Course Specifications

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

3rd Year Mechanical Power Engineering Students– 1st term

Fluid Mechanics (3)

By Dr. Mohsen soliman

Program(s) on which the course is given:	**B. Sc. Of Mechanical Power Engineering**
Major or Minor element of programs:	**Major**
Department offering the program:	**Mechanical Power Engineering**
Department offering the course:	**Mechanical Power Engineering**
Academic year / Level:	3rd Year Mechanics (Power),
Date of specification approval:	Faculty meeting on **11/12/2007**

A- Basic Information

Title: Fluid Mechanics (3) **Code: MEP 303 A**

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 basic material in MEP 202 A&B "Fluid Mechanics" but is more applied in nature. The course deals with different types of fluid flow problems from the differential control volume analysis point of view. The course examines various types of flows such as internal viscous flow, frictionless flow and boundary layer flow.

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 types of fluid flows in comparison with different types of fluids.
a2- Basic Governing conservation equations (mass, linear momentum and energy) for a differential control volume in comparison with similar Integral control volume equations.
a3- Physical meaning and weight of terms in the above Integral and Differential equations.
a4- The role and importance of viscous effects in different types of fluid flows.
a5- The role and importance of the concept of frictionless flow.
a6- The differential equations of the boundary layer flow.

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

b1- Analysis and selecting the differential equations in various coordinate-systems (cartisine, cylindrical and spherical forms) suitable for the flow examined.
b2- Solve basic and simple types of incompressible-viscous flow problems.
b3- Creative thinking and introducing the concepts of superposition, images and conformal-mapping of elementary plane flows in studying frictionless flow to simulate some practical engineering problems.
b4- Problem Solving and introducing concept of solution batching to link frictionless flow region to boundary layer viscous flow region in the real flow field problems.

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 such as lubrication in bearings, drag and lift on immersed bodies or airfoil shapes.

c2- Draw, Sketch, and present some flow patterns (stream and potential lines) around immersed bodies or airfoil shapes.
c3- Compute and Introduce different types of numerical solution techniques to solve differential equations such as using stream function method for frictionless flow and Blasius Solution for the boundary layer flow analysis.

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 between differential or integral control volume analysis to solve them.
d2- Building ability to compare between analytical or numerical methods.
d3- Use of technological tool: (e.g., the Internet) to prepare Report assignments.
d4- Practicing using numerical solution tables (e.g., Blasius Solution Table).
d5- Working in group and team of students.

3- Contents

Topic	No. of hrs	Lecture	Tutorial
Chapter 1: Differential equation of mass conservation	4	2	2
Driving Navier-Stokes equations (linear momentum) for Newtonian fluids, angular momentum and energy eqns.	6	4	2
Chapter 2: Viscous flow in pipes and ducts	4	2	2
Flow between parallel plates with pressure gradients	6	4	2
Chapter 3: Differential equations for frictionless flow (Euler's eqns.)	4	2	2
Stream and potential functions, vorticity, irrotationality, elementary plane-flow solutions.	6	4	2
Superposition of plane-flows and Images	4	2	2
Plane flows past closed body shapes, axi-symmetric flows	6	4	2
Lift & drag on submerged bodies in ideal flow, airfoil theory	4	2	2
Chapter 4: Introduction to Boundary Layer flows, the differential equations, Exact equations for 2-D flow	6	4	2
Blasius exact solution for laminar flow, the Momentum Integral equations	4	2	2
Approximate solutions for 2-D laminar and turbulent boundary layers	6	4	2
Thermal Boundary Layer over a flat plate	4	2	2
Revision of the course to confirm the objectives	1	1	--
Time for Preparing for the term exam	5	3	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. Three assignment Sheets (1, 2 and 3)
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 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	8 %
Reports 1, 2	8 %
Mid-term Exam	20 %
Final-term Examination	64 %
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: Prof. Samy Mourad Dr. Mohsen S. Mohamed

Head of Department: Prof. Zeinab Safer

Date: 10/12/2007