

# **AN EXPERIMENTAL COURSE IN BASIC FLUID MECHANICS**

Volume II

## ***Typical Laboratory Results***

**Prof. Moustafa M. Elsayed**  
**Dr. Hassan-Elbanna A. Zaki Dr. Abdulhaiy M. Radhwan**

*Thermal Engineering Department*  
*Faculty of Engineering*  
*King Abdulaziz University*

Scientific Publishing Centre  
**King Abdulaziz University**  
P.O. Box 1540, Jeddah 21441  
Saudi Arabia

© 1414 A.H. (1994 A.D.) King Abdulaziz University

*All rights reserved. No part of this work covered by the copyrights hereon may be reproduced or copied in any form or by any means – graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems – without written permission of the publisher.*

1st Edition 1414 A.H. (1994 A.D.)

2nd Edition 1418 A.H. (1998 A.D.)

**King Fahd National Library Cataloging-in-Publication Data**  
Elsayed, Moustafa M.

An experimental course in basic fluid mechanics; vol II Typical laboratory results \ Moustafa M. Elsayed , Hassan Elbanna A. Zaki Abdulhaiy M. Radhwan.- 2nd ed .- Jeddah.

2 vol. , 21x28 cm.

ISBN: 9960-06-168-X ( set )

9960-06-170-1 ( vol.2 )

I- Fluide mechanics      I- Zaki, Hassan-Elbanna A. ( j.a. )  
II- Radhwan, Abdulhadiy M. ( j.a. )      III- Title

620.106 dc

3933/18

**Legal Deposit no. 3933/18**

**ISBN: 9960-06-168-X ( set )**

**9960-06-170-1 ( vol.2 )**

## **Preface**

This volume is a supplement to Volume I of the text "An Experimental Course in Basic Fluid Mechanics". The present volume contains typical experimental results of the experiments described in Volume I. This volume is very useful to the reader where the typical results give confidence in the experiments.

M.M. Elsayed  
H.E.A. Zaki  
A.M. Radhwan

Jeddah  
October 1989

1978.1.25

1978.1.25

# Contents

	<b>Page</b>
Preface .....	v
Contents .....	vii
A. Calibration of Instruments and Properties Measurements	
A1 Calibration of a Pressure Gage .....	3
A2 Determination of the Viscosity of a Liquid by Stokes Method .....	5
B. Fluid Statics	
B1 Center of Pressure on Plane Surface .....	9
C. Flow Patterns	
C1 Visualization of Streamlines around Objects in a Laminar Flow .....	13
C2 Demonstration of Flow Patterns around Submerged Objects .....	15
D. Non-viscous Flow : Bernoulli's Equation	
D1 Bernoulli's Theorem .....	19
D2 Discharge from an Orifice .....	21
D3 Flow through a Venturi Meter .....	23
D4 Pressure Variation along a Convergent-Divergent Passage .....	27
D5 Forced Vortex .....	29
D6 Free Vortex .....	33

E. Non-viscous Flow : Momentum Principle	
E1 Impact of a Jet .....	37
E2 Force on a Sluice Gate .....	39
F. Turbomachinery	
F1 The Performance of a Centrifugal Pump .....	43
F2 Performance Test of a Fan .....	49
G. Viscous Flow	
G1 Friction Loss in Pipes .....	57
G2 Minor Loss in Pipes .....	61
G3 Velocity Profile in Fully Developed Turbulent Flow .....	63
G4 Loss Coefficient for Sudden Enlargement .....	67