

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Thermal Engg.	Advanced Fluid Mechanics	MET 501	SM+MT+ET 25+25+50
Semester	Credits	L-T-P	Exam.
I	4	3-1-0	3 Hours

Unit –I

Review of Basic Concept: Concept of continuum; Types of fluids; Basic Laws in Integral Form: Reynolds's transport theorem; Integral form of continuity; Momentum and Energy equations; Navier – Stokes equation. **(05 Hours)**

Unit –II

Potential Flow: Uniform flow; Source & Sink; Free Vortex flow; Source & Uniform flow (flow past a half body); Source - Sink pair; Doublet; Flow past a Cylinder (Doublet & Uniform flow); Flow past a Rankine oval body (source; sink & a uniform flow); Flow past a cylinder with circulation (Doublet ; Vortex and uniform flow). **(09 Hours)**

Unit –III

Turbulent Flow: Introduction; growth of instability and transition from laminar to turbulent flow; Effects and classification of turbulence; Turbulent Intensity; scale of turbulence; Reynolds Equations of turbulence; Turbulence modeling; Boussinesq Eddy Viscosity concept; Prandtl mixing length concept; Von - Karman similarity concept; Empirical correlations for coefficient of Friction; Average velocity distribution for smooth and rough pipes. **(10 Hours)**

Unit –IV

Compressible Flow: Introduction; Wave propagation and sound velocity; Mach number and compressible flow regimes; Mach Core; Mach angle and mach Line; Basic equations for one dimensional compressible flow; Continuity equation; Momentum equation; Energy equation; Isentropic flow relations; Compressibility correction factor; Flow through nozzles and from a reservoir. **(07 Hours)**

Unit –V

Normal Shock Waves: Continuity equation; Momentum equations & energy equations; Flow with oblique shock wave; Nature of flow through oblique shock wave; Prandtl's equation; Rankine- Hugoniot equation. **(07 Hours)**

Unit –VI

Viscous Flow in Ducts: Stress-deformation relation; Navier- Stokes equations; Reynolds number Regimes; Internal vs External Viscous flow; Flow in circular pipes; Alternate forms of Moody Charts; Flow in non circular ducts; Minor losses in pipe system; Fluid meters. **(07 Hours)**

Recommended Books:

1. Fundamentals of Compressible Flow; S.M. Yahya; New Age International Publishers; 3rd Ed.; 2003
2. Fluid Mechanics; John F Douglas; Janusz M. Gasiorek; John A; Swaffield; Pearson Education; 4th Ed.; 2007
3. Advanced Engineering Fluid Mechanics; K Muralidhar & G. Biswas; Alpha Science International Ltd; 2005
4. Fluid Mechanics; Frank M. White; McGraw Hill; 6th Ed.; 2011
5. Viscous Fluid Flow; Frank M. White; Tata McGraw Hill; 3rd Ed.; 2013