Amino Acids (BCAAs):** Leucine, Isoleucine, Valine → key for muscle recovery.

Leucine → key trigger for **muscle protein synthesis** (threshold $\approx 2\text{--}3$ g/meal).

Glutamine - most abundant free amino acid

Whey protein → fast digestion, post-workout.

Casein protein → slow digestion, best before sleep.

Complete vs Incomplete Proteins

Feature	Complete Proteins	Incomplete Proteins
Definition	Contain all 9 essential AAs	Missing ≥ 1 essential AA
Sources	Animal foods, Soy, Quinoa	Grains, Legumes, Nuts
Efficiency	Better for muscle growth	Combine foods for completeness

Limiting amino acid: The essential amino acid present in the lowest proportion in a food (e.g., Lysine in cereals, Methionine in pulses).

Limiting amino acids:

- Cereals → Lysine limiting.
- Pulses → Methionine limiting.

Protein Complementation → Combining foods (e.g., Rice + Dal, Chapati + Peanut butter, Beans + Corn) provides all essential amino acids.

Protein Quality Measures

- **Biological Value (BV):** % of absorbed protein retained by body (Egg = 100, highest BV).
- **Net Protein Utilization (NPU):** Ratio of nitrogen retained to nitrogen intake.
- **PDCAAS (Protein Digestibility Corrected Amino Acid Score):** Measures protein quality considering digestibility + essential amino acid profile (Whey, Soy = 1.0).

Unit 7 (Class 5)

Hydration | Sports Drinks | Dehydration | Recovery

Functions of Water

1. Hydration – Maintains fluid balance.
2. Temperature regulation – Sweating prevents overheating.
3. Nutrient transport – Delivers O₂ & nutrients to muscles.
4. Joint lubrication – Prevents injuries.
5. Muscle function – Reduces cramps.
6. Waste removal – Flushes toxins.
7. Mental focus – Prevents fatigue.
8. Energy production – Supports metabolism .

Hydration Guidelines

- **Daily Intake:** 3–4 L/day for athletes.
- **Pre-Exercise:** 500–600 ml (2 hrs before) + 200–300 ml (10–20 min before).
- **During Exercise:** 200–300 ml every 10–20 min; 400–800 ml/hr in endurance.
- **Post-Exercise:** Replace 1 kg weight loss with 700–1000 ml water; rehydrate within 2–6 hrs .

Sports Drinks

1. **Isotonic** (6–8% carbs + electrolytes) → Energy + hydration.

- Best for endurance (marathon, football, cycling).
 - Examples: Gatorade, Powerade .
2. **Hypotonic** (<6% carbs, more water) → Rapid hydration, low energy.
- Best for quick rehydration (swimmers, tennis).
 - Examples: Mizone, Aquarius .
3. **Hypertonic** (>8% carbs, high sugar) → Energy replenishment, not hydration.
- Best for ultra-endurance & recovery.
 - Examples: High-carb shakes .

Hydration Strategies by Sport

- **Endurance:** 150–250 ml every 15–20 min; electrolyte drinks for >60 min.
- **Strength/Power:** 150–250 ml every 15–20 min; recovery with protein + electrolytes.
- **Team Sports:** 200–300 ml every 15–20 min; focus on carb + electrolytes.
- **Racquet Sports:** 200–250 ml every changeover; add sodium for cramps.
- **Combat Sports:** Sip small amounts; gradual post-fight hydration.
- **Swimmers:** 100–150 ml every 20–30 min; may not feel thirsty.

- **Cold Weather Sports:** Warm fluids every 15–20 min; caffeine helps maintain temp .

Dehydration in Athletes

- **Causes:** Excess sweating, poor intake, climate stress.
- **Symptoms:** Fatigue, dizziness, cramps, nausea, headache, ↓ performance.
- **Severe:** Vomiting, diarrhea, confusion, PEES (Post-Extreme Endurance Syndrome)

% Body weight loss in fluids:

- 2% = performance ↓
- 4% = muscle cramps,
- 6% = heat exhaustion.

4 R's of Recovery

1. **Rehydrate** – Replace lost fluids.
 2. **Refuel** – Carbs to restore glycogen.
 3. **Repair** – Proteins for muscle recovery.
 4. **Rest** – Sleep & relaxation .
-

Unit 7(Class 6)

Sports Nutrition | Pre-, During & Post-Exercise Nutrition | Carbs | Proteins | Fats

Carbohydrates (CHO)

- **Functions:** Immediate energy, glycogen storage, delay fatigue, aid recovery.
- **Types:**
 - **Simple** (fast-digesting) → fruits, honey, white rice, sports drinks.
 - **Complex** (slow-digesting) → oats, quinoa, legumes, vegetables.
- **Requirements:**
 - Light activity → 3–5 g/kg BW/day.
 - Moderate (1 hr/day) → 5–7 g/kg.
 - Endurance (1–3 hrs/day) → 6–10 g/kg.
 - Ultra-endurance (4+ hrs/day) → 8–12 g/kg.
- **Timing:**
 - *Pre* (1–4 hrs before): High-carb, low-fat meal.
 - *During* (endurance): 30–60g/hr.
 - *Post* (within 30–60 min): High GI carbs + protein (3:1 ratio).
- **Carb Loading:** Maximizes glycogen storage 2–3 days before long events (>90 min).

- Deficiency → Early fatigue, poor recovery.
- Excess → Energy crashes, weight gain, digestive issues

Glycogen Storage Capacity

- **Liver glycogen:** ~80–100 g (maintains blood glucose).
- **Muscle glycogen:** ~300–400 g (fuel for muscle activity).
- **Total body glycogen:** ~400–500 g in a normal person (~1,600–2,000 kcal energy).
- **Well-trained athletes (after carb loading):** Can store up to 600–700 g glycogen.

Glycogen–Water Relationship

- 1 g of glycogen is stored with ~3–4 g of water.

Proteins

- **Functions:** Muscle repair, recovery, performance support.
- **Requirements:**
 - Endurance → 1.2–1.6 g/kg BW/day.
 - Strength/Power → 1.6–2.2 g/kg.
 - Team Sports → 1.4–1.8 g/kg.
- **Sources:**
 - *Animal:* Chicken, fish, eggs, dairy, whey.
 - *Plant:* Lentils, chickpeas, quinoa, tofu, chia seeds.
- **Pre-Workout:** Oats + protein, yogurt + honey, chicken + rice.

- **Post-Workout:** Eggs, fish, Greek yogurt, quinoa, nuts.
- **Supplements (by sport):**
 - Strength → Whey, casein, creatine blends.
 - Endurance → Whey, collagen, BCAAs.
 - Team Sports → Whey + carbs, casein.
 - Combat → Whey isolate, electrolyte blends.
 - Vegan → Pea, rice, soy, hemp proteins.
- **Deficiency** → Muscle loss, slower recovery, fatigue.
- **Excess** → Kidney strain, dehydration

Fats

- **Essential Fatty Acids:** Linoleic acid (Omega-6), α -Linolenic acid (Omega-3).

Omega-3 vs Omega-6 Fatty Acids

Feature	Omega-3 (n-3)	Omega-6 (n-6)
Key Types	ALA → Alpha-Linolenic Acid	Linoleic acid → Arachidonic acid
	EPA → Eicosapentaenoic Acid	
	DHA → Docosahexaenoic Acid	

Sources	Fish oil, flaxseed, chia, walnuts, algae	Sunflower, soybean, corn oil, nuts, seeds
Functions	Anti-inflammatory, supports brain, eye & heart health, improves recovery	Pro-inflammatory (immune response, cell signaling), growth & repair

Ideal Ratio (ω -6 : ω -3): Recommended ~4:1 to 5:1; Western/Indian diet often >15:1

Functions:

Long-term energy, hormone production, vitamin absorption, joint/brain health.

Sources:

- *Healthy:* Olive oil, nuts, avocados, fatty fish, flaxseeds.
- *To Avoid:* Trans fats (fried, processed foods), excess saturated fats.
- **Requirements:** 20–35% of daily calories.
 - Endurance → 0.8–1.5 g/kg BW/day.
 - Strength → 0.5–1.0 g/kg.
- **Omega-3 Importance:** ↓ inflammation, ↑ recovery, protects cartilage, boosts flexibility.
 - Sources: Fatty fish, chia seeds, walnuts, algae supplements.
 - Dose: 1,000–3,000 mg/day EPA+DHA (with meals).
- **Deficiency** → Low energy, poor recovery, muscle loss.

- **Excess** → **Weight gain, cardiovascular issues, inflammation**

Unit 7 (Class 7)

Micronutrients | Supplements | RDI for Athletes

Fat-Soluble Vitamins

Vitamin	Functions	Food Sources
A	Vision, immunity, antioxidant	Carrots, sweet potato, liver
D	Bone health, Ca absorption, muscle function	Sunlight, dairy, fish, eggs
E	Antioxidant, protects muscles, recovery	Nuts, seeds, spinach, oils
K	Blood clotting, bone health	Leafy greens, broccoli

Water-Soluble Vitamins

Vitamin	Functions	Food Sources
C	Antioxidant, collagen, immunity	Citrus fruits, kiwi, peppers
B1	Carbs → energy, nerve function	Whole grains, pork, nuts
B2	Energy metabolism, RBC production	Dairy, eggs, almonds
B3	Metabolism, muscle recovery	Meat, fish, peanuts
B5	Energy, ↓ fatigue	Avocados, eggs, mushrooms
B6	Protein metabolism, Hb formation	Poultry, bananas, potatoes

B7	Fat/carb metabolism, skin & hair	Eggs, seeds, sweet potatoes
B9	DNA synthesis, RBCs	Leafy greens, legumes
B12	Nerve function, RBCs, energy	Meat, fish, dairy

Minerals

Macrominerals

- **Calcium** → Bone strength, muscle contraction (Dairy, greens).
- **Magnesium** → Muscle relaxation, energy (Nuts, whole grains).
- **Phosphorus** → Works with Ca, energy (Meat, fish, nuts).
- **Sodium** → Fluid balance, nerve function (Salt, sports drinks) - **Electrolyte lost most in sweat = Sodium.**
- **Potassium** → Muscle contraction, electrolyte balance (Bananas, beans).
- **Chloride** → Fluid balance, digestion (Salt, tomatoes).

Trace Minerals

- **Iron** → O₂ transport, prevents anemia (Meat, spinach, cereals).
- **Zinc** → Muscle repair, immunity (Meat, seafood, nuts).
- **Copper** → Iron absorption, RBCs (Shellfish, whole grains).
- **Manganese** → Bone formation, metabolism (Nuts, pineapple).
- **Iodine** → Thyroid & metabolism (Iodized salt, fish).
- **Selenium** → Antioxidant, immunity (Brazil nuts, seafood).
- **Chromium** → Insulin function, glucose metabolism (Grains, broccoli).

- **Fluoride** → Bone & teeth strength (Water, tea, fish).

Recommended Dietary Intake (RDI)

- **Vitamin A:** 700–900 mcg (UL 3,000 mcg)
- **Vitamin D:** 600–2,000 IU (UL 4,000 IU)
- **Vitamin C:** 75–90 mg (UL 2,000 mg)
- **Vitamin B12:** 2.4–5 mcg (No UL)
- **Calcium:** 1,000–1,500 mg (UL 2,500 mg)
- **Iron:** 8–18 mg (Endurance athletes: 25 mg; UL 45 mg)

Key Supplements for Athletes

- **Protein (Whey, Casein, Plant-based)** → 1.2–2.0 g/kg BW/day; muscle repair.
- **Creatine** → 3–5 g/day; ↑ strength, power, mass.
- **BCAAs** → 5–10 g pre/post; muscle recovery, ↓ soreness.
- **Beta-Alanine** → 3–6 g/day; delays fatigue.
- **Caffeine** → 3–6 mg/kg BW; ↑ focus & endurance.
- **Omega-3 (Fish oil)** → 1–3 g/day EPA+DHA; ↓ inflammation, joint health.
- **Electrolytes** → 500–700 mg sodium/L during endurance.
- **Vitamin D + Calcium** → Bone strength.
- **L-Citrulline** → 6–8 g pre-workout; ↑ blood flow, ↓ fatigue.

- **Beetroot Juice (Nitrates)** → 300–600 mg nitrate 2–3 hrs before; ↑ endurance.
 - **Antioxidants (Vit C, E, CoQ10)** → ↓ oxidative stress.
 - **Iron (Lactoferrin)** → 10–15 mg/day; ↑ O₂ uptake.
-

UNIT - 7

Unit 7 (Class 1)

Body Systems | Development | Aging | Health Implications

Musculoskeletal System

- Childhood → Rapid bone growth.
- Adulthood → Peak bone density (~25 yrs).
- Aging → Bone loss (osteoporosis), muscle loss (sarcopenia).

Cardiovascular System

- Childhood → Higher heart rate.
- Adulthood → Peak cardiac output.
- Aging → ↓ heart efficiency, arterial stiffness → hypertension.

Respiratory System

- Childhood → Lung growth ↑.
- Adulthood → Peak lung function, VO_2 max.
- Aging → ↓ capacity, COPD risk.

Digestive System

- Infancy → Immature (milk-based).
- Adulthood → Efficient metabolism.
- Aging → Slow digestion, constipation.

Nervous System

- Infancy → Rapid brain growth.
- Adulthood → Peak cognitive function.
- Aging → Memory decline, dementia risk.

Endocrine System

- Childhood → Growth hormones.
- Puberty → Testosterone/Estrogen surge.
- Aging → Hormonal decline (e.g., menopause).

Immune System

- Infancy → Maternal antibodies.
- Adulthood → Peak immunity.
- Aging → Weakened immunity, infections ↑.

Skin & Integumentary System

- Childhood → Rapid healing.
- Adulthood → Firm, elastic (collagen).
- Aging → Wrinkles, sun damage, dryness.

Reproductive System

- Puberty → Sexual maturity.

