Program and Degree: **BSc in Aerospace Engineering**	
Course Description	
Course Title	**Aerodynamic II**
Prerequisites	Aerodynamic I
The course aims	-To provide students with knowledge of supersonic and compressible flow analysis -Ability of modelling and analysis of aerodynamic phenomenon in compressible flow -Ability of investigate of aerodynamics of flying objects with supersonic flows -Ability of analysis of boundary layer and aerodynamic forces
Contents	-Introduction to compressible flows: applications and principles of finite difference methods for solution of governing equations for viscous and inviscid flows. -Normal Shock Waves: formation of shock waves, normal shock wave governing equations, speed of sound and Mach number, Special forms of energy equations, compressibility criteria, normal shock waves characteristics, velocity measurement in compressible flows. -Oblique shock waves and expansion waves: oblique shock waves relations, supersonic flows over a wedge and a cone, interaction and reflection of shockwaves, detached shock over blunt bodies, Prantle-Meyer expansion waves and shock-expansion method for supersonic airfoils. -Compressible flow in convergent-divergent channels: one-dimensional compressible flow with cross-section variations, nozzle flows, investigation of isentropic flows and supersonic wind tunnels. - Compressible flow in constant cross-section channels with friction: Flow with friction in a pipe, Energy and momentum equations, Fanno line, Mach number-pipe length relation and effect of real gas. -Compressible flow in constant- cross-section channels with heat transfer, investigation of energy and momentum equations, Reighley line, Mach number-heat transferred relation, real gas effects. -Linearized flow (Subsonic and supersonic flows). -Hypersonic flows: Quantitative characteristics of hypersonic flows, Newtonian theory and some practical examples. -Introduction to viscous flows: quantitative characteristics of viscous flows, viscous separation, heat transfer, Navier-Stokes equations, energy equation for viscous flows, solution of incompressible boundary layer equations on a flat plate, Blasius method, Compressible flow over a flat plate, experimental data for laminar and turbulent flow boundary layers, examples of boundary layer control over airplane wings.

Duration	**1 Semester (16 weeks)**
Course Hours	**3 hours/week**
Course Type	**Required**