KL UNIVERISTY
FIRST SEMESTER 2010-11
Course Handout
Academic Division

Dated: 07-07-2010

Course No. : **ME C202 / CE C202**
Course Title : **Fluid Mechanics**
Course Structure : **3-1-2**
Course coordinator : **S Sudhakara Babu**
Instructors : **K.Shivasathyamohan, K.Srinivasa Rao, MNL Rajeswari, Sanjay Krishna, B. Bhavani, S.Kanakambara Rao, K.Sandeep Kumar**

1. Course Description:

It includes fluid properties, fluid statics-measurements of pressure, buoyancy, floatation, fluid kinematics-discharge, continuity equation, fluid dynamics-Euler's equation, Bernoulli's equation, Venturimeter, Orificemeter, Pitot-tube, orifices and mouth pieces, momentum equation, flow through pipes, boundary layer theory-laminar and turbulent boundary layers, dimensional analysis and model similitude.

2. Scope and Objective of the Course:

After thorough learning of Fluid Mechanics the student should be able to:

1. Solve problems related to the fundamental principles of fluid mechanics
2. Analyze a control volume by developing fundamental principles such as the linear momentum equation in the treatment of the control volume.
3. Discuss and compare fundamental Reynolds Number and fluid flow behaviour observation.
4. Decide in advance on the selection of scaling variables and data presentation for dimensional analysis.
5. Name the differences between theoretical analysis and practice through experimental investigation that corrects for the factors omitted from the theory.

3. Books:

(i) Textbook:

a. Fluid mechanics by SK Som G Biswas, Tata McGraw-Hill Publications.
b. Fluid mechanics by John F.Douglas, Pearson Publications.

(ii) Reference Book:

a. Fluid Mechanics by Frank M white
b. Fluid Mechanics by A.cengel and John M.Cimbala
c. Fluid Mechnics by G.S sawhney
d. Fluid Mechanics by Edward J.Shaughnessy

4. Syllabus:

UNIT-I

FLUID PROPERTIES: Definition of fluid, properties of fluid-density, specific weight, specific gravity, viscosity, classification of fluids, surface tension and capillarity, vapour pressure and cavitation.

FLUID STATICS: Introduction, pressure, Pascal's law, hydrostatic law, measurement of pressure-simple and differential manometers, Total pressure and centre of pressure on vertical, horizontal, Inclined and curved surfaces.

UNIT-II

FLUID STATICS-BUOYANCY AND FLOATATION: Buoyancy, centre of buoyancy, Meta-centre, Meta-centric height

FLUID KINEMATICS: Introduction, types of fluid flow, Discharge, Continuity equation, Continuity equation in three dimensional flow, velocity potential function and stream function, vortex flow

UNIT-III

FLUID DYNAMICS: Introduction, Euler's equation of motion, Bernoulli's equation and applications, Venturimeter, Orificemeter, Pitot-tube, coefficient of discharge, Introduction to orifices and mouth pieces.

MOMENTUM EQUATION: Impulse-momentum equation, Force exerted by flowing fluid on pipe-bend.

UNIT-IV

FLOW THROUGH PIPES: Introduction, major and minor energy losses, hagen-poiseuille law, Hydraulic gradient and total energy line, pipes in series and parallel, Transmission of power through pipe, Water hammer.

UNIT-V

BOUNDARY LAYER THEORY: Introduction, laminar, turbulent boundary layer, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, separation of boundary layer, Methods of preventing separation

DIMENSIONAL ANALYSIS & MODEL SIMILITUDE: Introduction, Buckingham's PI theorem, Model analysis, Types of similarities, Dimensionless numbers, Classification of models, Model laws-Reynolds and Froude model law

5.Course Plan:

Lec No.	Learning Objective	Topics to be covered	Reference
1	***Understand what is fluid and their properties***	***Definition of fluid, properties of fluid-density, specific weight, specific gravity***	T1:2-5
2	Understand different types of fluids	viscosity, classification of fluids	T1:5,8
3	Understand fluid properties	surface tension and capillarity,	T1:12,15
4	Understand fluid properties	Vapor pressure and cavitation.	T1:16
5	Understand Fundamental pressure laws	Introduction, pressure, Pascal's law and hydrostatic law	T1:28
6	Understand Pressure measurement device	Measurement of pressure-simple manometers	T1:35
7	Understand Pressure measurement device	Measurement of pressure-differential manometers	T1:2-5
8	Find out total and centre of pressure on plane surfaces	Total pressure and centre of pressure on horizontal and vertical surfaces	T1:40,41
9	Find out total and centre of pressure on curved surfaces	Total pressure and centre of pressure on inclined and curved surfaces	T1:42

10	Understand the floating phenomenon	Buoyancy	T1:45
11	Understand the floating phenomenon	Centre of buoyancy	T1:45
12	Understand the floating phenomenon	Meta-centre	T1:49
13	Understand the floating phenomenon	Meta-centric height	T1:49
14	Understand the types of fluid flow	Introduction, types of fluid flow	T2:127-129
15	Understand the concept	Discharge, Continuity equation	T2:136,138
16	Understand the concept	Continuity equation in three dimensional flow	T2:141
17	Understand the concept	Velocity potential function and stream function	T1:276
18	Understand the Type of fluid flow	Vortex flow	T1:282
19	Understand the Mathematical approach	Introduction, Euler's equation of motion	T1:138
20	Understand the Mathematical approach	Bernoulli's equation, applications	T1:148
21	Understand the flow control and measuring device	Venturimeter	T1:196
22	Understand the flow control and measuring device	Orificemeter	T1:199
23	Understand the pressure measurement device	Pitot-tube, coefficient of discharge	T1:204
24	Understand the flow rate measuring device	Introduction to orifices	T1:205
25	Understand the flow rate measuring device	Introduction to mouth pieces.	T1:205
26	Understand the mathematical approach	Impulse-momentum equation	T2:148,149
27	Understand the concept	Force exerted by flowing fluid on pipe-bend.	T2:160
28	Understand the flow behavior through pipes	Introduction to flow through pipes	T1:192
29	Understand the energy losses	Major energy losses	T1:192
30	Understand the energy losses	Minor energy losses	T1:192-195
31	Understand the fundamental law	Hagen-poiseuille law	T1:198
32	Understand the concept	Hydraulic gradient	T1:204
33	Understand the concept	Total energy line	T1:206
34	Understand the concept	Pipes in series	T1:441
35	Understand the concept	Pipes in parallel	T1:443
36	Understand the power transmission through pipe	Transmission of power through pipe, Water hammer.	T1:452,515
37	Understand the types of boundary layers	Introduction, laminar, and turbulent boundary layers	T1:359
38	Understand the boundary layer concepts	Boundary layer thickness, displacement thickness	T1:369
39	Understand the boundary layer concepts	Momentum thickness, energy thickness	T1:369
40	Understand the boundary layer concepts	Separation of boundary layer	T1:373

41	Understand the boundary layer concepts	Methods of preventing separation	T1:377
42	Understand the theorem	Introduction, Buckingham's PI theorem	T1:241,252
43	Understand the concept	Model analysis, Types of similarities	T1:242
44	Understand the dimensionless numbers and Types of models	Dimensionless numbers, Classification of models	T1:249
45	Understand the model laws	Model laws-Reynolds and Froude model law	T1:249

6.Self learning material:

Unit	Topic	Source
I	a) Fluid and their properties b) Pressure and its measurement devices	www.ku.edu.np/mech/Tutorials/propFluid.pdf http://www.brighthub.com/engineering/civil/articles/43777.aspx
II	a) Buoyancy b) Types of fluid flow	http://en.wikipedia.org/wiki/Buoyancy http://www.brighthub.com/engineering/civil/articles/47264.aspx
III	a) Venturi and Orifice meters b) Orifice and Mouth piece	http://www.engineeringtoolbox.com/orifice-nozzle-venturi-d_590.html
IV	a) Energy losses of flow through pipes b) Water hammer	http://www.engineeringtoolbox.com/major-loss-ducts-tubes-d_459. htmlhttp://udel.edu/~inamdar/EGTE215/Minor_loss.pdf http://en.wikipedia.org/wiki/Water_hammer
V	a) laminar and turbulent boundary layer b) Dimensionless numbers	http://www.centennialofflight.gov/essay/Theories_of_Flight/Skin_Friction/TH11G2.htm http://silver.neep.wisc.edu/~shock/tools/fluids_dimnumb.pdf

7.Evaluation Scheme:

Component	Duration (minutes)	% Weightage	Marks	Date & Time	Venue
Test-1	50 Min	8	10	14.08.2010 9.30 to 10.20 A.M	CSE005,101, 104,105,106, 201,202,204, 205,209,301, 309,502,509
Test-2	50 Min	8	10	18.09.2010 9.30 to 10.20 A.M	CSE005,101, 104,105,106, 201,202,204, 205,209,301, 309,502,509
Assignement submission		4	5		CSE005,101, 104,105,106, 201,202,204, 205,209,301, 309,502,509
Assignment Test	50 Min	4	5	30.10.10 9.00 to 10.20 A.M	CSE005,101, 104,105,106, 201,202,204, 205,209,301, 309,502,509
Quiz	30 Min	4	5	30.10.10 9.00 to 10.20 A.M	CSE005,101, 104,105,106, 201,202,204, 205,209,301, 309,502,509
Regular Lab Evaluation	Continuous	10	50		
Comprehensive Lab Exam	3 Hrs	8	40		
Comprehensive Exam	3 Hrs	48	60		
Attendance for Theory & Tutorial		4	5	Continuous	
Attendance for Lab		2	10	Continuous	

8. Chamber consultation hour: Informed in the class in first week.

9. Notices: All notices regarding the course will be put in E-learning website.

10.Tutorial: Tutorial will be conducted by the respective in charge faculty. The tutorials are planned to supplement the material taught in the lectures and clear doubts. Student must attend registered section for tutorial in the respective classroom. Class assignment, class tests and other evaluation components will also be conducted during tutorials. Students must actively participate in the tutorial and come prepared for it.

Course Coordinator