

SS843

APPLICATION OF PHYSICS IN SPORTS AND GAMES

3-0-0-3

Course description: This course examines the physics behind a wide variety of sports, including football, baseball, hockey, soccer, track and field, swimming, etc. Understanding on the scientific concepts such as force, momentum and energy give a deeper understanding and appreciation of sports. The topics include basic physics, force, friction, torque and rotation, temperature and heat.

Course objectives/ outcome:

To get the deep understanding of scientific concepts behind all sports.

Unit I: Introduction/Orientation Length, Mass and Time: The Basic Units, Average speed, Velocity, and Acceleration (Auto/bicycle racing, Marathon, Sprint) Gravity and Falling Bodies w/o air resistance (Jumping, Diving, Sky Diving), Vectors and Projectile Motion: Two-dimensional problems w/o air resistance (Baseball, Football, Basketball throwing)

Unit II: Force; Newton's Laws of Motion (Concussion in Football and Boxing), Friction (Skiing, skating), Momentum Conservation, Collisions and Impact (Football, Auto racing, Auto accident, Tennis, Baseball batting)

Unit III: Torque and Rotation (Football blocking and tackling), Rotational Motion Centripetal Force (Bicycle and Auto racing, Figure skating), Angular Momentum Conservation (Football throwing, Figure skating, Diving, Gymnastics), Work, Energy, Power (Baseball pitching, Diving)

Unit IV: Temperature and Heat; Heat loss by conduction and radiation (Uniforms, Heat exhaustion) Elasticity (Bungee Jumping), Fluids and Pressure; Bernoulli's Effect (Scuba diving, Hang Gliding, Sailing), Air and Fluid Resistance, Drag force, Terminal speed (Sky diving, Auto racing)

Unit V: Magnus Force (Baseball Pitching: Curve ball, Slider, Knuckle ball, Sinker, cut fast ball; Football throwing and kicking; Volleyball hitting, Spins in Tennis, Ping-Pong and Soccer)

TEXT BOOKS/ REFERENCES:

1. David Halliday, Robert Resnick, and Jearl Walker, Fundamentals of Physics 9th Edition, John Wiley (2012)
2. Kittel et al, Mechanics, Berkeley Physics Course Vol. 1, 2nd edition, Tata McGraw Hill 2011.
3. Raymond. A. Serway and Jerry. S. Faughn, College Physics 7th Ed., Thomson Brooks/Cole, USA, 2009.
4. Francis. W. Sears, Mark. W. Zemanski and Hugh. D. Young, University Physics, Narosa Publishing House, 2011.
5. Richard P. Feynman, Robert. P. Leighton and Matthew Sands, Feynman Lectures on Physics Vol. 1, Narosa, 2003.
6. D.S. Mathur, Mechanics, S. Chand and C, India, 2000.
7. An Introduction to the Physics of Sports, Vasilios McInnes Stathopoulos