Course Specifications

Mechanical Power Engg Dept.- - - Faculty of Engineering, Cairo University

3rd Year Mechanical Power Engineering Students– 2nd term

Fluid Mechanics (4)

By Dr. Mohsen soliman

A- Basic Information

Title: Fluid Mechanics (4) **Code: MPE ### – 2nd Term**

Credit Hours: 4 hrs

Lecture: 3 hrs/wk, Tutorial: 2 hrs/wk, Practices:--, Total: 5 hrs/wk

B- Professional Information

1- Overall Aims of Course

This course builds upon the material in MEP ### A "Fluid Mechanics (3)". It covers 4 subjects related to practical applications of fluid flow. The 1st subject introduces basic concepts and elements of compressible flow (Gas Dynamics). The 2nd subject covers real incompressible viscous flow around immersed bodies and applications on drag and lift forces. The 3rd subject covers the analysis of positive displacement pumps. Last subject introduces the concept of water hammer and some applications in pipe network analysis.

2- Intended Learning Outcomes of Course (ILOs)

a- Knowledge and Understanding: Having successfully completed this course, the student should have knowledge and understanding of:

a1- Basic concepts and elements of compressible flow (Gas Dynamics)

a2- Basic Governing conservation equations for compressible flow

a3-Method of analysis for some practical examples in 1-D flows in both variable area and constant area ducts.

a4-Method of examining real incompressible viscous flow around immersed bodies and measurements of drag and lift forces.

a5- Method of evaluating the performance of positive displacement pumps.

a6- Basic concept of water hammer and its applications in pipe network analysis.

b- Intellectual Skills: Having successfully completed this course, the student should have the ability to do:

b1- Creative thinking and analysis of using suitable 1-D approximations for solving some real gas flow problems and using 1-D analysis for Water Hammer in pipe lines.

b2- Analysis and using of the concepts of Mach Number, subsonic, sonic and supersonic flows in studying and identifying various gas dynamics relations.

b3- Problem Solving and Introducing practical problem solving tables and charts.

c- Professional and Practical Skills: Having successfully completed this course, the student should have the ability to:

c1- Apply fluid dynamics to deal with some important engineering problems.

c2- Compute and using Gas Dynamics Tables, Tables or charts of measurements of Lift and Drag Coefficients, and the Water Hammer Charts / tables.

d-General and Transferable Skills: Having successfully completed this course, the student should have the ability to do:

d1- Engineering design and Building ability to identify practical problems and select suitable approximations to solve them.

d2- Building ability to compare between analytical or numerical methods.

d3- Use of technological tool: (e.g., internet) to prepare required Report assignments.

d4- Working in group.

3- Contents

Topic	No. of hrs	Lecture	Tutorial/ Practicals
Chapter 1: Introduction to Gas Dynamics (compressible flow), Basic concepts: Speed of sound, Mach number, Stagnation properties and Critical properties	6	4	2
Equations of steady 1-D isentropic flow with area changes , Isentropic flow in a converging nozzle	4	2	2
Normal Shock Wave equations, Flow in a converging-diverging nozzle	6	4	2
1-D adiabatic flow in constant area duct with wall friction	4	2	2
Iso-thermal flow in constant area duct with wall friction	6	4	2
Frictionless flow with heat transfer across the wall	4	2	2
Chapter 2: Analysis of real incompressible viscous flow around immersed bodies	6	4	2
Applications on Lift and drag forces, measurements and experimental external flows	4	2	2
Chapter 3: Analysis, basic concepts and the governing equations of pumps and positive displacement machines	6	4	2
Chapter 4: Introduction and basic concepts of Water Hammer theory	4	2	2
Analysis and applications of Water Hammer equations	6	4	2
Analysis and applications of pipe networks	4	2	2
Revision of the course to confirm the objectives	6	4	2
Time for Preparing for the term exam	4	2	2
Total teaching hours in 14 weeks (+ 1 office hr/wk)	**70**	**42**	**28**

4- Teaching and Learning Methods

4.1- Lectures and problem solving in tutorial classes.

4.2- Information collection from text material, class notes and the Internet sites.

4.3- Report and research assignments. Four assignment Sheets (1, 2, 3 and 4)

4.4-Group discussions in lectures and tutorial classes.

4.5- Hand-outs materials.

5- Student Assessment Methods

5.1-Test (1) & Report (1) to assess understanding Chapter (1) and solving Sheet #1 and part of the ILO's

5.2-Test (2) & Report (2) to assess understanding Chapter (2) and solving Sheet #2 and part of the ILO's

5.3-Mid-term exam to assess understanding Chapters (1-3) and solving Sheets #1-3 and part of the ILO's

5.4- Final Term Exam to assess gains of all completed topics and all parts of the course ILO's.

Assessment Schedule

Test (1) & Report (1)	End of Week 4
Mid-term Exam	In Week 8
Test (2) & Report (2)	End of Week 11
Final Term Exam	End of Term

Weighting of Assessments

Tests 1, 2, assignments & class performance	5 %
Reports 1, 2	5 %
Mid-term Exam	20 %
Final-term Examination	70 %
Total	100%

6- List of References

6.1- Course Notes: Compiled Notes corresponding to different course sections

6.2- Essential Books (Text Books):

B.R. Munson, D. F. Young, and T. H. Okishi, "*Fundamentals of Fluid Mechanics"*, John Wiley & Sons, Inc., New York, 4th Edition (2002).

6.3- Recommended Books:

Frank M. White "Fluid Mechanics", 2nd ed., McGraw Hill, 1986.

R.W.Fox & A.T.McDonald "Introd. to Fluid Mechanics", 3rd ed., John Wiley & Sons, 1989

6.4- Hand-outs and Web Sites information,… etc

7- Facilities Required for Teaching and Learning

Data Show, White Screen, new reference in library

Internet for Enhancing the ability to think for students in Engineering Schools

Course Coordinator: A. Prof. Dr. Mohsen Sayed Mohamed,

Head of Department:

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