- Adulthood → Peak fertility.
- Aging → Fertility ↓, menopause in women.

Psychosocial Development

- Childhood → Emotional growth.
- Adolescence → Identity development.
- Adulthood → Career/family focus.
- Aging → Loneliness, depression risk.

Sensory System

- Childhood → Vision & hearing mature.
- Adulthood → Optimal senses.
- Aging → Presbyopia, hearing loss.

Nutrition & Exercise in Aging

- Infancy → High protein/fat needs.
- Adulthood → Balanced diet, peak fitness.
- Aging → Need ↑ vitamins/minerals; exercise slows decline.

Cellular & Genetic Aging

- Youth → Active cell division.
- Aging → Telomere shortening, oxidative stress, stem cell decline.

- Genetics → Longevity influenced by family history & variation.

Environmental & Technological Impact

- Pollution, lifestyle, healthcare access affect aging.
- Tech → Fitness trackers, gene therapy, assistive devices.

Strategies for Healthy Aging

1. Regular exercise.
2. Balanced diet.
3. Mental stimulation.
4. Social connections.
5. Routine medical check-ups.

Unit 7 (Class 2)

Fatigue | Recovery | Energy Systems in Sports

Fatigue

- **Definition:** State where **physical or mental performance is impaired**.
- **Types:**
 - Physical – ↓ muscular strength & endurance.
 - Mental – ↓ focus & cognition.
 - Central – Impaired brain's ability to activate muscles.

- Peripheral – Muscle fiber-level problems.
- **Causes:** Energy depletion, dehydration, overtraining.
- **Effects:** ↓ speed, accuracy, endurance, motivation; ↑ soreness & injury risk.

Recovery

- **Definition:** Restoration of body systems to baseline after exertion.
- **Phases:**
 1. **Immediate (0–2 hrs)** → Rehydration, nutrition, light movement.
 2. **Short-term (24–48 hrs)** → Active rest, nutrition, sleep.
 3. **Long-term (72+ hrs)** → Rehab, psychological recovery, return to training.
- **Factors:** Sleep, nutrition, hydration, age, training intensity.

Recovery Methods

- **Active** → Light exercise, stretching, foam rolling, massage.
- **Passive** → Rest, heat/ice therapy, compression, elevation, mental rest.
- **Cold Therapy** → Ice baths, cold showers; reduce inflammation & soreness.

Nutrition & Recovery

- **Proteins** → Muscle repair.

- **Carbs** → Replenish glycogen (carb-loading before endurance events).
- **Fats** → Secondary fuel.
- **Micronutrients** → Vitamins, minerals for repair.
- **Hydration** → Replace fluids & electrolytes (Na, K, Mg).

Sleep → 7–9 hrs; growth hormone release during deep sleep = muscle repair.

Body Temperature & Fatigue

- **Heat Fatigue** → Overheating, dizziness, nausea, heavy sweating.
- **Cold Fatigue** → Hypothermia, ↓ muscle function.
- **Cooling Down** → Jogging + stretching; prevents pooling, aids recovery.

Energy Systems

1. **ATP–CP (Phosphagen)**
 - Duration: 10–15 sec.
 - Fuel: Creatine phosphate.
 - Activities: Sprints, jumps, weightlifting.
 - Recovery: 3–5 min.
2. **Anaerobic Glycolysis**
 - Duration: 15 sec–2 min.

- Fuel: Glucose → Lactic acid byproduct.
- Activities: 400m sprint, HIIT.
- Limitation: Muscle fatigue due to lactate.

3. Aerobic System

- Duration: >2 min (long events).
- Fuel: Carbs + fats + O₂.
- Efficient but slower.
- Activities: Marathon, swimming, cycling.

Role of Oxygen & Glycogen

- **Oxygen** → Essential for aerobic metabolism, endurance.
- **Oxygen Debt** → Extra O₂ needed post-exercise for lactate clearance.
- **VO₂ Max** → Key measure of aerobic capacity.
- **Glycogen** → Primary fuel for both anaerobic & aerobic; depletion = fatigue.

Unit 7 (Class 3)

Cardiovascular Physiology | Heart Function | Cardiac Cycle | Oxygen Transport | Adaptations

Cardiovascular Physiology

- **Definition:** Study of **heart, blood vessels, and blood flow**.
- **Importance:** Key to understanding **exercise response & performance**.
- **Components:**
 - **Heart** – Pumps blood.
 - **Blood Vessels** – Arteries, veins, capillaries.
 - **Blood** – Carries O₂, nutrients, waste.
 - **Circulatory Pathways** – Pulmonary & systemic .

Heart Structure & Function

- **Chambers:** 2 atria + 2 ventricles.
- **Circulation:**
 - Right side → Lungs (deoxygenated blood).
 - Left side → Body (oxygenated blood).
- **Valves:** Tricuspid, Mitral, Aortic, Pulmonary (ensure one-way flow).
- **Myocardium:** Heart muscle for contraction.
- **Conduction System:** SA node, AV node, Bundle of His, Purkinje fibers .

Cardiac Cycle

- **Definition:** Sequence of events in one heartbeat.

- **Phases:**

- **Systole** → Contraction, blood ejected.
- **Diastole** → Relaxation, heart refills.

- **Key Terms:**

- **EDV (End-Diastolic Volume)** – Blood in ventricles before contraction.
- **ESV (End-Systolic Volume)** – Blood left after contraction.
- **Stroke Volume (SV)** – Blood pumped per beat .

Heart Rate & Cardiac Output

- **Heart Rate (HR)** → Beats per minute (Resting: 60–80 bpm).
- **Stroke Volume (SV)** → Blood ejected per beat.
- **Cardiac Output (CO)** = $HR \times SV$.
- **Regulation:**
 - *Sympathetic NS*: ↑ HR & SV.
 - *Parasympathetic NS*: ↓ HR (rest).
- **Exercise Response** → ↑ HR & SV → higher CO to muscles .

Blood Flow Distribution During Exercise

- **Redistribution** → More blood to muscles, heart, lungs.
- **Vasodilation** → In working muscles.

- **Vasoconstriction** → In digestive & inactive areas.
- **Skin Flow** → ↑ for temperature regulation.
- **Perfusion Pressure** → Maintains supply to organs .

Role of Oxygen in Performance

- **Transport** → Hemoglobin carries O_2 .
- **Delivery** → More O_2 to working muscles during exercise.
- **Uptake** → Efficiency of body to use O_2 .
- **VO_2 Max** → Maximal oxygen utilization; key indicator of endurance .

Adaptations to Exercise

- **Increased Stroke Volume.**
- **Decreased Resting HR** (bradycardia in trained athletes).
- **Improved Blood Flow** – Capillarization.
- **↑ Max Cardiac Output.**
- **↑ VO_2 Max.**
- **Aerobic Exercise** – ↑ HR & SV over time.
- **Anaerobic Exercise** – ↑ HR during short bursts.
- **HIIT** – Maximizes both aerobic & anaerobic adaptations .

Monitoring Cardiovascular Health

1. **HR Monitoring** – Ensure optimal training zones.
 2. **Blood Pressure** – Prevent hypertension.
 3. **Observe Overtraining** – Fatigue, high resting HR, sleep disturbance.
 4. **Recovery Importance** – Rest & sleep restore function .
-

Unit 7 (Class 4)

Blood Components | Endocrine Hormones | Respiratory Physiology

Blood Components

Red Blood Cells (RBC)

- Function: Carry O₂ → tissues; return CO₂ → lungs.
- Normal Range:
 - Men: 4.7–6.1 million/μL
 - Women: 4.2–5.4 million/μL
 - Children: 4.1–5.5 million/μL
- Disorders:
 - Low → Anemia (fatigue, weakness).
 - High → Polycythemia (clots, stroke risk).

White Blood Cells (WBC)

- Function: Fight infection & disease.
- Normal Range: 4,000–11,000/μL.

- Disorders:
 - Low (Leukopenia) → Infection risk.
 - High (Leukocytosis) → Infection, inflammation, leukemia.

Platelets

- Function: Blood clotting.
- Normal Range: 150,000–450,000/μL.
- Disorders:
 - Low → Thrombocytopenia (excess bleeding).
 - High → Thrombocytosis (clot risk, stroke, heart attack).

Hemoglobin (Hb)

- Function: O₂ transport via RBCs.
- Normal Range:
 - Men: 13.8–17.2 g/dL
 - Women: 12.1–15.1 g/dL
 - Children: 11.0–16.0 g/dL.

Serum

- Clear yellowish fluid left after clotting.
 - Contains electrolytes, hormones, antibodies, proteins.
-

Endocrine Hormones

- **Definition:** Chemical messengers regulating metabolism, growth, stress, recovery.
- **Key Glands:** Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads, Pineal, Hypothalamus, Thymus.
- **Exercise Role:** Modifies hormone release → energy, recovery, performance.

Major Hormones

- **Growth Hormone (GH)** → Growth, repair, muscle mass.
- **Cortisol** → Stress, metabolism, inflammation control.
- **Adrenaline/Noradrenaline** → ↑ HR, ↑ energy, endurance, alertness.
- **Insulin** → Glucose uptake, ↓ blood sugar.
- **Thyroid Hormones (T3, T4)** → Metabolism, HR, energy use.
- **Testosterone** → Muscle growth, strength, recovery.
- **Estrogen** → Endurance, recovery, fat utilization.

Respiratory Physiology

- **System Components:**
 - Upper airways: Nose, pharynx, larynx.
 - Lower airways: Trachea, bronchi, lungs.
- **Mechanics of Breathing:**
 - Inhalation → Diaphragm contracts, chest expands.

- Exhalation → Diaphragm relaxes, chest contracts.

- **Gas Exchange:**

- In alveoli: O₂ enters blood, CO₂ removed.

- **Respiratory Volumes:**

- Tidal Volume (TV) ~500 mL (normal breath).
- IRV ~3000 mL (extra inhalation).
- ERV ~1200 mL (extra exhalation).
- RV ~1200 mL (air left after max exhalation).

- **Control of Breathing:** Medulla & pons regulate rate.

- **VO₂ Max:** Max oxygen uptake; best endurance measure.

Unit 7 (Class 5)

Respiratory Diseases & Exercises | Musculoskeletal System | Bones | Muscles | Joints

Common Respiratory Diseases & Exercises

1. **Asthma** – Inflammation & airway constriction → wheezing, chest tightness.
 - *Exercises:* Pursed-lip breathing, Diaphragmatic breathing, Yoga, Swimming.
2. **COPD** – Chronic bronchitis & emphysema → airflow obstruction.
 - *Exercises:* Pursed-lip, Diaphragmatic, Walking, Trikonasana, Paschimottanasana.

3. **Pneumonia** – Lung infection, alveoli fluid-filled.
 - *Exercises:* Incentive spirometry, Walking, Gentle Yoga.
4. **Bronchitis** – Inflammation of bronchial tubes.
 - *Exercises:* Huff coughing, Deep breathing, Light aerobics, Ustrasana, Matsyasana.
5. **Sleep Apnea** – Airway obstruction during sleep.
 - *Exercises:* Diaphragmatic breathing, Aerobics, Cycling, Nadi Shodhana.
6. **Pulmonary Fibrosis** – Lung scarring → restricted airflow.
 - *Exercises:* Inspiratory muscle training, Controlled breathing, Walking, Anulom Vilom.
7. **Cystic Fibrosis** – Genetic; thick mucus in lungs.
 - *Exercises:* Airway clearance techniques (ACT), ACBT, Swimming, Endurance training, Yoga.

Key Point: Breathing & physical exercises improve **lung capacity & disease management**.

Musculoskeletal System Overview

- **Definition:** Bones + muscles + joints + connective tissues.
- **Functions:** Support, movement, organ protection, mineral storage, blood cell & energy storage.

Bone Functions

- Support, Protection, Movement, Mineral storage (Ca, P), Blood cell production (marrow), Energy storage (lipids).

Bone Cells

- **Osteoblasts** – Build bone.
- **Osteocytes** – Maintain bone.
- **Osteoclasts** – Break down bone.
- **Osteogenic cells** – Stem cells → osteoblasts.

Bone Matrix

- **Organic** (Collagen) → Flexibility.
- **Inorganic** (Hydroxyapatite) → Hardness, strength.

Muscles

- **Types:** Skeletal (voluntary), Cardiac (heart), Smooth (organs).
- **Functions:** Movement, posture, body temperature regulation.
- **Examples & Exercises:**
 - *Deltoid* → Lateral raises.
 - *Pectoralis major* → Push-ups, bench press.
 - *Biceps brachii* → Curls, chin-ups.
 - *Quadriceps* → Squats, leg extensions.
 - *Hamstrings* → Deadlifts, leg curls.
 - *Gluteus maximus* → Hip thrusts, lunges.
 - *Gastrocnemius* → Calf raises, jump rope.

- *Core muscles* → Plank, Russian twists.

Joints

- **Definition:** Point where bones meet → movement & stability.
- **Types:**
 - *Synovial* (elbow, knee) – freely movable.
 - *Ball & socket* (hip, shoulder) – circular movement.
 - *Pivot* (neck) – rotation.
 - *Gliding* (wrist, ankle) – sliding.
 - *Condylloid* (wrist) – movement, limited rotation.
 - *Saddle* (thumb) – grasping.

