



Department of Automobile Engineering		LP: AE122302 Rev. No: 00
B.E/B.Tech/M.E/M.Tech : Automobile Engineering	Regulation: 2018A	Date: 27.07.2023
PG Specialisation : NA		
Sub. Code / Sub. Name : AE22302 / FLUID MECHANICS AND HYDRAULIC MACHINES		
Unit : I		

Unit Syllabus:

FLUID PROPERTIES AND FLOW CHARACTERISTICS

09

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Pressure measurement devices - U- tube manometers, pressure gauges. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation - venturi, airfoil, spoiler.

Objective: Students learn about the properties of fluids, pressure measurement and flow characteristics.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Introduction to the subject & syllabus contents, Units & Dimensions	1 - Ch.1; Pg.01 - 06	PPT, BB
2	Properties of fluids - Mass density, Specific weight, specific volume	1 - Ch.1; Pg.07 -08 5 - Ch.1; Pg.02 - 03	PPT, BB
3	Specific gravity, Viscosity, Compressibility, Vapour pressure, Surface tension and Capillarity	1 - Ch.1; Pg.08-14 1 - Ch.1; Pg.12 - 17 5 - Ch.1; Pg.02-23 5 - Ch.1; Pg.23 - 29	PPT, BB
4	Pressure measurement devices - U- tube manometers, Pressure gauges	5 - Ch.2; Pg.150-162	PPT, BB
5	Flow characteristics - Concept of control volume	1 - Ch.6; Pg.236 -246 5 - Ch.5; Pg.165 - 169	PPT, BB
6	Application of continuity equation	1 - Ch.7; Pg.288 -300 5 - Ch.6; Pg.261 -267	PPT, BB
7	Energy equation - Orifice-meter - Problems	1 - Ch.7; Pg.305 -317 5 - Ch.6; Pg.268 - 287	PPT, BB
8	Energy equation - Venturimeter and Pitot tube - Problems	1 - Ch.7; Pg.305 -317 5 - Ch.6; Pg.268 - 287	PPT, BB
9	Momentum equation - Venturi, Airfoil, Spoiler - Problems	1 - Ch.5; Pg.230 -246 5 - Ch.6; Pg.160 - 169	PPT, BB

Content beyond syllabus covered (if any):

* Session duration: 50 minutes



Sub. Code / Sub. Name: **AE22302 / FLUID MECHANICS AND HYDRAULIC MACHINES**

Unit : **II**

Unit Syllabus:

FLOW THROUGH CIRCULAR CONDUITS AND BOUNDARY LAYER

09

Hydraulic and energy gradient, Laminar flow through circular conduits, Darcy Weisbach equation -friction factor, Moody diagram, series and parallel pipes - major losses and minor losses, Boundary layer concepts - types of boundary layer thickness, Drag and Lift.

Objective: Students learn about the types of flow, Boundary layer concepts and losses in pipes.

Session No *	Topics to be covered	Ref	Teaching Aids
10	Flow through pipes - Hydraulic and energy gradient, Laminar flow through circular conduits	2 - Ch.3; Pg.129 5 - Ch.11; Pg.491 5 - Ch.9; Pg.387 - 392 5 - Ch.9; Pg.397 - 401	PPT, BB
11	Major Losses - Darcy Weisbach equation - derivation	5 - Ch.11; Pg.465 - 471 5 - Ch.10; Pg.434 - 436	PPT, BB
12	Problems on Darcy Weisbach equation-friction factor - Moody diagram- commercial pipes	5 - Ch.11; Pg.467 - 469 2 - Ch.6; Pg.293 - 295	PPT, BB
13	Minor losses - Problems	5 - Ch. 11; Pg.471 - 474 5 - Ch. 11; Pg.483 - 486	PPT, BB
14	Flow through pipes in series - Problems	5 - Ch. 11; Pg.502 - 506 5 - Ch. 11; Pg.508 - 511	PPT, BB
15	Flow through pipes in parallel - Problems	5 - Ch.11; Pg.522 - 536	PPT, BB
16	Boundary layer concepts - Types of boundary layer thickness	2 - Ch.7; Pg.318 - 325 5 - Ch.13; Pg.611 - 616 5 - Ch.13; Pg.625 - 626	PPT, BB
17	Boundary Layer Concepts	5 - Ch.11; Pg.522 - 536	PPT, BB
18	Drag and Lift	5 - Ch.11; Pg.522 - 536	PPT, BB

Content beyond syllabus covered (if any): Flow of viscous fluid between two parallel plates, Problems on Boundary layer

* Session duration: 50 mins



Sub. Code / Sub. Name: **AE22302 / FLUID MECHANICS AND HYDRAULIC MACHINES**

Unit : **III**

Unit Syllabus:

DIMENSIONAL ANALYSIS

09

Need for dimensional analysis - methods of dimensional analysis - Similitude - types of similitude - Dimensionless parameters - application of dimensionless parameters - Model analysis - Similarity between Model and Prototype Vehicle.

Objective: Students gained adequate knowledge of Dimensional analysis and Model analysis.

