MAK4033E (13253) **GAS DYNAMICS** **Fall 2019/2020**

Lecturer : Prof. Dr. Bedii Özdemir
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Ofice Hours : Mon: 13:30-17:00, Thu: 13:30-17:00, Fri: 13:30-17:00

Lecture Hours : Thu: 9:30 am - 12:29 pm (MOB 220)

Course Content
Fundamentals of fluid mechanics and thermodynamics. Steady One-dimensional Compressible Flow. Normal Shocks. Fanno ve Rayleigh Lines, Rankine-Hugoniot Relation. Converging-Diverging Nozzle Flows. Adiabatic Flow with Friction in Constant-area Ducts. Isothermal Flow in Long Ducts. Flow through Ducts with Heat Transfer. Oblique Shocks. Mach Waves. Prandtl-Meyer Function and Combination of Shock Waves.

Course Book
- Shapiro, A. H. 1953 The Dynamics and Thermodynamics of Compressible Fluid Flow, The Ronald Press. Co.

References
- Hodge, B. K. & Koenig, K. 1995 Solutions Manual Compressible Fluid Dynamics with Personal Computer Applications, Prentice Hall.
- Landau, L. D. & Lifshitz, E. M. 1987 Fluid Mechanics; Course of Theoretical Physics, Volume 6, 2nd Edition, Pergamon Press.
- Liepmann, H. W. & Puckett, A. E. 1947 Introduction to Aerodynamics of a Compressible Fluid, John Wiley.
- Oosthuizen, P. H. & Carscallen, W. E. 1997 Compressible Fluid Flow, McGraw-Hill.
- Streeter, V. L. & Wylie, E. B. 1983 Fluid Mechanics, McGraw-Hill.
- Thomson, P. A. 1972 Compressible Fluid Dynamics, McGraw-Hill.
- Tritton, D. J. 1988 Physical Fluid Dynamics, Oxford Univ. Press.

Course Objectives
To understand;
- fundamentals of subsonic and supersonic ideal compressible fluid flows,
- isentropic flows in Laval and other nozzles,
- normal and reflected shock waves,
- frictional and adiabatic compressible flows in long, and short and insulated pipes,
- principles of two-dimensional supersonic flows.

Course Outcomes
Ability to;
- formulate and solve problems in one dimensional steady compressible flows,
- solve the problems of steady isentropic flow of ideal gases in Laval nozzles,
- calculate the change in pressure, density and temperature for flows through normal and reflected shock waves,
- solve the problems of adiabatic frictional (Fanno) flows in long constant area ducts,
- solve the problems of frictional , uninsulated (isothermal) constant area duct flows,
- solve the problems of frictionless flows with heat transfer (Rayleigh) in short ducts,
- solve oblique shock wave problems of supersonic flows around wedge shaped bodies and concave corners,
- determine the change in flow conditions through a Prandtl Meyer expansion wave.

Course Plan

Week	Topics
1	Thermodynamic Relations, Speed of Sound and Mach number, Karman Rules for Supersonic Flows
2	Fluid Particle and Continuum Hypotheses, Continuity, Momentum and Energy Equations, Compressibility Condition
3	Fluid Particle and Continuum Hypotheses, Continuity, Momentum and Energy Equations, Compressibility Condition
4	Steady One-dimensional Compressible Flow
5	Normal Shocks
6	**1st Midterm 24 October 2019**
7	Fanno ve Rayleigh Lines, Rankine-Hugoniot Relation
8	Converging-Diverging Nozzle Flows
9	Adiabatic Flow with Friction in Constant-area Ducts
10	Isothermal Flow in Long Ducts
11	Flow through Ducts with Heat Transfer
12	**2nd Midterm 5 December 2019**
13	Oblique Shocks
14	Mach Waves
15	Prandtl-Meyer Function and Combination of Shock Waves

Exams & Course Work

Midterms	2	30%
Homework Assignments	4	15%
Term Project	1	15%
Final Exam	1	40%

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