**AE/ME/BME/ES 541** Dr. R. V. Arimilli
**Fluid Mechanics-I** 235 Dougherty Hall

# Course Outline/Syllabus

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| Session | Topic | Chap.Sec[1] | Chap.Sec[2] |
|---|---|---|---|
| 1 | Introduction; Few Motivating Ideas | 1 | 1.9 |
| 2 | Review of Integral Conservation Laws | 2 | 3 |
| 3 | Differential Conservation Laws | 2 | 4.1 - 4.3 |
| 4 | Differential Conservation Laws | 2 | 4.5 |
| | *Exact Solutions of Viscous Flow Equations* | | |
| 5 | Couette Flow, Cylindrical Couette Flow | 3.1 - 2 | 4.6 |
| 6 | Steady & Unsteady Duct Flow | 3.3.1-5; 3.4 | |
| 7 | First & Second Stokes Problems | 3.5 | |
| 8 | Similarity Solutions | 3.8 | |
| 9 | Laminar Boundary Layers | 4 | |
| 10 | Blasius Solution; Thwaites Method | 4.3; 4.6 | |
| 11 | Potential Flows | Notes | 4.7 |
| 12 | Potential Flows | Notes | 4.8 |
| 13 | Potential Flows | Notes | 8.1 - 8.4 |
| 14 | Potential Flows | Notes | 8.5 |
| 15 | Potential Flows & Review | Notes | |
| 16 | **Midterm Examination** | | |
| 17 | Similarity Solutions Falkner-Skan Flows | 4.3 | |
| 18 | Approximate Integral Methods | 4.6 | |
| 19 | Rotationally Symmetric Boundary Layers | 4.9 | |
| 20 | Computer Project Assignment & Discussion | | |
| 21 | Computer Project Discussion | | |
| 22 | Stability of Flows | 5.1, 5.2, 5.4 | |
| 23 | Stability of Flows - continued | | |
| 24 | Stability of Flows - continued | | |
| 25 | Turbulent Flows - Fundamental Ideas | 6.1-2 | |
| 26 | 2-D Turbulent Boundary Layer Equations, Semi-Theoretical Consideration of Turbulent Shear Flows | 6.3-4 | |
| 27 | Turbulent Flow in Pipes | 6.5 | |
| 28 | Turbulent Flow over Flat Plates | 6.6 | |
| 29 | Review of Turbulent Flows | | |
| 30 | **Review** | | |

## Texts:

**1** *Principal text:*
White, Frank M., Viscous Fluid Flow, 3rd Ed., 2006,McGraw Hill.

**2** *Supplementary Text:*
White, Frank M., Fluid Mechanics, 5th ED., 2008 or 2003, McGraw Hill.

## Other helpful texts:

**3** Schlichting, Hermann, Boundary layer Theory, McGraw Hill.

**4** Bachelor, G.K., An Introduction to Fluid Dynamics, Cambridge University Press, 1970.