Key Facts

- Longest muscle = Sartorius.
 - Largest muscle = Gluteus maximus.
 - Shortest muscle = Stapedius (ear).
 - Longest bone = Femur.
 - Shortest bone = Stapes (ear).
-

***Write Down What You Usually Forget
For Last Minute Revision!***

UNIT - 8

Topic 1 – Meaning & Definition of Research

Meaning

- The word **Research = “Re + Search”** → to search again, systematically.
 - It is a **systematic, scientific, and objective investigation** to gain new knowledge or verify existing facts.
 - In **Physical Education & Sports**, research helps in **improving performance, preventing injuries, and promoting fitness**.
-

Definitions

1. **Clifford Woody** – “Research comprises defining and redefining problems, formulating hypotheses, collecting, organizing and evaluating data, making deductions, and reaching conclusions.”
 2. **Best & Kahn** – “Research is a more formal, systematic and intensive process of carrying on scientific method of analysis.”
 3. **Kerlinger** – “Research is a systematic, controlled, empirical, and critical investigation of hypothetical propositions about the presumed relations among natural phenomena.”
 4. **Oxford**: Systematic investigation into sources to establish facts & new conclusions.
 5. **Redman & Mory**: A systematized effort to gain new knowledge.
 6. **Leedy & Ormrod**: Systematic process of collecting & analyzing information to increase understanding.
-

Key Points

- **Systematic process** → follows definite steps (not random).
 - **Objective** → free from bias, based on facts.
 - **Evidence-based** → uses data and observations.
 - **Replicable** → results can be tested again by others.
-

Examples in Physical Education

- Studying the **effect of yoga training on flexibility** among school children.
 - Analyzing **nutritional supplements and their impact on muscle recovery** in athletes.
 - Researching **injury prevention methods** in football or kabaddi players.
-

Need, Nature & Importance of Research in Physical Education

A. Need for Research in Physical Education

- To **scientifically improve performance** of athletes.
- To **develop new training methods** (e.g., HIIT vs continuous running).
- To **reduce sports injuries** through biomechanics and physiology studies.
- To **evaluate effectiveness** of PE programs in schools.
- To **promote health & fitness** in the general population.

Example: Research on the effect of aerobic exercise on reducing childhood obesity.

B. Nature of Research

- **Systematic** → follows logical steps (problem → hypothesis → data → conclusion).
 - **Objective** → free from personal bias.
 - **Empirical** → based on observation/experiments.
 - **Replicable** → others can repeat to verify.
 - **Problem-Oriented** → starts with a real issue (e.g., fatigue in athletes).
 - **Multi-disciplinary** → uses physiology, psychology, biomechanics, nutrition.
-

C. Importance of Research in Physical Education

1. **Improves Performance** – identifies best techniques (*e.g., sprint start mechanics*).
 2. **Guides Coaching** – provides evidence-based training schedules.
 3. **Injury Prevention** – studies posture, load, equipment design.
 4. **Curriculum Development** – helps design effective PE programs in schools/colleges.
 5. **Sports Technology** – supports development of equipment (running shoes, fitness trackers).
 6. **Policy Making** – supports government decisions in health, fitness, and sports promotion.
 7. **Promotes Fitness & Wellness** – lifestyle studies for obesity, stress management, aging.
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Types of Research in Physical Education

Type of Research	Definition	Focus	Example in Physical Education
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Basic Research	Develops fundamental principles and theories	Expanding knowledge without immediate use	Studying how muscle fibers adapt to resistance training
Applied Research	Uses principles to solve practical problems	Direct application	Testing which warm-up method reduces injury risk
Action Research	Conducted by teachers/coaches to solve local problems	Immediate classroom/field improvement	A PE teacher tests a new teaching method for basketball skills
Analytical Research	Explores existing facts, ideas, or data	Critical evaluation & synthesis	Meta-analysis on yoga's effect on stress in athletes
Philosophical Research	Examines values, beliefs, and theories	Understanding concepts	Studying ethics in doping
Historical Research	Studies past records/events	Understanding evolution & trends	Tracing Olympic Games development in modern era
Descriptive Research	Describes current status without manipulation	Surveys, observations, case studies	Survey on fitness levels of school students
Experimental Research	Manipulates variables to find cause-effect	Controlled experiments	Comparing HIIT vs endurance training on VO ₂ max
Qualitative Research	Focuses on non-numerical data	Experiences, interviews, case studies	Interviewing athletes on psychological stress
Quantitative Research	Uses numerical/statistical data	Measurement & analysis	Measuring BMI, VO₂ max, agility scores
Exploratory Research	Conducted when little information is available	To generate new ideas & directions	Exploring impact of esports on youth fitness
Ex-post Facto Research	Analyzes existing data/events without manipulation	Cause-effect after the fact	Studying effect of previous injuries on performance
Longitudinal Research	Study over long period	Changes & trends across time	Tracking growth & performance of athletes for 5 years

Cross-Sectional Research	Data collected at one point in time	Group comparison	Comparing strength of U14, U16, U18 athletes
Mixed Methods Research	Combines quantitative & qualitative approaches	Comprehensive perspective	Using fitness tests + athlete interviews to study motivation

Very Important

- **Basic = Theory, Applied = Practice, Action = Immediate problem-solving.**
- **Descriptive = What is, Experimental = What causes what, Qualitative = Why & How.**
- **Quantitative → Numbers, Qualitative → Experiences.**
- **Exploratory → New directions, Ex-post Facto → Past data.**
- **Longitudinal → Same group over years, Cross-sectional → Different groups at once.**
- **Mixed Methods = Best of both worlds.**

Steps in Research Process

Step 1. Identifying the Problem

- First step → find a **clear, researchable problem**.
- In PE: *“Does plyometric training improve vertical jump in volleyball players?”*

Step 2. Review of Literature

- Collect information from **books, journals, theses, online databases**.
- Purpose → know what is already done, avoid duplication, identify gaps.
- Example: Checking past studies on **nutrition & recovery in athletes**.

Step 3. Set research questions, objectives & hypotheses

- A **testable prediction** based on theory/observation.
- Example: *“Interval training will improve 1500m performance more than continuous running.”*

Step 4. Research Design and sample design

- Blueprint of the study → decides **method, sample, tools, variables**.
- Types: Experimental, Descriptive, Survey, Case study.
- Example: Choosing **experimental design** to compare two training groups.

Step 5. Data Collection

- Tools: **Tests, Questionnaires, Observations, Interviews, Physiological measurements.**
 - Example: Using **Harvard Step Test** to measure cardiovascular endurance.
-

Step 6. Data Analysis

- Organizing & interpreting data using **statistics.**
 - Example: Using **t-test** to compare mean performance of two groups.
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Step 7. Interpretation of Results

- Relating findings to **hypothesis & previous studies.**
 - Example: If results show HIIT is more effective → conclude it enhances endurance.
-

Step 8. Reporting & Presentation

- Writing the **thesis/dissertation/research paper.**
 - Structure: Introduction → Review → Methodology → Results → Discussion → Conclusion → References.
 - Example: Submitting dissertation on *“Effect of Yogic Practices on Stress of University Students.*
-

Steps in Research Process

Step	What it Means	Example in Physical Education
1. Identify the Problem	Select a clear, researchable issue	“Does plyometric training improve vertical jump in volleyball players?”
2. Review of Literature	Study past research to find gaps	Checking studies on nutrition & recovery
3. Set research questions, objectives & hypotheses	Make a testable prediction	“Interval training improves 1500m more than continuous running”
4. Research Design and sample design	Plan of study (method, sample, tools)	Choosing experimental design with two groups
5. Data Collection	Gathering information using tools	Using Harvard Step Test for endurance
6. Data Analysis	Organizing & applying statistics	Using t-test to compare groups

7. Interpretation	Relating results to hypothesis	Concluding HIIT is effective for endurance
8. Report Writing	Presenting findings systematically	Writing a dissertation on yoga & stress reduction

Hypothesis in Research

- **Hypothesis** = A **tentative, testable prediction** about the relationship between two or more variables.
- Acts as a **bridge** between theory and research.
- Guides the **direction of the study**.

In PE: “Regular strength training will improve sprint performance among football players.”

Formulation of Hypothesis

1. **Identify the problem** (e.g., low endurance in athletes).
2. **Review existing literature** to know what is already found.
3. **Frame in clear terms** – must be **specific, measurable, testable**.
4. Ensure **variables are identifiable** (independent & dependent).

Characteristics of a Good Hypothesis

- **Clear & Precise** → No ambiguity.
- **Testable** → Can be measured scientifically.
- **Based on theory/observation** → Not random guesswork.
- **Limited in scope** → Focused on the specific problem.
- **Predictive** → Suggests a possible outcome.
- **Consistent with facts** → Supported by prior studies.

Types of Hypothesis

Type	Meaning	Example in Physical Education
Null (H_0)	States no difference/relationship	“There is no difference in VO_2 max between continuous and interval training.”
Alternative (H_1)	States a difference exists	“Interval training improves VO_2 max more than continuous training.”

Directional	Specifies the direction of difference	“Yoga reduces anxiety levels in adolescent athletes.”
Non-directional	Predicts a difference but not the direction	“There is a difference between male and female students in flexibility.”
Statistical Hypothesis	Expressed in statistical terms for testing	$H_0: \mu_1 = \mu_2$; $H_1: \mu_1 \neq \mu_2$
Conceptual Hypothesis	Based on theoretical assumptions	“Motivation improves performance in all games.”
Working Hypothesis	Initially accepted for starting research Tentative, used at the beginning of research	“A new warm-up drill might improve agility.”
Simple Hypothesis	Predicts relationship between one IV and one DV	“Dietary protein intake improves muscle mass.”
Complex Hypothesis	Predicts relationship between two or more IVs and DVs	“Training method and diet together improve speed and endurance.”
Associative Hypothesis	States a relationship exists but not causal	“There is a relationship between BMI and sprint performance.”
Causal Hypothesis	States cause–effect relation between variables	“Strength training causes an increase in bone density.”

Very important:

- H_0 = No difference, H_1 = Difference exists.
- **Directional** → Predicts increase/decrease, **Non-directional** → Only states difference.

Errors in Hypothesis Testing

Error Type	Symbol	Meaning	Example in Physical Education
Type I Error	α (alpha)	Rejecting a true null hypothesis (False Positive)	Concluding interval training is better than continuous training, when actually there is no difference
Type II Error	β (beta)	Failing to reject a false null hypothesis (False Negative)	Concluding no difference exists between yoga and aerobic exercise on flexibility, when in fact yoga is more effective
Power of a Test	$1 - \beta$	Probability of correctly rejecting a false null hypothesis (sensitivity of test)	Correctly detecting that plyometric training improves jump height when it truly does

Very important:

- **Type I Error (α , False Positive) → Rejecting true H_0 .**
 - **Example: Saying person guilty when innocent.**
- **Type II Error (β , False Negative) → Failing to reject false H_0 .**
 - **Example: Letting guilty person go free.**
- **Power of a Test = $1 - \beta$.**

In PE research:

- **Type I → May waste resources on ineffective training.**
- **Type II → May ignore a training method that actually works.**

Purposes of Review of Literature

Purpose	Explanation	Example in PE
Avoids Duplication	Ensures the researcher is not repeating what is already done	Knowing several studies already tested <i>treadmill training on endurance</i>
Provides Theoretical Base	Builds on existing theories & models	Using FITT principle studies before planning a training experiment
Helps Identify Gaps	Shows what is <i>not yet studied</i>	Few studies exist on yoga's effect on adolescent stress
Guides Hypothesis Formation	Suggests possible relationships	After reading sprint studies, hypothesize " <i>Interval training > continuous training</i> "
Improves Methodology	Learn which tools/tests are reliable	Using VO₂ max test as validated by earlier studies
Helps in Data Interpretation	Compare new findings with previous	If results differ, find why (e.g., climate, age group, intensity differences)
Adds Credibility	Shows researcher has strong background knowledge	Review supports the significance of the study

Primary vs Secondary Sources of Literature

Aspect	Primary Sources	Secondary Sources
Definition	Original, first-hand reports of research findings	Interpretations, summaries, or reviews of primary sources
Nature	Direct evidence, raw data, new results	Analysis, explanation, or commentary on primary works

Reliability	More authentic & accurate (but technical)	Easier to understand, but depends on accuracy of primary sources
Examples (General)	Research journals, dissertations, conference papers, technical reports	Textbooks, encyclopedias, review articles, handbooks

Very Important

- **Primary = Direct evidence (raw research).**
- **Secondary = Indirect evidence (interpretation/review).**

Online Databases – used for ROL (Digital Sources)

- PubMed
- Google Scholar
- ERIC (Education Resources Information Center)
- ResearchGate
- Shodhganga (India)
- Scopus
- Web of Science
- SPORTDiscus
- ScienceDirect (Elsevier)
- JSTOR
- SpringerLink
- Taylor & Francis Online
- Wiley Online Library
- ProQuest
- DOAJ (Directory of Open Access Journals)

Steps in Reviewing Literature

1. **Define keywords** (e.g., endurance, sprint, HIIT).
2. **Search databases** systematically.
3. **Filter relevant studies** (last 5–10 years + classic references).
4. **Summarize findings** in note form.
5. **Highlight research gaps.**

Population vs Sample

Term	Meaning	Example in Physical Education
Population	The entire group of individuals, events, or objects that a researcher is interested in studying	All high school athletes in Tamil Nadu
Sample	A subset of the population selected for actual study; represents the population	200 athletes randomly selected from 10 schools in Tamil Nadu

Very important:

- **Population** = Whole group → too large to study fully.
- **Sample** = Smaller group → manageable, used to generalize results back to population.
- **Good sample** must be **representative, unbiased, and adequate in size**.