Session No *	Topics to be covered	Ref	Teaching Aids
19	Introduction - Dimensional analysis, Fundamental dimensions and derived units	3 - Ch.7; Pg.386 - 389	PPT, BB
20	Methods of dimensional analysis - Rayleigh's method	3 - Ch.7; Pg.390 - 412	PPT, BB
21	Methods of dimensional analysis - Buckingham's II theorem	3 - Ch.7; pg.416 - 417	PPT, BB
22	Buckingham's II theorem - Problems	3 - Ch.7; Pg.418 - 420	PPT, BB
23	Buckingham's II theorem - Problems	3 - Ch.7; Pg.418 - 420	PPT, BB
24	Buckingham's II theorem - Problems	3 - Ch.7; Pg.418 - 420	PPT, BB
25	Similitude - types of similarities - Geometric, Kinematic & Dynamic similarities	3 - Ch.7; Pg.420 - 428	PPT, BB
26	Dimensionless parameters - its significance	3 - Ch.7; Pg.431 - 449	PPT, BB
27	Similarity between Model and Prototype Vehicle - Problems	3 - Ch.7; Pg.431 - 449	PPT, BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 mins



Sub. Code / Sub. Name: **AE22302 / FLUID MECHANICS AND HYDRAULIC MACHINES**

Unit : **IV**

Unit Syllabus:

PUMPS

09

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 - Diaphragm pump - Rotary pump - Gear, Vane and Lobe types.

Objective: Students gains exposure to the various types of Pumps

Session No *	Topics to be covered	Ref	Teaching Aids
28	Theory of roto-dynamic machines - various efficiencies, velocity components at entry and exit of the rotor - velocity triangles	5 - Ch.19; Pg.948 - 950 4 - Ch.11; Pg.778 - 782	PPT, BB
29	Centrifugal pumps - Working principle, Derivation of work done by the impeller	5 - Ch.19; Pg.945 - 948	PPT, BB
30	Centrifugal pumps - Performance curves	4 - Ch.11; Pg.782 - 783	PPT, BB
31	Problems on Centrifugal pumps	5 - Ch.19; Pg.951 - 954	PPT, BB
32	Problems on Centrifugal pumps	5 - Ch.19; Pg.951 - 954	PPT, BB
33	Reciprocating pump- working principle	5 - Ch.20; Pg.993	PPT, BB
34	Reciprocating pump - Problems	5 - Ch.20; Pg.918 - 920	PPT, BB
35	Reciprocating pump - Problems	5 - Ch.20; Pg.918 - 920	PPT, BB
36	Diaphragm pump - Rotary pumps - Gear, Vane and Lobe types	4 - Ch.21; Pg.784 -798	PPT, BB

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins



Sub. Code / Sub. Name: **AE22302 / FLUID MECHANICS AND HYDRAULIC MACHINES**

Unit : **V**

Unit Syllabus:

TURBINES

09

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

Objective: Students gain knowledge about the constructional, working principle of different types of turbines and its characteristics.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Introduction to Hydraulic Turbines - Classification - Definition of heads and efficiencies, velocity triangles	3 - Ch.2; Pg.52 - 53, 3 - Ch.2; Pg.59 - 61, 3 - Ch.2; Pg.57 - 58	PPT, BB
38	Types of turbines - Axial, radial and mixed flow	3 - Ch.2; Pg.53 - 54	PPT, BB
39	Pelton wheel turbine, Francis turbine and Kaplan turbines - working principles	3 - Ch.2; Pg.55 - 56, 3 - Ch.2; Pg.81 - 82, 3 - Ch.2; Pg.122 - 124	PPT, BB
40	Problems on Pelton wheel	5 - Ch.18; Pg.862 - 865	PPT, BB
41	Problems on Francis turbine	5 - Ch.18; Pg.896 - 900	PPT, BB
42	Problems on Kaplan turbines	5 - Ch.18; Pg.905 - 908	PPT, BB
43	Draft tube	3 - Ch.2; Pg.57-59	PPT, BB
44	Specific speed - unit quantities	5 - Ch.18; Pg.920 - 922 5 - Ch.18; Pg.927 - 929	PPT, BB
45	Performance curves for turbines	5 - Ch.18; Pg.933 - 937	PPT, BB

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins



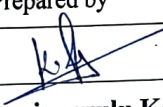
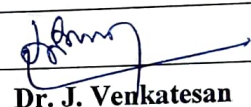
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TEXTBOOKS:

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", 5th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2008.
2. Rajput, R. K., "Fluid Mechanics and Hydraulic Machines", 6th edition, S. Chand Pvt. Ltd, New Delhi, 2017.

REFERENCES:

1. Fox W.R. and McDonald A.T., "Introduction to Fluid Mechanics", John-Wiley and Sons, Singapore, 1995.
2. Jain A. K., "Fluid Mechanics", Khanna Publishers, 2010.
3. Roberson J.A and Crowe C.T., "Engineering Fluid Mechanics", Jaico Books Mumbai, 2000.
4. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
5. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2003.

	Prepared by	Approved by
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Date	27.07.2023	27.07.2023
Remarks* :		
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* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD