

COURSE TEMPLATE

1.	Department centre proposing the course	Applied Mechanics
2.	Course title	Mechanics of Fluids
3.	L-T-P structure	3-1-2
4.	Credits	5
5.	Course number	AML XXX
6.	Status (category for program)	Core for Civil
7.	Prerequisite	none
8.	Status vis a vis other course	Overlap with Fluids courses
9.	Not allowed for (indicate program names)	Chemical, Mechanical
10.	Frequency of offering	Alternate semester
11.	Faculty who will teach the course	Prof. S.N. Singh, Prof. S. V. Veeravalli, Prof. S. Sanghi, Prof. A. Dewan, Dr. M. Cholemani, Dr. S. Balaji
12.	Will the course require any visiting faculty	no
13.	Course objective (50 words)	
	This is an introductory course to teach students basic concepts of mechanics of fluids. Integral as well as differential flow analysis will be covered with an emphasis on the fundamental concepts. Laboratory experiments illustrating the principles learnt in the course will further strengthen the concepts.	
14.	Course contents (about 100 words) (Include laboratory/ design activities)	
	Introduction to Fluids and the concept of viscosity, Flow visualization, Fluid Statics, Physical laws for a control volume including continuity, momentum and energy equations, Bernoulli equation, Differential equations of fluid motion, Navier Stokes equations, vorticity and potential flows, dimensional analysis and similitude, Boundary layer theory, viscous flow in ducts and applications to turbomachinery. Laboratory experiments will demonstrate the concepts learnt in the theory and appreciation of their limitations.	

15.	Lecture outline (with topics and number of lectures)	
Module No.	Topic	No. of hours
i)	Introduction: Fundamental concepts and introductory definitions; Fluid properties; Viscosity, Classification of fluids and flow regimes; Flow visualization; Pathlines, streaklines and streamlines.	3
ii)	Fluid Statics: Pressure force on a fluid element; Basic equation of fluid statics; Hydrostatic distribution; Manometry; Forces on submerged surfaces; Buoyancy and Stability; Fluids in rigid body motion.	3
iii)	Integral Relations for Fluid Flow: Basic physical laws; Systems and Control Volumes; Reynolds transport theorem; Conservation of Mass; Linear momentum equation; Angular momentum equation; Energy equation; Bernoulli equation.	8

iv)	Differential Equations for Fluid Motion: Acceleration; Equations for mass, momentum and energy (Navier-Stokes equations); Boundary conditions; Exact solutions; Stream function; Vorticity and irrotationality; Potential flows.	8
v)	Dimensional Analysis and Similarity: Buckingham pi-theorem; Non-dimensionalization of basic equations; Modelling; Significance of important dimensionless groups.	3
vi)	Boundary Layer Theory: Introduction; Boundary layer equations; Approximate solution; Experimental external flows.	5
vii)	Viscous Flow in Ducts: Reynolds number regimes; Head loss and friction factor; Minor losses in pipe systems;	5
viii)	Turbulence: An introduction	3
viii)	Turbomachinery: Introduction and classification; Pumps and turbines; Performance characteristics. (4)	5
Course total		42
16.	Brief description of tutorial activities	
Appreciation of the concepts covered in lectures through problem solving on the corresponding topics		
17.	Brief description of laboratory activities	
Module no.	Experiment description	No. of hours
i)	Flow visualization	2
ii)	Conservation of Mechanical energy(Bernoulli principle)	2
iii)	Characteristics of free jets	2
iii)	Obstruction type flow meters	2
iv)	Principle of linear momentum (Impact of jets)	2
v)	Flow around a circular cylinder	2
vi)	Development of turbulent flow in pipes	2
vii)	Frictional loss in fully developed flows	2
viii)	Characteristics of hydraulic turbine and centrifugal pumps	6
ix)	Study of mean flow of a free air jet	2
18.	Suggested text and reference materials	
	Fluid Mechanics by Frank M. White: Tata Mcgraw Hill, 7 th edition, 2011 Fluid Mechanics by P. K. Kundu, I. M. Cohen and D. R. Dowling: Academic Press and Elsevier, 2012 Fluid Mechanics by Y.A. Cengel, Tata Mcgraw Hill, 2010	
19.	Resources required for the course	
19.1	Software	

19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Equipment	As per laboratory requirement
19.5	Class room infrastructure	White board, projection system
19.6	Site visits	
20.	Design Content of the course	
	Examples and case studies to be discussed in the course include design elements	

Date:

16/01/2014

Signature of Head of Department