Probability & Non-Probability Sampling

Aspect	Probability Sampling / <i>Random Sampling</i>	Non-Probability Sampling / <i>Non-Random Sampling</i>
Definition	Every element of the population has a known, non-zero chance of being selected	Not every element has a chance; selection is based on convenience or judgment
Bias	Less bias (more scientific & objective)	More bias (researcher's subjectivity possible)
Representativeness	Yes	No
Usefulness	Used in large-scale, generalizable studies	Used in exploratory, pilot, or small-scale studies
Sub-Types	Simple Random, Systematic, Stratified, Cluster, Multi-Stage	Convenience, Purposive, Quota, Snowball

Sampling Techniques in Research

Type	Sub-Type	Explanation (How it is done + Notes)	Examples in Physical Education
Probability Sampling (each unit has equal chance)	Simple Random Sampling	Every individual has equal chance of being selected . Done using lottery method, random number tables, or computer randomization.	(1) Selecting 50 students by lottery method for a fitness test. (2) Randomly choosing 20 athletes from a

			school team for flexibility study.
	Systematic Sampling	Select every kth individual from an ordered list (e.g., every 5th, 10th). First unit is chosen randomly, then fixed intervals are applied.	(1) Choosing every 5th athlete in a roster for VO ₂ max testing. (2) Selecting every 10th participant entering a stadium for a fitness survey.
	Stratified Sampling	Divide the population into homogeneous sub-groups (strata) based on characteristics (gender, age, sport type), then randomly sample from each stratum. Ensures representation.	(1) Dividing by gender (boys/girls), then randomly selecting equal numbers for strength test. (2) Selecting proportionate samples from sprinters, footballers, and basketball players.
	Cluster Sampling/ Area sampling	Population divided into clusters (natural groups like schools, teams, districts). Entire clusters are chosen randomly , then all individuals in selected clusters are studied.	(1) Choosing 3 schools at random and testing all their PE students. (2) Selecting 2 football clubs and measuring agility of all players.
	Multi-stage Sampling	Combines cluster and random sampling in stages. First select larger clusters, then progressively smaller units, finally individuals.	(1) Selecting districts → schools → athletes for a state-level sports study. (2) Selecting zones → schools → classes → students for PE curriculum evaluation.
Non-Probability Sampling (no equal chance)	Convenience Sampling/ Accidental Sampling	Selecting individuals who are easiest to access. Quick, low-cost, but biased.	(1) Testing students in one's own college gym. (2) Collecting data from players available at a sports meet.
	Purposive Sampling/ Judgment Sampling	Selecting individuals who fit specific criteria set by researcher (knowledge, expertise, traits).	(1) Choosing elite sprinters for reaction time study. (2) Selecting physiotherapists for a

			study on injury rehabilitation.
	Quota Sampling	Selecting participants to match a set proportion (age, gender, category). Researcher fills quotas but does not use random selection.	(1) Selecting 40% boys & 60% girls for flexibility test. (2) Ensuring equal representation of rural and urban athletes.
	Snowball Sampling/ Chain Referral Sampling	Start with a few participants , then they refer others , especially useful in hard-to-reach populations.	(1) Injured players refer other injured athletes for rehabilitation study. (2) Retired athletes referring peers for a lifestyle survey.

Variables in Research

What is a Variable?

- A **variable** is any **characteristic, condition, or factor** that can take on different values or vary among individuals.
- In research, variables are the **building blocks** that help establish relationships.

In **Physical Education**, variables could be: **training method, heart rate, agility score, gender, diet, BMI, flexibility, speed.**

Types of Variables

Type of Variable	Explanation	Example in Physical Education
Independent Variable (IV)	The factor manipulated/changed by researcher to study its effect	Training method (HIIT vs Continuous Running)
Dependent Variable (DV)	The outcome measured, depends on IV	Endurance level (measured by VO₂ max test)
Control Variable	Factors kept constant to avoid interference	Age, training duration, diet kept same for all participants
Extraneous Variable	Uncontrolled factors that may affect DV unintentionally	Weather, sleep, prior physical activity
Moderator Variable	Affects the strength/direction of the relationship between IV & DV	Gender moderating effect of strength training on flexibility

Intervening (Mediating) Variable	Explains <i>how/why</i> IV influences DV	Motivation mediates between coaching style (IV) and performance (DV)
Continuous Variable	Can take any value within a range	Running time (seconds), weight, heart rate
Discrete Variable	Whole numbers only	No. of push-ups, no. of matches won
Qualitative Variable	Non-numeric, describes categories	Type of game (football, hockey, basketball)
Quantitative Variable	Numeric, measurable	Speed, reaction time, BMI

Very Important

- **IV → Manipulated, DV → Measured, Control → Fixed.**

Data Collection Tools in Research

Tool	Description	Specific Example in Physical Education
Questionnaire	Written set of structured/unstructured questions to gather info	<i>Sports Motivation Questionnaire</i> to measure athletes' intrinsic vs extrinsic motivation
Interview	Oral, face-to-face or online interaction to gather detailed insights	Interviewing elite coaches on mental preparation strategies for Olympic athletes
Observation	Systematic watching & recording of behavior or performance	Using an observation checklist to note errors in swimming technique
Physical Fitness Tests	Standardized tests to measure fitness components	Harvard Step Test (cardio endurance), Sit & Reach Test (flexibility), 50m Sprint Test (speed), Illinois Agility Test (agility)
Physiological Tools	Devices that measure internal body functions	Spirometer (lung capacity), VO₂ max analyzer , Lactate analyzer , Heart Rate Monitor
Psychological Tools	Scales to assess mental characteristics	Sports Anxiety Scale , Athletic Coping Skills Inventory , Profile of Mood States (POMS)
Rating Scale	Scale from low to high to assess performance/attitude	Rating team cooperation on a 1–5 scale during a football match

Checklist	Binary marking (✓ / X) for presence/absence of actions	Checklist for warm-up drills completed before training
Portfolio	Collection of evidence showing progress	Student's logbook of weekly fitness scores & practice sessions
Rubrics	Predefined scoring guide with performance levels	Gymnastics rubric: balance (0–5), posture (0–5), coordination (0–5)

Research Design

Type of Design	Explanation	Example in Physical Education
Experimental Design	Researcher manipulates IV, controls conditions, observes effect on DV	Comparing HIIT vs Continuous Running on endurance (VO ₂ max test)
Pre-Experimental Design	No control group or randomization; limited validity	Testing a new yoga routine on one group of students without comparison
Quasi-Experimental Design	Has experimental features but lacks randomization	Studying effect of morning vs evening training where groups are pre-formed
True Experimental Design	Includes randomization, control, and manipulation; most valid	Randomly assigning athletes into control & training groups for sprint drills
Descriptive Design	Describes current status, attitudes, or conditions without manipulation	Survey on fitness levels of school children across districts
Correlational Design	Examines relationship between two variables (no cause-effect)	Correlation between BMI & 100m sprint time
Comparative Design	Compares two or more groups without manipulating variables	Comparing urban vs rural students in flexibility test
Case Study	In-depth study of one case/group/athlete	Detailed analysis of rehabilitation of an injured footballer
Longitudinal Design	Study same subjects over long period	Tracking growth & performance of adolescent athletes over 3 years
Cross-Sectional Design	Data collected at one point in time from different groups	Comparing strength levels of U14, U16, U18 athletes at one time

Experimental Design – Few features:

Randomization

- **Meaning:** The process of assigning participants to groups by chance to remove bias.
- **Example in PE:** Randomly assigning 40 athletes into **control group (normal training)** and **experimental group (plyometric training)**.
- **Exam Note:** Randomization ensures each participant has an equal chance of being in any group → increases validity.

Blinding

- **Single Blind:** Participants don't know which group (control or experimental) they are in.
- **Double Blind:** Both participants and researchers don't know group allocation (to remove bias).
- **Example in PE:** Testing a new sports supplement — athletes don't know if they got the real supplement or placebo.

Placebo Studies

- **Placebo** = A treatment with no real effect, used for comparison.
- **Example in PE:** One group receives an **energy drink**, another receives a **flavored placebo drink**; compare endurance results.

The “**Gold Standard**” **research design** in methodology is:

Randomized Controlled Trial (RCT)

Why?

- **Randomization** → Participants are randomly assigned to groups (removes bias).
- **Control group** → Comparison group ensures changes are due to intervention, not chance.
- **Manipulation of IV** → Researcher introduces treatment (independent variable).
- **Blinding / Placebo** → Minimizes subject and researcher bias.
- **Causality** → Provides the strongest evidence for cause–effect relationship.

Understand what is what first :

(from start → end of research cycle):

1. **Research Proposal** → (plan of intended study)
2. **Research Synopsis** → (short summary/outline, usually for approval/progress)
3. **Thesis / Dissertation** → (detailed final research report)
4. **Research Paper** → (published version of findings)

5. **Abstract** → (shortest summary, always attached at the beginning of thesis/paper)

Distinction Between Research Documents

Type	What it is	When Prepared	Length	Physical Education Example
Research Proposal	A plan of intended research (objectives, methods, tools, significance)	Before starting research (for approval/funding)	Medium (10–25 pages)	Proposal to study impact of yoga on adolescent stress
Research Synopsis	A brief outline or summary of proposed/ongoing research; condensed version of proposal	After proposal, before conducting full research (for review/approval)	Short (3–5 pages)	Synopsis for a dissertation on sports injuries among football players
Thesis / Dissertation	A comprehensive report of original research (for degree requirement)	At the end of research work	Long (100–300+ pages)	“Effect of Plyometric Training on Explosive Power of Volleyball Players”
Research Paper	A journal article presenting research findings concisely	After completing research, for publication	5–15 pages	Paper on BMI & sprint performance correlation published in a sports journal
Abstract	A very concise summary of a research paper/thesis (objectives, method, results, conclusion)	At the beginning of thesis/paper	Very short (150–300 words)	Abstract: “HIIT significantly improved VO ₂ max among PE students”

Mechanism of Writing a Thesis / Dissertation

1. Pre-Writing Stage

- **Select a Topic** – Relevant, researchable, within time/resources.
- **Review of Literature** – Identify gaps and justify study.
- **Formulate Objectives & Hypotheses** – Clear, measurable aims.
- **Design Methodology** – Sampling, tools, procedure, analysis plan.
- **Proposal Approval** – Submit to guide/committee before starting.

2. Writing Stage

- **Structure (Standard Format):**

1. **Title Page** – Title, author, institution, year.
 2. **Certificates & Acknowledgements**
 3. **Abstract** – 150–300 words (purpose, method, findings, conclusion).
 4. **Table of Contents**
 5. **Introduction** – Background, need, objectives.
 6. **Review of Literature** – Past studies.
 7. **Methodology** – Sample, design, tools, procedures.
 8. **Results & Analysis** – Tables, graphs, statistical outcomes.
 9. **Discussion** – Interpret results, compare with past studies.
 10. **Summary & Conclusion** – Key findings, recommendations.
 11. **Bibliography / References** – APA format.
 12. **Appendices** – Questionnaires, raw data, consent forms.
-

3. Post-Writing Stage

- **Proofreading & Editing** – Check clarity, grammar, APA references.
 - **Plagiarism Check** – Ensure originality.
 - **Final Submission** – Print, bind, and submit as per university norms.
 - **Viva / Defense** – Oral presentation of research before experts.
-

Standard Format of a Research Proposal

1. **Title Page**
 - Title, researcher's name, institution, guide's name, date.
2. **Introduction / Background**
 - Context of study, rationale, importance.
3. **Statement of the Problem**
 - Exact problem/question being studied.
4. **Objectives of the Study**
 - Broad & specific aims.

5. **Hypotheses / Research Questions** (if applicable)
6. **Review of Literature (Brief)**
 - Relevant past studies, gap identification.
7. **Methodology**
 - **Research Design**
 - **Population & Sample** (size, sampling method)
 - **Variables** (IV, DV, control)
 - **Tools / Instruments** (tests, questionnaires, equipment)
 - **Procedure** (how the study will be carried out)
 - **Data Analysis** (statistical techniques planned)
8. **Significance / Rationale of Study**
 - Contribution to Physical Education / society / policy.
9. **Limitations & Delimitations**
10. **Time Schedule / Work Plan** (sometimes required)
11. **Budget** (if funding is sought)
12. **References** (APA style)

NOTE: Everything that appears in a Proposal also appears in a **Synopsis — but in a much shorter, concise form.**

Research Paper

- A **concise document** presenting the results of a completed study, usually published in journals.
- Shorter than a thesis but follows a standard structure.

Structure

1. **Title** – Clear & specific.
2. **Abstract** – Brief summary (150–300 words).
3. **Introduction** – Background, rationale, objectives.
4. **Methodology** – Design, sample, tools, procedure.
5. **Results** – Tables, graphs, stats.
6. **Discussion** – Interpretation, link with past studies.
7. **Conclusion** – Main findings, recommendations.
8. **References** – APA format.

Abstract

- A **very short summary** of a research paper/thesis.

Types

- **Descriptive Abstract** – States purpose, scope, methods (no results).
- **Informative Abstract** – Summarizes purpose, methods, results, conclusion (most common).

Standard Format (150–300 words)

1. **Purpose / Problem** – Why the study was done.
2. **Methods** – Sample, tools, procedures.
3. **Results** – Key findings.
4. **Conclusion** – Implications/significance.

PE Example

Abstract: *“This study tested the effect of HIIT on endurance among 40 college athletes. VO₂ max was measured before and after 8 weeks. Results showed significant improvement in the HIIT group compared to continuous training. It was concluded that HIIT is more effective for enhancing endurance in PE students.”*

Very Important:

- **Research Paper** = Full article with findings.
- **Abstract** = One-paragraph summary.
- **Abstract always comes at the beginning of a paper/thesis.**

Bibliography

- A **bibliography** is the list of sources (books, journals, websites, reports) used in research.
- **APA (American Psychological Association) style** is the most widely used in Education, Psychology, and Physical Education research.
- **APA 7th edition is the current standard.**

General Rules (APA Style)

1. Author's Last Name, Initial(s).
2. Year in brackets (2023).
3. Title in italics (Sentence case).
4. Publisher / Journal details.

5. DOI (Digital object identifier) or URL (**Uniform Resource Locator** -if online)

↓
Author(s)

↓
Year, Date

↓
Title (*in italics*)

↓
Website name

Johnson, A. (2018, May 24). *“It doesn’t need to be this way”: The promise of specialised early intervention in psychosis services*. IEPA.
<https://iepa.org.au/network-news/it-doesnt-need-to-be-this-way-the-promise-of-specialised-early-intervention-in-psychosis-services/>

↑
Indent 5-7 spaces

↑
URL

DOI vs URL

Full Form / Meaning	Use
Digital Object Identifier	A unique permanent alphanumeric code assigned to a research paper/article. Never changes, always leads to the same source.
Uniform Resource Locator	The web address (link) of a resource. May change or expire if website is updated.

