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FLUID MECHANICS AND MACHINERY

For 3rd Semester B.E. Mechanical, Production, Automobile, Mechatronics & Aeronautical Branches

As per the Latest Syllabus of ANNA UNIVERSITY, CHENNAI

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FLUID MECHANICS AND MACHINERY

By Dr. G.K. Vijayaraghavan & Dr. S. Sundaravalli

First Edition: May 2009
Revised Sixth Edition: May 2014
Fully Revised Tenth Edition: June 2018

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ISBN 978-93-831030-8-9

Price: Rs. 430/-

Published by and copies can be had from:

LAKSHMI PUBLICATIONS

Plot No.73, VGP Gokul Nagar,
2nd Main Road (40 Feet Road),
Perumbakkam, Medavakkam P.O,
Chennai - 600 100, Tamil Nadu, INDIA.
Phone: 044 - 49523977
Mobile: 9894598598, 96772 21371
E-mail: lakshmipublication@gmail.com, suchitrapublications@gmail.com

Type set at:

Surya DTP center, 91/4A/2, Gandhi road, Srinivasa Nagar 2nd st., Thiruvanai kovil, Trichy – 620 005. Ph. no: 9790801417.Email: haigkv@yahoo.com

Dedicated to

Our

Beloved Students

PREFACE

We are pleased to bring out our fully revised Tenth edition of ***"Fluid Mechanics and Machinery"*** for Engineering and Technology studies. This book is written to serve the needs of under graduate students embarking introductory course in Fluid Mechanics and Machinery. This book is designed to meet the requirement of revised syllabus prescribed by the ***Anna University Chennai, Trichy, Coimbatore & Tirunelveli*** for ***3rd Semester Mechanical, Production, Automobile, Mechatronics and Aeronautical engineering*** students of its affiliated colleges.

This book consists of 5 units.

- **Unit 1** broadly deals with fluid properties such as mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. This unit also covers flow characteristics such as concept of control volume, application of continuity equation, energy equation and momentum equation to fluid systems.
- **Unit 2** has wide coverage of flow through circular conduits in which various topics such as hydraulic and energy gradient, laminar flow through circular conduits and circular annuli, Darcy Weisbach equation, friction factor, Moody diagram, commercial pipes, minor losses, flow through pipes in series and parallel, boundary layer concepts and types of boundary layer thickness are discussed.
- **Unit 3** deals with need for dimensional analysis, methods of dimensional analysis, similitude and its types, dimensionless parameters, application of dimensionless parameters and model analysis.
- **Unit 4** has an in-depth dealing of topics related to pumps such as impact of jets, Euler's equation, theory of roto-dynamic machines, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles, centrifugal pumps, working principle, work done by the impeller, performance curves, working principle of reciprocating pump and rotary pumps.

- **Unit 5** elaborately discusses topics related to turbines such as classification of turbines, heads and efficiencies, velocity triangles, axial, radial and mixed flow turbines, working principles of Pelton wheel, Francis turbine and Kaplan turbines, work done by water on the runner, draft tube, specific speed, unit quantities, performance curves for turbines and governing of turbines.

Important solved University questions, and two mark questions and answers have been added at the tail end of each unit which will enable the students to score high marks in the University examinations. Recent ***Solved Anna University Question Papers*** have been added at the end of this book.

With these features, we sincerely hope that this book would serve as a valuable text for the students.

Though efforts have been taken aiming at a '*zero flaw*' content, we do recognize that mistakes may have inadvertently crept in. We welcome constructive criticisms on any specific topics of this book.

Our sincere thanks to **Mrs. Nirmala Durai, Proprietor** of **"Lakshmi Publications"** and **Publishing Advisor Mr. A. DURAI, B.E.** for their involvement to make this publication successful.

- Authors

ANNA UNIVERSITY SYLLABUS - Reg. 2017

CE8394 FLUID MECHANICS AND MACHINERY

(Common to B.E. Mechanical, Production, Automobile, Mechatronics and Aeronautical Engineering branches)

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS

Impact of jets – Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT V TURBINES

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

Fluid Mechanics and Machinery

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