

Dr. Kwon's Golf Biomechanics Instructor Training Program - Level 1
Course Outline (15 hours)
(Last updated in February 2021)

Objectives

- To introduce basic mechanical quantities/concepts relevant to golf swing
- To introduce key biomechanical principles of human movement
- To provide the mechanical/biomechanical framework of a “mechanically good golf swing”

Class 1: Introduction

- Orientation & expected outcomes
- Golf swing biomechanics
- Main themes & key biomechanical principles
- Kinematics vs. kinetics
- Swing events & phases
- Types of motion
 - Linear
 - Angular
 - General: club & pelvis
 - Analysis strategies

Class 2: Basic kinematic concepts

- Scalar vs. vector
 - Vector addition/subtraction
 - The tip-to-tail method
 - Vector components
 - Tangential & normal acceleration
- Linear kinematic quantities
 - Position
 - Velocity & speed
 - Acceleration
- Angular kinematic quantities
 - Angular position
 - Angular velocity
 - Angular acceleration

Class 3: Basic kinetic quantities

- Mass
 - Center of mass (CM)
- Force
 - Properties
 - Various forces

- Properties
- Cause of motion
- Pressure
- Moment of force (torque)
 - Center of rotation
 - Point of action
 - Line of action
 - Plane of action
 - Moment arm
 - Moment of force (torque)
 - Moment vs. moment arm
- Types of force
 - Concentric
 - Eccentric
 - Force couple
- Net force & net moment
- Pivoting moment

Class 4: Key mechanical laws & principles

- System & external force
- Newton's laws of motion
 - Inertia
 - Acceleration
 - Reaction
- Ground reaction force
 - Foot-ground interaction
 - Center of pressure
 - Ground reaction moment
 - COP revisited
 - Net GRF & combined COP
- Momentum
 - Linear momentum
 - Angular momentum
- Impulse
 - Net linear impulse on golfer's body
 - Stack & Tilt
 - Jumping off
 - Net angular impulse on golfer's body
 - Frontal plane moment
- Newton's laws revisited
 - Newton's equation of motion

Class 5: Golfer's body

- Degrees of freedom (DOFs) in the golfer's body
- Types of muscle contraction
- Characteristics of skeletal muscle
- Stretch-shortening cycle (SSC)
 - Countermovement
- Countermovement vs. squat jump

Class 6: Linear kinematics of the CM & pelvis

- Body CM of the golfer's body
- Body CM motion
 - Horizontal
 - Vertical
- Positive/negative velocity/acceleration components
- Position-velocity-acceleration relationships
 - Horizontal rhythm
 - Vertical rhythm
- Pelvis CM motion
 - Forward/backward
 - Toward/away
 - Upward/downward
- Horizontal motion of the pelvis CM vs. surface-mounted sensor

Class 7: Functional swing plane

- Popular swing planes
 - Ben Hogan's shoulder plane
 - Hank Haney's shaft plane
 - Jim Hardy's shoulder/arm lines
 - Double-pendulum & triple-pendulum
- Functional swing plane (FSP)
 - Clubhead trajectory plane
 - Properties
 - Position of FSP
- Swing style classification based on FSP
- Popular models revisited
 - Jim Hardy's
 - Hank Haney's
- Motion planes (MPs) of the joints
 - Motion plane orientation
 - Hand MP and swing styles
- Ideal swing?
- Upper body- vs. lower body-dominant swing

Class 8: Angular kinematics

- Inclined axle-chain system
- Functional double-pendulum (FDP)
 - On-plane motion
- Angular position
 - Upper & lower lever angles
 - X-factor & shoulder/hip line angles
 - Hip/shoulder line motion ranges
- Angular velocities
- Kinematic sequence
 - Normal vs. abnormal sequences
 - Common issues
- Angular accelerations
- Rotation-based swing phases
- Club motion: linear vs. angular
 - Velocity relationship
 - Acceleration relationships
- Pelvis angular motions
 - Left/right rotation
 - Right/left lateral tilt
 - Posterior/anterior tilt
- Centrifugal force
- Pelvis angular motion
- Thorax angular motions
 - Conventional vs. Kwon method

Class 9: Kinetics: golfer-ground interaction

- Force plate vs. pressure mat/plate
- Golfer-ground interaction moments
 - GRF moments
 - Pivoting & foot contact moments
- Stepping-like rhythm in golf swing
- Biomechanics of the two-step swing
- Two-step swing drills

Chapter 10: Kinetics: momentum generation & transfer

- Moment of inertia
 - MOI of a particle & object
 - Human body
- MOI of the club about the body CM
- Angular momentum of the club
 - Local angular momentum
 - Remote angular momentums
- Angular momentum conservation
- Angular momentum transfer
- Angular momentum generation & transfer

- Changes in angular momentums of the body & club

Class 11: Summary

- The K·GRAND=IO=SE swing principles
 - Ground-up
 - Rhythmic
 - Asynchronous

- Natural
- Dynamic
- Impulsmart
- Orchestrated
- Safe
- Effectificient
- Q & A