Examples

Source Type	APA Format Example	PE Example
Book	Author, A. A. (Year). <i>Title of the book</i> . Publisher.	Fox, E. L., Bowers, R. W., & Foss, M. L. (2013). <i>The physiological basis for exercise and sport</i> . McGraw-Hill.
Journal Article	Author, A. A. (Year). Title of article. <i>Journal Name</i> , 12(3), 123–135. https://doi.org/xxxxx	Singh, R., & Kumar, P. (2021). Effect of interval training on VO ₂ max of university athletes. <i>International Journal of Sports Science</i> , 15(2), 78–86. https://doi.org/10.1234/ijss.2021.15.2.78
Thesis/Dissertation	Author, A. A. (Year). <i>Title of dissertation</i> (Doctoral dissertation, University Name). Database/Repository.	Rajesh, M. (2022). <i>Impact of plyometric training on explosive power in volleyball players</i> (Doctoral dissertation, LNIPE, Gwalior). Shodhganga.
Website	Author/Organization. (Year, Month Date). Title of webpage. Website name. URL	World Health Organization. (2023, June 12). <i>Physical activity and health</i> . WHO. https://www.who.int/news-room/fact-sheets/detail/physical-activity

Research Ethics

Set of **moral principles and professional standards** guiding researchers to ensure honesty, fairness, and respect for participants.

Core Principles of Research Ethics

Principle	Explanation	Example in Physical Education
Informed Consent	Participants must be fully informed about the study and voluntarily agree	Athletes sign consent before fitness testing
Confidentiality	Participant data must be kept private and used only for research	Students' BMI results kept anonymous
No Harm / Safety	Research must avoid physical/psychological harm	Avoid excessive exercise protocols that may cause injury
Honesty & Integrity	Report true data; no fabrication, falsification, or plagiarism	Not manipulating test results to support a hypothesis
Fair Selection	Participants chosen without bias/discrimination	Equal chance for boys and girls in a school fitness survey
Voluntary Participation	Freedom to withdraw anytime without penalty	A player may leave a study on VO₂ max testing midway
Plagiarism-Free Work	Properly acknowledge sources in APA style	Citing references in dissertation on sports psychology
Transparency	Clear reporting of methods, findings, and conflicts of interest	Disclosing funding sources for a nutrition research study

Research Misconduct

- **Fabrication** → Making up data/results .
- **Falsification** → Manipulating/omitting data to misrepresent .
- **Plagiarism** → Copying without acknowledgment .

Basic Misconduct (FFP Rule) = Fabrication + Falsification + Plagiarism .

Plagiarism

- Copying & using others' work without acknowledgment .
- **Origin:** Latin *Plagiarius* = "kidnapper"

Types of Plagiarism

Type	Alternate Names	Explanation	Example in Physical Education Research
Direct Plagiarism	Verbatim Plagiarism	Copying text word-for-word without citation	Copying a definition of VO_2 max from a textbook without giving reference
Self-Plagiarism	Text Recycling	Reusing one's own previous work without acknowledgment	Submitting the same dissertation chapter as a new journal article
Mosaic / Patchwork Plagiarism	Incremental Plagiarism, Patchwriting	Mixing copied phrases from multiple sources without proper citation	Combining sentences from 3 research papers on yoga & stress without citations
Paraphrasing Plagiarism	-	Rewriting ideas from a source without giving credit	Rewording a study on aerobic training benefits without citing the author
Accidental Plagiarism	Unintentional Plagiarism	Failing to cite correctly due to carelessness or lack of knowledge	Forgetting to reference a source after using Illinois Agility Test norms
Source-based Plagiarism	-	Misquoting or citing an incorrect/non-existent source	Citing a fake journal for sports psychology results
Complete Plagiarism	Global Plagiarism	Submitting someone else's entire work as one's own	Using another student's dissertation on plyometric training and claiming it
Idea Plagiarism	Intellectual Theft	Using another researcher's concepts, methods, or theories without acknowledgment	Adopting a new PE teaching model presented in a seminar without citing
Authorship Plagiarism	Honorary / Ghost Authorship	Not giving proper credit to co-authors or adding names without contribution	Leaving out a coach who helped in a fitness study or adding a professor's name without contribution
Code/Data Plagiarism	Computational Plagiarism	Copying datasets, software codes, or statistical analyses without permission	Using another researcher's VO_2 max dataset or SPSS coding without acknowledgment
Image/Figure Plagiarism	Visual Plagiarism	Using tables, graphs, or photographs without citation	Copying a biomechanical diagram of a sprinting technique from a book without credit

Professor academy

UNIT 9

Unit 9 (Class 1)

Introduction to Statistics | Types | Data | Applications in Sports

What is Statistics?

- Branch of mathematics → **collection, analysis, interpretation, presentation & organization of data.**
- Two senses:
 - **Plural:** Aggregate of facts, numerically expressed, systematic, accurate.
 - **Singular:** Methods – collection, organization, presentation, analysis, interpretation.

Properties of Statistics

- Completeness, Consistency, Sufficiency, Unbiasedness.
- Features: clarity, simplification, accuracy, variability.

Characteristics of Statistics

- **Data collection** → census, surveys.
- **Representation** → tables, charts, graphs.
- **Analysis** → patterns, trends.
- **Decision-making** → evidence-based.
- **Forecasting** → sales, demand, performance.

- **Quality control & Risk assessment.**
- **Research & Critical thinking.**

Limitations of Statistics

1. Ignores qualitative aspects.
2. Deals only with aggregates, not individuals.
3. Requires uniform & homogeneous data.
4. Can be misused by untrained persons.
5. Results true only on **average**.

Types of Statistics

1. **Descriptive Statistics** → summarises data (mean, SD, frequency, position).
 - *Measures:* Frequency, Central Tendency (Mean, Median, Mode), Dispersion (Range, SD, Variance), Position (Percentiles, Quartiles, Z-scores).
2. **Inferential Statistics** → draws conclusions about population from sample.
 - *Techniques:* Estimation, Hypothesis testing, Regression, ANOVA.

Types of Data

- **Qualitative (Categorical)** → gender, colors, types of sport.
- **Quantitative (Numerical):**

- **Discrete** → countable (goals scored).
- **Continuous** → measurable (height, weight, time).

Scales of Measurement

1. **Nominal** – categories without order (sports type, jersey no.).
2. **Ordinal** – ranked but no equal intervals (race positions, medals).
3. **Interval** – equal intervals, no true zero (°C, IQ).
4. **Ratio** – equal intervals + true zero (weight, distance, age).

Importance in Physical Education & Sports

- **Performance Analysis** → accuracy, speed, endurance, agility.
- **Talent Identification** → selection through measurable data.
- **Training Design** → track progress, optimize programs.
- **Injury Prevention & Rehab** → track injury patterns.
- **Psychological & Biomechanical Studies** → motivation, stress, movement efficiency.

Unit 9 (Class 2)

Measures of Central Tendency: Mean | Median | Mode | GM | HM

Types of Measures

1. Arithmetic Mean (AM)

- **Formula:** $\bar{x} = \Sigma X / N$

- **Shortcut:** $\bar{x} = A \pm \Sigma d / N$
- **Weighted Mean:** $\bar{x} = \Sigma WX / \Sigma W$
- **Merits:** Simple, uses all data, stable, unique, algebraically useful.
- **Demerits:** Affected by outliers, not for qualitative/skewed data.

2. Geometric Mean (GM)

- **Formula:** $GM = (x_1 \times x_2 \times \dots \times x_n)^{1/n}$
- **Example:** GM of 3, 9, 27 = $\sqrt[3]{(729)} = 9\sqrt[3]{(729)} = 9$.
- **Merits:** Considers all data, less affected by extremes, best for growth rates.
- **Demerits:** Complex, invalid for negative/zero values.

3. Harmonic Mean (HM)

- **Formula:** $HM = N / \Sigma (1/X)$
- **Use:** Best for rates, speeds, ratios.
- **Merits:** Based on all data, gives more weight to small values, algebraically useful.
- **Demerits:** Complex, invalid for zero/negative values, affected by extremes.

4. Median

- **Definition:** Middle value when data arranged in order.

- **Odd N:** Median = $(n+1)/2$ th item.
- **Even N:** Median = Average of $(n/2)$ th & $(n/2+1)$ th terms.
- **Merits:** Not affected by outliers, works for ordinal data.
- **Demerits:** Ignores distances, unstable, not algebraically usable.

5. Mode

- **Definition:** Most frequently occurring value.
- **Formula (Continuous Series):**

$$\text{Mode} = L + (f_1 - f_0) / (2f_1 - f_0 - f_2) \times i$$

- **Merits:** Simple, unaffected by extremes, useful for qualitative data.
- **Demerits:** May not exist, not unique, unstable in small samples.

Relationships

- **AM $\geq$ GM $\geq$ HM** (always).
- **Karl Pearson's Formula:**

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$$

Unit 9 (Class 3)

Measures of Dispersion: Range | Variance | SD | QD | MD | Coefficients

Types of Measures

Absolute Measures

1. Range

- Formula: $R = L - SR = L - S$ (Largest – Smallest).
- Simple, quick. Affected by outliers, ignores distribution.

2. Variance (σ^2)

- Formula (Population): $\sigma^2 = \Sigma(x - \bar{x})^2 / N$
- Formula (Sample): $\sigma^2 = \Sigma(x - \bar{x})^2 / n - 1$
- Uses all data, foundation for SD. Not intuitive, unit squared.

3. Standard Deviation (σ)

- Formula: $\sigma = \sqrt{\text{Variance}}$
- Widely used, accurate. Complex, affected by outliers.

4. Quartile Deviation (QD)

- Formula: $QD = (Q_3 - Q_1) / 2$
- Less affected by extremes. Ignores 50% of data, limited use.

5. Mean Deviation (MD)

- Formula: $MD = \Sigma|x - \bar{x}| / N$
- Simple, less affected by outliers. Not algebraically usable.

Relative Measures (Unit-free; for comparison)

1. **Coefficient of Range** = $L-S / L+S$
2. **Coefficient of QD** = $Q3-Q1 / Q3+Q1$
3. **Coefficient of MD** = $MD / (\text{Mean/Median/Mode})$
4. **Coefficient of Variation (CV)** = $\sigma / \bar{x} \times 100$

Applications in Sports & PE

- Compare **performance consistency** of athletes.
- Assess **risk & variability** in test scores.
- Talent identification & monitoring.
- Training program evaluation.
- Injury & fatigue analysis.

Unit 9 (Class 4)

Skewness | Kurtosis | Measures & Types

Skewness (Asymmetry of Distribution)

- **Symmetrical / Normal Distribution**
 - Mean = Median = Mode
 - Balanced tails, bell or U-shaped curve .
- **Asymmetrical Distribution**
 - Mean $\neq$ Median $\neq$ Mode
 - Tails unequal; irregular frequencies.

Types of Skewness

1. Positive Skewness (Right-skewed)

- Right tail longer.
- Mean > Median > Mode 【751†source】negative Skewness (Left-skewed)**
- Left tail longer.
- Mode > Median > Mean 【751†source】 Measures of Skewness

2. Karl Pearson's Coefficient

$$Skp = (\text{Mean} - \text{Mode})$$

- σ = Standard deviation 【751†source】owley's Coefficient**

$$Sk = (Q3 + Q1 - 2\text{Median}) / (Q3 - Q1)$$

- Based on quartiles, less affected by extremes 【751†source】elly's Coefficient**

$$Sk = (P90 + P10 - 2P50) / (P90 - P10)$$

Uses percentiles; robust to outliers 【751†source】 Kurtosis (Peakedness of Distribution)

- **Definition:** Describes **flatness/sharpness** of frequency curve 【751†source】mal Curve = Mesokurtic ($\beta_2 = 3$)** 【751†source】Types of Kurtosis

1. Mesokurtic ($\beta_2 = 3$)

- Normal distribution, medium peak.

2. Leptokurtic ($\beta_2 > 3$)

- High peak, heavy tails, more outliers.

3. Platykurtic ($\beta_2 < 3$)

- Flatter peak, thinner tails, fewer extremes 【751†source#

Unit 9 (Class 5)

Sampling & Techniques

Objectives of Sampling

- Approximate population characteristics.
- Make research practical & cost-effective.
- Improve accuracy and reliability.
- Save time and resources .

Steps in Sampling Process

1. Define the target population.
 2. Select a sampling frame.
 3. Choose a sampling technique.
 4. Determine sample size.
 5. Collect sample data.
 6. Assess response rate .
-

Types of Sampling

1. Probability Sampling (Random, each unit has equal chance)

- **Simple Random Sampling** – Every item has equal chance; lottery method.
- **Systematic Sampling** – Select every n th item after a random start.
- **Stratified Sampling** – Divide into homogeneous subgroups (strata), sample from each.
- **Cluster Sampling** – Select whole groups (clusters) randomly 【760†sourcentages**
Unbiased, representative, supports statistical inference.
Disadvantages: Time-consuming, costly, needs complete population list.

2. Non-Probability Sampling (Subjective, not all units included)

- **Convenience Sampling** – Based on easy access (e.g., nearby students).
- **Consecutive Sampling** – Study one group/person, then move to next.
- **Quota Sampling** – Selection based on specific traits to meet set numbers.
- **Purposive/ Judgmental Sampling** – Based on researcher's expertise.
- **Snowball Sampling** – Existing participants recruit others (hard-to-reach groups) 【760†sourcentages**
Quick, cost-

effective, useful in exploratory/qualitative research.

Disadvantages: Biased, not representative, limited generalization.

Probability vs Non-Probability

Aspect	Probability Sampling	Non-Probability Sampling
Selection	Random	Researcher's judgment / convenience
Bias	Less prone	More prone
Generalization	Possible to population	Limited
Accuracy	Allows error estimation	Cannot measure sampling error
Cost/Time	Higher	Lower

Unit 9 (Class 6)

Parametric & Non-Parametric Statistics | Hypothesis Tests

Parametric Statistics

- **Definition:** Tests that assume data follows a **normal distribution** and use **interval/ratio data**.
- **Key Assumptions:**
 - Normal distribution.

- Interval/ratio level data.
- Homogeneity of variance.
- Larger sample size preferable.

- **Examples:**

- **t-test** (Independent, Paired, One-sample).
 - **Z-test** (Large n , σ known).
 - **ANOVA** (compare ≥ 3 groups).
 - **Pearson's correlation.**
 - **Regression analysis.**
-

Non-Parametric Statistics

- **Definition:** Tests that **do not assume normality**, suitable for **ordinal/nominal data**.
- **Key Features:**
 - Based on **ranks/frequencies**.
 - Useful with small sample sizes.
- **Examples:**
 - **Chi-Square test** (Goodness-of-fit, Independence).
 - **Mann-Whitney U test** (alternative to independent t-test).
 - **Wilcoxon signed-rank test** (alternative to paired t-test).
 - **Kruskal-Wallis test** (alternative to ANOVA).

- **Spearman's rank correlation.**

Key Statistical Tests

Z-Test

- Compares sample mean to population mean (σ known, $n > 30$).
- Types: One-sample, Two-sample, Proportions.
- Formula: $Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$

T-Test

- Used for small samples ($n < 30$, σ unknown).
- Types:
 - One-sample → compares sample mean to population mean.
 - Independent (two-sample) → compares two group means.
 - Paired (dependent) → compares pre/post within same group.

ANOVA (Analysis of Variance)

- Compares means of **3+ groups**.
- Types: One-way, Two-way, Repeated Measures.
- Assumes normal distribution & equal variances.

Chi-Square (χ^2)

- Tests **association between categorical variables**.

- Types:
 - Goodness-of-fit.
 - Test of independence.
- Formula: $\chi^2 = \sum \frac{(O - E)^2}{E}$

Mann-Whitney U Test

- Non-parametric alternative to **independent t-test**.
- Compares medians of two independent groups.

Kruskal-Wallis H Test

- Non-parametric alternative to **ANOVA**.
- Compares **3+ independent groups**.

F-Test

- Compares **variances of two populations**.
- Also used in regression to test model significance.

Unit 9 (Class 7)

Hypothesis Testing & Errors

Hypothesis

- **Definition:** Formal statement predicting relationship between variables.
 - **Objectives:** Guides research, predicts outcomes, testable statement.
-

Types of Hypothesis

- **Null (H_0):** No difference/effect.
 - **Alternative (H_1):** Effect/difference exists.
 - **Simple:** Relates 2 variables (IV & DV).
 - **Complex:** Involves >2 variables.
 - **Statistical:** Testable using statistical tools.
 - **Empirical:** Based on observations/evidence.
 - **Directional:** Specifies direction.
 - **Non-directional:** Relationship exists, no direction.
-

Characteristics of a Good Hypothesis

- Short & precise.
 - Specific & related to existing knowledge.
 - Capable of verification.
-

Type I Error (False Positive)

- Rejecting **true H_0** .
 - Probability = α (**significance level**).
 - Example: Innocent athlete declared doped.
 - **Reduce:** Smaller α (0.01), reliable tools, larger sample.
-

Type II Error (False Negative)

- Failing to reject **false H_0** .
 - Probability = β .
 - Example: Guilty athlete passes clean.
 - **Reduce:** Larger sample, powerful tests, reduce variability.
 - **Power of Test = $1 - \beta$** → higher power = better detection.
-

Steps in Hypothesis Testing

1. State H_0 & H_1 .
 2. Choose α (0.05 / 0.01).
 3. Collect & analyze data.
 4. Compute test statistic & p-value.
 5. Compare p with α → reject/accept H_0 .
 6. Interpret & report findings.
-

Unit 9 (Class 8)

Correlation & Regression Analysis

Correlation

- **Definition:** Statistical relationship between two variables; symbol **r**, range **-1 to +1**.
- **Significance:** Helps in prediction, decision-making, problem identification, and reducing uncertainty.

Types of Correlation

1. **Positive** → both variables ↑ or ↓ together (e.g., income & expenditure).
2. **Negative** → one ↑ while other ↓ (e.g., price & demand).
3. **Linear** → change in constant ratio; straight-line relation.
4. **Non-linear** → change not proportional; curved relation.
5. **Simple** → between 2 variables.
6. **Partial** → between 2 variables while keeping others constant.
7. **Multiple** → 3 or more variables studied together.

Degree of Correlation

- **Perfect Positive:** $r = +1$.
- **Perfect Negative:** $r = -1$.
- **Zero Correlation:** $r = 0$.
- **Limited Correlation:** r lies between -1 and $+1$ (low, moderate, high).

Methods of Correlation

1. **Scatter Diagram** → visual relation (perfect, positive, negative, none).
2. **Simple Graphical Method** → line, bar, histograms, circle graphs.
3. **Karl Pearson's Coefficient (r)** → Product-Moment method.

- Methods: Actual mean, Direct, Assumed mean, Step-deviation.
- Assumptions: linearity, normality, no outliers, ratio/interval data.

4. Spearman's Rank Correlation (ρ)

- Formula: $\rho = 1 - \frac{6\sum D^2}{N(N^2-1)}$
- Non-parametric, used for ordinal/ranked data.

Regression Analysis

- **Definition:** Estimates relationship between dependent (Y) & independent (X) variables.
- **Uses:** Prediction, assessing strength of relation, future modeling.

Types

1. **Simple Linear Regression:** One IV, one DV → $y = a + bx$
2. **Multiple Linear Regression:** Several IVs predict DV.
3. **Logistic Regression:** For binary outcomes.
4. **Ordinal Regression:** Ordered categories (ratings).
5. **Multinomial Regression:** Multiple unordered categories.
6. **Discriminant Analysis:** Classifies into categories.

Assumptions

- Linearity, normality, independence, homoscedasticity, no outliers, representative sample.

Variables & Attributes

- **Variables:** Quantitative (height, score), Qualitative (gender), Independent (training type), Dependent (performance), Discrete (goals scored), Continuous (time).
 - **Attributes:** Qualitative characteristics not numerically measurable (e.g., gender, blood group).
-

Normal Probability Curve

- Symmetrical, bell-shaped.
 - Mean = Median = Mode.
 - 68–95–99.7 Rule applies.
 - No skewness.
-

Difference: Correlation vs Regression

Aspect	Correlation	Regression
Definition	Measures association between 2+ variables	Explains how IV affects DV numerically
Range	–1 to +1	Coefficients may be any value
Variables	Both random	IV fixed, DV dependent
Aim	Show relationship	Predict DV from IV

Aspect	Correlation	Regression
Symmetry	Mutual	One-way (IV→DV)
Measure	Relative	Absolute

Unit 9 (Class 9)

Numerical Practice – Statistics in Physical Education & Sports

Measures of Central Tendency

- **Mean:** Average of values.
 - Ex: Push-ups [35, 40, 38, 37, 50] → Mean = 40.
 - **Median:** Middle value when data arranged.
 - Ex: Swimmers' times [28, 29, 30, 31, 32, 33, 35] → Median = 31.
 - **Mode:** Most frequent value.
 - Ex: Scores [6, 8, 7, 9, 8, 6] → Bimodal, mode = 6.
-

Measures of Dispersion

- **Range** = Max – Min.
 - Ex: Shooting scores [6–10] → Range = 4.
- **Variance** = Avg. squared deviation from mean.
 - Ex: Football goals [1,2,0,4,2,1,3] → Var ≈ 1.81.
- **Standard Deviation (SD)** = $\sqrt{\text{Variance}}$.

- Ex: Sprint times [10.2, 10.4, 10.3, 10.1, 10.0] → $SD \approx 0.16$.
 - **Mean Deviation (MD)** = Avg. absolute deviation from mean.
 - Ex: Javelin throws [55, 59, 60, 58, 57] → $MD \approx 1.4$.
-

Correlation & Regression

- **Pearson's r**: Measures linear relationship (−1 to +1).
 - Ex: Age vs Jump height → $r = +1$ (perfect positive).
 - **Spearman's Rank**: Non-parametric, for ranks.
 - **Regression**: Predicts DV from IV (not directly asked, but recall basics).
-

Distribution & Normal Curve

- **Empirical Rule (68–95–99.7)**:
 - 68% data within ± 1 SD.
 - Ex: Mean = 10.2s, $SD = 0.4$ → Range [9.8, 10.6].
 - **Skewness**:
 - Positively skewed → Tail to right (e.g., Runner times: 60–70 sec).
-

Applied Examples in Sports

- **CV (Coefficient of Variation)** = $(SD/Mean) \times 100$.
 - Ex: Basketball scores Mean=17.33, $SD=6$ → $CV \approx 34.6\%$.

- **Mode & Median together**: Volleyball team scores → Mode=22, Median=22.
 - **Range**: Jump heights [60–48] → Range=12.
-

UNIT 10

Unit 10 (Class 1)

Thirumoolar – Key Facts

- One of **63 Nayanmars** & **18 Siddhars** .
- Disciple of **Nandi Devar** (Lord Shiva's attendant).
- Authored **திருமந்திரம் (Thirumandiram)** – Tamil Shaiva Siddhanta text (~3000 verses, 9 Tantras) .
- Famous quote: **“Anbae Sivam”** = *Love is God; God is Love* .
- Yogic power: **Kayakalpa Siddhi** – used to revive Moolan .

Contributions of Thirumoolar

- Explained **Therapeutic benefits of Yoga** (more detailed than Patanjali).
- Balanced **Tridoshas**: Vata, Pitta, Kapha .
- Oldest Tamil scripture on **Yoga & Shaivism**.
- Detailed **Ashtanga Yoga** (3rd Tantra of Thirumandiram) .

Thirumoolar's Ashtanga Yoga – 8 Limbs

1. **Yama (Ethical Discipline)** – Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha.
2. **Niyama (Self-Discipline)** – Shaucha, Santosha, Tapas, Swadhyaya, Ishwarapranidhana.

3. **Asana (Postures)** – Padmasana, Siddhasana, Sarvangasana, Halasana, Bhujangasana, Dhanurasana, Paschimottanasana, Vajrasana, Trikonasana, Vrikshasana .

4. Pranayama (Breath Control) –

- **Phases**: Puraka (Inhale), Kumbhaka (Hold), Rechaka (Exhale).
- **Types**: Nadi Shodhana, Kapalabhati, Ujjayi, Surya Bhedana, Chandra Bhedana, Murcha, Plavini .

5. **Pratyahara** – Withdrawal of senses, turning inward.

6. **Dharana** – Concentration; ex: **Trataka** (candle gazing).

7. **Dhyana** – Meditation (Siva Dhyana, Nada Yoga).

8. **Samadhi** – Ultimate realization (Savikalpa, Nirvikalpa, Sahaja Samadhi) .

Unit 10 (Class 2)

Sports Tourism

Definition

- **Sports Tourism** → Traveling to **observe or participate** in sports events (spectator or participant).
- Includes both **commercial & non-commercial** activities.

Characteristics of Sports Tourism

- **Blends sports & travel.**

- Offers **unique experiences**: stadiums, golf courses, cultural events.
- Builds **community & camaraderie**.
- Promotes **health & fitness**.
- Reflects **local traditions & culture**.
- Supports **authentic local experiences**.

Case Study – Barcelona Olympics (1992)

- Improved **transport, communication & hospitality**.
- Elevated Barcelona to **global tourism hub**.
- Tourism ↑ by **90% in a decade**.
- Created **20,000+ jobs**.
- Boosted **long-term economy & civic pride**.

Stakeholders in Sports Tourism

- **Athletes** – Central attraction, brand value.
- **Event Organizers** – Logistics, sponsorship, fan experience.
- **Government Bodies** – Policy, funding, regulation.
- **Tour Operators & Travel Agencies** – Packages & bookings.
- **Local Communities** – Services & cultural experiences.
- **Media & Broadcasters** – Global coverage & promotion.
- **Sponsors & Advertisers** – Financial support, branding.

- **Infrastructure Providers** – Stadiums, transport, hotels.

Types of Sports Tourists

1. **Hard-core Fans** – Travel for mega-events (Olympics, FIFA).
2. **Active Participants** – Compete/train (marathons, camps).
3. **Cultural Tourists** – Explore sports heritage (Camp Nou, Jallikattu).
4. **Recreational Tourists** – Fitness holidays (skiing, scuba diving, golf).
5. **Corporate Sports Tourists** – MICE events, team-building, sports retreats.

Sports Tourism in India

- **Rising Trend** → aligned with global growth.
- **Cricket-centric tourism** (IPL, World Cup, Ranji).
- **Leagues**: IPL, ISL, Pro Kabaddi, Prime Volleyball.
- **Challenge**: Short league duration (2–3 months) → off-season slump.
- **Solutions**: Year-round events, sports infrastructure (e.g., **CSE, Bengaluru**).

Economic Impact

- By **2027** → **USD \$14.4 Trillion globally**.

- **Hard Benefits:** flights, stadiums, mega events (Olympics, F1, World Cups).
- **Soft Benefits:** vendor income, local tourism boost.
- **Core Benefits:** Employment, income, destination branding, urban development.

Issues in Sports Tourism

- Strain on transport, water & resources.
- Overcrowding, safety, security issues.
- Noise, waste, pollution.
- Seasonal dependence.

Future Trends (2025–2030)

1. **AI & VR Sports Tourism** – Virtual stadiums, AR experiences.
2. **Eco-Sustainable Tourism** – Green stadiums, eco-lodges.
3. **E-Sports Tourism** – Global gaming tournaments (PUBG, Dota 2).
4. **Women-Centric Packages** – Women's marathons, yoga retreats.
5. **Solo & Digital Nomad Sports Travel** – Active holidays with remote work.

Famous Sports Tourism Hubs

International

- **FIFA Museum** – Zurich, Switzerland.
- **Camp Nou** – Barcelona, Spain.
- **Anfield & Old Trafford** – England.
- **Lord's, MCG** – Cricket (London, Melbourne).
- **Roland Garros, Wimbledon, Melbourne Park** – Tennis.
- **Suzuka Circuit (Japan), F1 – Greater Noida (India).**
- **Great Barrier Reef (Australia)** – Diving.
- **Everest Base Camp (Nepal)** – Trekking.
- **Bondi Beach (Australia)** – Surfing.

National (India)

- **Cricket** – Eden Gardens (Kolkata), Narendra Modi Stadium (Ahmedabad), Wankhede (Mumbai).
- **Adventure Sports** – Rishikesh (rafting, bungee), Manali (skiing, trekking), Auli Ski Resort.
- **Polo** – Jaipur (Rajasthan).
- **Desert Sports** – Jaisalmer (Thar Desert).
- **Hockey** – Major Dhyan Chand Stadium (Delhi).
- **Shooting** – Dr. Karni Singh Range (Delhi).
- **Multi-sport** – Kalinga Stadium (Bhubaneswar), SDAT (Tamil Nadu).
- **Yoga & Wellness** – Rishikesh (Yoga Festival).
- **Traditional Sports** – Jallikattu (Tamil Nadu).

Unit 10 (Class 3)

Interdisciplinary Approach | LTAD | Technological Innovations in Sports

Interdisciplinary Approach in Athlete Development

- **Definition** → Integration of multiple disciplines for **holistic athlete growth**.
- **Fields Involved** → Coaching, Sports Medicine, Physiotherapy, Psychology, Biomechanics, Nutrition, Technology.
- **Focus Areas** → Physical, mental, emotional, tactical, nutritional, social needs.
- **Major Outcomes** → Injury prevention, recovery, performance enhancement, communication, long-term development.

Roles of Specialists

- **Coach** → Training plans, technical & tactical skills, team coordination.
- **Exercise Physiologist** → VO₂ max, energy systems, fatigue, recovery.
- **Nutritionist** → Diet, hydration, nutrient timing.
- **Sports Psychologist** → Motivation, focus, visualization, stress control.
- **Biomechanist** → Movement, posture, technique, injury prevention.
- **Physiotherapist** → Rehabilitation, mobility, flexibility training.

- **Sports Doctor** → Medical check-ups, injury assessment, return-to-play.
- **Sports Lawyer** → Legal aid, contracts, fair play, doping issues.
- **Pedagogue** → Teaching skills, rules, ethics.
- **Sociologist** → Social & cultural aspects.
- **Technologist/Analyst** → Wearables, video, data analytics.

Long-Term Athlete Development (LTAD)

- **Framework:** Develops **physical literacy & performance** from childhood → elite → lifelong activity.

Stage	Focus Area	Age	Key Features
Active Start	Fun physical activity, basic movements	0–6 yrs	Play-based
FUNDamentals	Agility, balance, coordination	6–9 yrs	Skill learning before competition
Learn to Train	Sport-specific skills	8–12 yrs	Structured practice, light competition
Train to Train	Endurance, strength, strategy basics	11–16 yrs	Periodized training
Train to Compete	High performance prep	15–21 yrs	Refinement of tactics & skills

Stage	Focus Area	Age	Key Features
Train to Win	Elite performance	18+ yrs	Maximum output in competitions
Active for Life	Fitness & recreation	Any age	Lifelong activity

Technology & Data Analytics in Sports

- **Wearables:** Track HR, GPS, sleep, stride, motion.
- **Video & AI Analysis:** Skill correction, tactical feedback.
- **Motion Capture:** Posture, joint movement, biomechanics.
- **Apps:** Strava, Garmin Connect, MyFitnessPal.
- **AR/VR Tools:** Virtual training, fan engagement.

Types of Wearables

- **Head-worn** → Smart glasses, headcams.
- **Straps** → HR monitors, ECG chest straps.
- **Shirts/Vests** → Smart sensors for posture & HR.
- **Wrist-worn** → Smartwatches, fitness bands.
- **Shoe/Foot Pods** → Stride, cadence, foot strike.
- **Motion Sensor Suits** → Track joint movement.
- **Smart Mouthguards/Helmets** → Detect collisions & concussions.

Benefits

- Real-time performance feedback.
- Injury prevention & recovery monitoring.
- Data-driven coaching.
- Improved fairness (Hawk-Eye, VAR).
- Enhanced fan engagement.

Unit 10 (Class 4)

Biomechanical Analysis

- **Definition:** Study of **structure & function of human movement** using mechanics .
- **Kinesiology** → scientific study of human movement.
- **Biomechanics** → application of mechanical principles to body structure & function.
- **Focus:** Performance improvement + injury prevention .

Types of Biomechanical Analysis

- **Qualitative** → Visual observation, descriptive.
- **Quantitative** → Measured using instruments .

Branches of Biomechanics

1. **Kinematics** – Motion without considering force.
 - *Aspects:* position, displacement, velocity, acceleration.

- *Motion*: Linear (straight), Angular (rotary).
- *Examples*: Stride length, release angle in throwing.
- *Related Law*: Equations of motion ($s=ut+\frac{1}{2}at^2$, $s = ut + \frac{1}{2}at^2$).

2. **Kinetics** – Forces causing or modifying motion.

- *Aspects*: force, torque, mass, momentum, friction, gravity.
- *Formula*: Force ($F = m \times a$), Torque ($\tau = F \times r \times \sin\theta$, $\tau = F \times r \times \sin\theta$).

Static vs Dynamic

Aspect	Static	Dynamic
Motion	No movement / constant velocity	Movement with acceleration
Forces	Balanced	Unbalanced cause motion
Examples	Standing still, yoga pose, handstand	Walking, sprinting, throwing, swimming
Focus	Stability, posture, control	Movement analysis

Newton's Laws in Biomechanics

1. **First Law (Inertia)**

- Object stays at rest/motion unless external force acts.

- *Ex*: Football stays still until kicked; puck moves till friction stops.

2. **Second Law (Acceleration)**

- $F = m \times a$, $F = m \times a$. Acceleration $\propto$ force, $\propto 1/\text{mass}$.
- *Ex*: Light ball accelerates faster than heavy ball with same force; sprinter pushes ground harder for fast start.

3. **Third Law (Action–Reaction)**

- Every action $\rightarrow$ equal & opposite reaction.
- *Ex*: Swimmer pushes water back $\rightarrow$ moves forward; jumper pushes ground $\rightarrow$ ground pushes up.

Momentum

- **Definition**: Quantity of motion = $\mathbf{p} = \mathbf{m} \times \mathbf{v}$.
- **Vector quantity** (magnitude + direction).
- **Units**: $\text{kg} \cdot \text{m/s}$.

Types

- **Linear Momentum**: Straight-line motion (Sprinter running).
- **Angular Momentum**: Rotary motion (Gymnast spinning).

Law of Conservation of Momentum

Total momentum before collision = Total momentum after collision
 $\{ \text{Total momentum before collision} = \text{Total momentum after collision} \}$

- **Impulse**: Change in momentum, $F \times t$, $F \times t$.

- Longer time → safer landing (e.g., bend knees in jump) .

Tools & Techniques

- Motion capture (3D).
- Force plates.
- EMG (muscle activity).
- Wearable sensors.
- High-speed cameras.
- Video analysis software (Dartfish, Kinovea) .

Applications in Sports

- **Performance improvement** → Technique analysis, movement efficiency.
- **Injury prevention** → Identifying risky movements.
- **Rehabilitation** → Monitor recovery.
- **Equipment design** → Ergonomic tools.
- **Coaching** → Scientific training & correction .

Unit 10 (Class 5)

Stability | Levers | Equilibrium | Projectile | Walking

Stability

- **Definition:** Resistance to linear & angular motion; resistance to disturbance of equilibrium .

Factors Affecting Stability:

- Base of Support → wider base = more stable.
- Centre of Gravity → lower C.G. = more stable.
- Line of Gravity → should fall within base.
- Body Mass → greater mass = more stability .

Levers (நெம்புகோல்)

Definition: Rigid bar rotating around a fixed point (Fulcrum).

Parts:

- **Fulcrum (F)** – axis of rotation (usually a joint).
- **Effort (E)** – muscular force applied.
- **Load (L)** – resistance to be moved .

Classes of Levers in Body

Class	Order	Fulcrum Position	Mechanical Advantage	Examples	Human Body
I	L-F-E	Fulcrum between load & effort	Can be >1, <1, or =1	Seesaw, scissors	Neck joint (head nodding), Batting in cricket

Class	Order	Fulcrum Position	Mechanical Advantage	Examples	Human Body
II	F-L-E	Load between fulcrum & effort	Always >1 (force advantage)	Wheelbarrow	Standing on tiptoes (toes = fulcrum, body = load, calf muscles = effort)
III	F-E-L	Effort between fulcrum & load	Always <1 (speed advantage)	Tweezers, fishing rod	Biceps curl (elbow = fulcrum, biceps = effort, hand = load)

Equilibrium (சமநிலை)

- **Definition:** State of balance when all forces and torques cancel out → no acceleration .
- **Conditions:**
 - $\Sigma F = 0$ (no net force).
 - $\Sigma T = 0$ (no net torque).
- **Factors:**
 - Base of Support – wide base = more stability.
 - Centre of Gravity – lower = more stable.
 - Line of Gravity – should pass within base.

- Mass – greater mass = more stability .

Types of Equilibrium

1. **Stable** – Returns to original position (e.g., standing posture).
2. **Unstable** – Moves further away when disturbed (e.g., sprinter at “set” position).
3. **Neutral** – Remains in new position when displaced (e.g., ball on table) .

Projectile Motion (வீச்சு)

- **Definition:** Path of a body thrown into space, influenced by force & gravity .

Factors Affecting Projectile Path

1. **Angle of Projection** –
 - 90° → vertical path.
 - 0° – 90° → parabolic (e.g., long jump, javelin).
 - 0° → horizontal fall .
2. **Projection Speed** – Higher speed = longer range.
3. **Relative Height** – Difference between release & landing height affects flight time & distance .

Walking Analysis

- **Walking** = rhythmic, repetitive forward movement of limbs.

- **Phases:**

- **Stance phase** (foot in contact with ground).
- **Swing phase** (foot moves forward).
- **Double support** (both feet contact ground).

- **Comparison with Running:**

- Walking → always one foot on ground.
- Running → includes **double float phase** (both feet in air).
- Running requires more **balance, strength, joint mobility**; higher **injury risk**.

Unit 10 (Class 6)

Biomechanical Analysis of Movements | Track & Field | Bones & Muscles

Walking (நடப்பது) – Gait Cycle

Stance Phase (60%): Heel strike → Foot flat → Mid-stance → Heel off → Toe off

Swing Phase (40%): Acceleration → Mid-swing → Deceleration

- **Base of Support:** Narrow but stable.
- **Centre of Gravity (COG):** Slight vertical displacement.
- **Joint Actions:**
 - Hip: Flexion → Extension

- Knee: Extension → Flexion → Extension
- Ankle: Dorsiflexion → Plantarflexion

- **Muscles:** Gluteals, Hamstrings, Quadriceps, Calf muscles, Tibialis anterior.
- **Forces:** Ground Reaction Force (GRF), friction, minimal vertical impulse.
- **Focus:** Gait symmetry, stride length, cadence, posture.

Jumping

Phases: Preparation → Take-off → Flight → Landing

- **Principle:** Newton's 3rd Law (Action–Reaction).
- **Centre of Mass:** Raised at take-off.
- **Joint Actions:** Hip flexion → Extension; Knee flexion → Extension; Ankle dorsiflexion → Plantarflexion.
- **Muscles:** Quadriceps, Glutes, Calves.
- **Projection Angle:** 30°–35° (long jump optimal).
- **Landing:** Flexion to absorb force.

Running

Phases: Stance → Swing → Flight phase

- **Key Factors:** Stride frequency + length = speed.
- **Forces:** GRF higher than walking.
- **COG:** More vertical displacement.

- **Muscles:** Glutes, Hamstrings, Quadriceps, Calves (explosive).
- **Energy Transfer:** Elastic energy in tendons aids propulsion.

Throwing

Phases: Wind-up → Cocking → Acceleration → Release → Follow-through

- **Sequential Summation of Force:** Legs → Trunk → Shoulder → Arm → Hand.
- **Lever:** Third-class lever (arm).
- **Joint Actions:** Shoulder external → internal rotation; Elbow flex → extension; Wrist flex → extension.
- **Muscles:** Deltoid, Triceps, Pectorals, Core.
- **Key Factor:** Angular velocity at release.

Pushing

- **Types:** Horizontal / Vertical pushing.
- **Principle:** Force in line with object, Newton's 3rd Law.
- **Joint Actions:** Shoulder flexion, Elbow extension, Wrist stabilization.
- **Muscles:** Pectorals, Triceps, Deltoid, Core.
- **Stability:** Wide base, correct posture for effective transfer.

Kicking

Phases: Preparation → Leg swing → Impact → Follow-through

- **Principle:** Sequential force (Hip → Thigh → Knee → Foot).
- **Lever:** Third-class lever.
- **Joint Actions:** Hip flexion, Knee extension, Ankle plantarflexion.
- **Muscles:** Quadriceps, Hip flexors, Glutes, Tibialis anterior.
- **Factors:** Balance on support leg, approach speed, flexibility.

Track Events

1. Sprints (100m, 200m, 400m)

- Phases: Start → Acceleration → Max Velocity → Deceleration.
- Focus: Reaction time, Explosive power, Stride frequency/length, Low COG.

2. Middle Distance (800m, 1500m)

- Even pacing, aerobic–anaerobic balance.
- Efficient stride, smooth gait, tactical finish.

3. Long Distance / Marathon

- Steady rhythm, endurance focus, fatigue management.
- Use of slow-twitch fibers.

4. Hurdles (100mH, 110mH, 400mH)

- Phases: Start → Approach → Take-off → Clearance → Landing → Recovery.

- Key: Lead/trail leg coordination, low COG, rhythm maintenance.

5. **Relay (4×100m, 4×400m)**

- Key: Baton exchange (non-visual in 4×100m), stride synchronization, team timing.

6. **Steeplechase (3000m)**

- Barriers, water jump, energy management, recovery after jumps.

7. **Race Walking (20km, 50km)**

- No flight phase, knee straight at contact, pelvic rotation, step frequency.
- Focus: Rule compliance & efficiency.

Field Events

1. **Long Jump** → Angle: 30°–35°, speed + lift, stable landing.
2. **High Jump** → Fosbury Flop, vertical lift, COG beyond bar.
3. **Triple Jump** → Hop → Step → Jump, equal distribution, balance.
4. **Pole Vault** → Run-up → Plant → Take-off → Rock back → Clearance → Landing; energy conversion.
5. **Shot Put** → Glide/Spin → Power position → Release (35°–42°) → Recovery.
6. **Discus Throw** → Release angle 35°–40°, rotation & balance.

7. **Javelin Throw** → Release angle 30°–36°, speed + block leg.
8. **Hammer Throw** → Swings → Turns → Release → Recovery; centripetal force, smooth turns.

Unit 10 (Class 7)

Basketball – Biomechanical Analysis

Shooting

- **Kinematics:** Shoulder, elbow, wrist angles.
- **Kinetics:** Force transfer from legs → trunk → arms → hands.
- **Key Factor:** Parabolic trajectory; release angle = **50–55°** for free throw/jump shot.
- **Backspin** → Softer rebound, accuracy.

Dribbling

- Coordination of **upper & lower limbs**.
- **Ground Reaction Force** during ball-hand contact.

Jumping (Rebound/Block)

- Requires **vertical force production**.
- **Centre of Gravity (COG)** & **Base of Support** critical for balance.

Factors Affecting Accuracy

- Consistent release **angle & speed**.
- Stable base of support.

- Eye focus on **back edge of rim**.
- Proper timing of jump & release.

Speed in Basketball

- **Shot speed**: Too slow → blocked; Too fast → less control.
- **Pass speed**: Chest pass ~ **8–12 m/s**.
- **Dribble speed**: Controlled in close play, faster in breaks.
- **Sprint speed**: Needed for quick transitions.

Football (Soccer) – Biomechanical Analysis

Key Skills & Biomechanics

1. Kicking

- Motion: Angular + Linear.
- Muscles: Hip flexors, quadriceps, ankle plantar flexors.
- Principles: **Sequential summation of forces**, angular velocity, stable plant foot.
- Example: **Free kick with curve**.

2. Running/Sprinting

- Motion: Linear.
- Factors: Stride length & frequency, GRF, arm swing.
- Example: **Counter-attack sprint**.

3. Agility / Changing Direction

- Deceleration + re-acceleration.
- Low COG, eccentric control.
- Example: Dodging defender.

4. Jumping & Heading

- Motion: Vertical/projectile.
- Factors: Leg force, neck stability, timing.
- Example: Header goal from corner.

5. Tackling

- Motion: Rapid + contact.
- Stability, momentum, proper angle.
- Example: **Slide tackle**.

Key Biomechanical Concepts

- **Angle of Projection** → Controls flight path (shooting, passing).
- **Speed of Release** → Affects distance & accuracy.
- **Height of Release** → Higher = harder to block.
- **Spin** → Backspin for control; topspin for bounce passes.
- **Force Application** → Sequential & coordinated muscular effort.

Unit 10 (Class 8)

Biomechanical Analysis of Sports Skills & Stress Management Techniques

Biomechanical Analysis – Common Errors & Key Principles

Football (Soccer)

- **Common Errors:** Leaning back too far while shooting, poor foot placement, limited hip follow-through.
 - **Performance Factors:** Optimal kicking angle ($\sim 30^\circ$), proper ball contact, hip rotation, balance before/after contact.
 - **Biomechanical Principles:** Newton's Laws, Projectile motion, Stability & balance, Force production, Momentum transfer.
 - **Key Skills:** Passing, Dribbling, Shooting, Heading.
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Basketball

- **Common Errors:** Flat trajectory, no follow-through, poor landing balance.
 - **Performance Factors:** Release angle ($\sim 45^\circ$), backspin for stability, knee & ankle flexion for jump height.
 - **Principles:** Projectile motion (shooting), Stability, Levers (arm = 3rd class lever), Coordination of kinetic chain.
 - **Key Skills:** Shooting, Dribbling, Passing, Rebounding.
-

Volleyball

- **Common Errors:** Late timing, incomplete arm extension, excessive forward lean in jump.

- **Performance Factors:** Jump height, arm swing timing, wrist snap, COG control.
 - **Principles:** Angular motion (spike), Force summation, Stability, Projectile motion (serve), Reaction time.
 - **Key Skills:** Serve, Spike, Block, Dig.
-

Hockey (Field)

- **Common Errors:** Upright posture (less balance), poor stick-ball contact.
 - **Performance Factors:** Stick angle, low body stance, proper follow-through.
 - **Principles:** Newton's Laws, Friction (stick-ball), Momentum transfer, Stability.
 - **Key Skills:** Push pass, Hit, Dribble, Tackle.
-

Handball

- **Common Errors:** Poor jump balance, delayed release, weak arm whip.
 - **Performance Factors:** Jump height, release height, wrist flick, step rhythm.
 - **Principles:** Projectile motion, Angular velocity, Stability, Force summation.
 - **Key Skills:** Jump shot, Dribble, Pass, Block.
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Cricket

- **Common Errors:** Over-rotation in bowling, poor head position in batting.
 - **Performance Factors:** Bat speed, back lift, hip–shoulder separation, seam position.
 - **Principles:** Linear & angular motion, Projectile motion, Stability, Torque in bowling.
 - **Key Skills:** Batting (drives, pulls), Bowling, Fielding throws.
-

Rugby

- **Common Errors:** Upright tackling, poor plant foot before kick.
 - **Performance Factors:** Body alignment, optimal kicking angle, leg drive in scrums.
 - **Principles:** Stability (low COG in tackles), Force production, Momentum transfer, Projectile motion.
 - **Key Skills:** Passing, Tackling, Scrum push, Kicking.
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Kabaddi

- **Common Errors:** Overextending reach, poor recovery stance.
- **Performance Factors:** Low COG, quick acceleration/deceleration, grip strength.
- **Principles:** Balance, Stability, Reaction time, Force production.
- **Key Skills:** Raid run, Hand touch, Block, Escape.

Water Polo

- **Common Errors:** Dropped elbow, poor kick rhythm.
 - **Performance Factors:** High elbow release, core stability, ball spin, eggbeater kick.
 - **Principles:** Stability in water, Force summation, Projectile motion, Water resistance.
 - **Key Skills:** Passing, Shooting, Eggbeater kick.
-

American Football

- **Common Errors:** Poor foot stance, over-rotation in throws.
 - **Performance Factors:** Throwing arc, low stance in blocking, COG behind base.
 - **Principles:** Projectile motion, Stability, Force summation, Momentum.
 - **Key Skills:** Passing, Blocking, Tackling.
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Stress Management Techniques

Definition: Strategies to control stress (esp. chronic) for better performance, health & well-being.

Uses

- **Performance** → Improves focus, reduces distractions.

- **Physical Health** → Lowers heart rate, BP; improves recovery & immunity.
- **Mental Health** → Reduces anxiety, burnout; improves balance.
- **Decision-Making** → Clarity in high-pressure moments.
- **Team Dynamics** → Better communication & cooperation.

Applications

- **Athletes:** Manage pressure, recover from injury, maintain stability.
- **Coaches:** Manage team expectations, strategy, relationships.
- **Officials:** Handle crowd stress, maintain impartiality.
- **Sports Managers:** Reduce decision fatigue, plan under stress.
- **Academies:** Yoga, meditation programs, balance sports & academics.

Common Techniques

1. **Breathing Exercises** – Deep, rhythmic breathing; lowers HR, activates parasympathetic NS.
2. **Progressive Muscle Relaxation (PMR)** – Tense & relax muscles; reduces tension.
3. **Visualization/Mental Imagery** – Mentally rehearse skills (e.g., gymnastics vault).
4. **Mindfulness & Meditation** – Focus on present, reduce anxiety.
5. **Positive Self-Talk** – Build confidence (e.g., “I can do this”).

6. **Time Management & Goal Setting** – Balance training, rest, studies.
7. **Counseling & Support Systems** – Seek psychologist/team sessions.
8. **Listening to Music / Art Therapy** – Reduces stress, motivates.
9. **Physical Activity / Cross-training** – Non-competitive fitness (swimming, yoga).

Unit 10 (Class 9)

Modern Trends in Physical Education & Sports

Virtual Reality (VR) in Sports Training

- **Definition:** Immersive digital simulation using VR headsets for skill practice in realistic environments.
- **Purpose:** Performance improvement, decision-making, skill precision, mental conditioning, safe practice.
- **Example:** Basketball player practices virtual shooting.

Pros

- Realistic simulations.
- Injury prevention (safe practice).
- Instant feedback & analytics.
- Remote training anytime, anywhere.
- Enhances mental focus & spatial awareness.

Cons

- High cost.
 - Limited physical engagement.
 - Technical glitches.
 - Motion sickness risk.
 - Overdependence may reduce adaptability.
-

Key Benefits of VR in Sports

1. Immersive match simulation.
 2. Improves focus & reaction time.
 3. Safe injury rehab & prevention.
 4. Skill development through repetition.
 5. Real-time analytics & tracking.
 6. Remote coaching access.
 7. Risk-free practice for dangerous moves.
 8. Better spatial awareness.
 9. Training in extreme conditions.
 10. Mental skills (visualization, resilience).
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Applications of VR/Tech in Sports

- **Team Sports:** Football, Basketball, Hockey strategy practice.

- **Individual Sports:** Golf, Tennis, Skiing technique.
 - **Tactical Analysis:** Game reviews, positioning analysis.
 - **Rehabilitation:** Interactive rehab sessions.
 - **Fan Engagement:** VR live/recorded matches.
 - **Officiating:** Video replay, AR/VR analysis.
 - **Equipment Training:** Virtual swings, racquet drills.
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Physical Literacy (Early Childhood)

Domains

- **Affective** → Motivation, confidence, enjoyment in activity.
 - **Physical** → Fundamental movement skills, endurance.
 - **Cognitive** → Knowledge of movement, health, safety.
 - **Behavioural** → Lifelong active participation, responsibility.
-

Age-Wise Physical Activity Guidelines

- **Infants (<1 yr):** ≥30 min tummy time/day, no screen time.
- **Toddlers (1–2 yrs):** ≥180 min/day any activity, no screen time <2 yrs.
- **Preschoolers (3–4 yrs):** ≥180 min/day (≥60 min energetic), screen ≤1 hr.
- **Children ≥5 yrs:** ≥60 min/day moderate–vigorous activity, 3+ days/wk strength & aerobic; limit screen ≤2 hrs/day.

Sedentary Behavior (all ages):

- Avoid >1 hr continuous sitting.
- Reduce screen time.
- Encourage active play & breaks.

Consequences of Overweight in Children

- Risk of **Type 2 Diabetes**.
- Reduced physical activity & sports participation.
- Low self-esteem, bullying.
- Poor health outcomes.

Technological Innovations in Sports

- **Wearables** → Track HR, GPS, load, injury risk.
- **VR & AR** → Training, officiating, fan experience.
- **Data Analytics** → Big data for performance & strategy.
- **Sports Biomechanics** → Motion capture, technique optimization.
- **Sports Betting Tech** → Real-time odds, predictive analysis.
- **Digital/Smart Stadiums** → IoT, mobile ticketing, green energy.
- **Smart Equipment** → Sensor-embedded balls, racquets, helmets.

- **AI & Machine Learning** → Scouting, prediction, tactical analysis.
- **5G Connectivity** → Instant data transfer, high-quality streaming.
- **E-sports Integration** → New fan engagement & revenue streams.

Playing Surfaces in Sports

Sport	Typical Surface	Key Points
Athletics (Track)	Polyurethane, Tartan, Rubberized	Shock absorption, grip
Football (Soccer)	Natural grass / Artificial turf	Turf for indoor/low maintenance
Cricket	Grass pitch, Clay wicket, Matting	Surface affects bounce, pace
Hockey	Synthetic turf (water-based/sand-dressed), Grass	Water-based = faster ball speed
Tennis	Grass, Clay, Hard court	Surface affects bounce & speed
Basketball	Wooden (maple), Synthetic vinyl, Asphalt (outdoor)	Indoor wood preferred
Badminton	Wooden floor + PVC/vinyl mats	Cushion mats reduce impact

Sport	Typical Surface	Key Points
Table Tennis	Wooden / Synthetic non-slippery	Stability required
Kabaddi/Kho-Kho	Clay/mud, Synthetic mats	Traditional games often on mud
Handball	Wooden / Synthetic; Asphalt (outdoor)	Requires friction & impact control
Rugby	Natural grass, Artificial turf	High durability needed
Baseball/Softball	Grass + Clay infield	Different field size
Swimming	Ceramic tiled pools	Anti-slip decks, safety
Gymnastics	Foam mats, carpet-bonded foam	Impact absorption
Track Cycling	Siberian pine, Synthetic (banked tracks)	Smooth, fast surface
Ice Hockey/Skating	Ice, Synthetic panels	Refrigerated rinks
Golf	Natural grass, Artificial turf (ranges)	Different grass cuts matter
