

## COURSE PLAN

**Course Title:** Mechanics of Fluids

**Course Code** CEPC12

**No. of Credits** 3

**Department:** Civil Engineering

**Programme:**

B.Tech. Civil Engineering

**Pre-requisites:** -

**Co-requisites:** -

**Course Co-ordinator:** Dr. R. Manjula

**Course Teacher/Tutor:** -

**Learning Hours:**

| Sl. No. | Nature of teaching hours | No. of hours of teaching |
|---------|--------------------------|--------------------------|
| 1.      | Learning hours           | 26                       |
| 2.      | Tutorial hours           | 10                       |
| 3.      | Assessment hours         |                          |

**Course Type.** PC

**Student Quota** -

**Course Description**

No prior co – requisite is required

**Course Objectives**

- To understand the properties of fluids and fluid statics.
- To solve kinematic problems such as finding particle paths and stream lines.
- To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems.
- To study about specific speed and performance characteristics of different types of turbines.
- To study types of centrifugal Pumps, work done and efficiency of the different types centrifugal pumps and also study about performance of pumps & characteristic curves.

## Course Content

Continuum concept - CGS, MKS and SI systems - Properties of Fluids - Ideal and real fluid - Flow classification, stream lines, streak lines, continuity equation, velocity, tangential, normal, local and convective acceleration, types of fluid motions, stream function, velocity potential function, flownet.

Pressure at a point – pascal law - Hydrostatic law - pressure measurement – Hydrostatic forces on immersed plane and curved surfaces, Buoyancy, Stability of floating and submerged bodies. Bernoulli's equation, Energy correction factor, Coefficients of contraction, velocity and discharge, free vortex motion, Analysis of free liquid Jet, Cavitation.

Laminar and turbulent flow - Reynold's number - Navier stoke equations of motion - shear stress and pressure gradient - Laminar flow between parallel plates - Couette flow - Hagen Poiseuille equation for flow through circular pipes.

Turbulence - Major losses - Darcy-Weisbach equation for flow through circular pipe - Friction factor - Smooth and rough pipes - Moody diagram - Minor losses - pipes in series and parallel - Equivalent length - water hammer phenomena- flow measurement – orifice mouth piece, weirs, flow under sluice gates.

Centrifugal pump - minimum speed to start the pump – multistage Pumps –Positive displacement pumps – reciprocating pump - negative slip - flow separation conditions - air vessels -indicator diagram and its variation - savings in work done- Turbines - draft tube and cavitations –classification - radial flow turbines - axial flow turbines – Impulse and Reaction turbines.

## Course Learning Outcomes (CLOs)

1. Understands the basic principles of fluid mechanics.
2. Understands the concepts of statics and dynamics of fluid flow.
3. Develops skills in analyzing fluid flows through the proper use of modeling and the application of the basic fluid-flow principles.
4. Acquire knowledge in the selection of type of turbine required with reference to available head of water and also used for Identification of type of turbine with estimated specific speed.
5. Capable of estimating efficiency of different pumps and performance of the pumps with the study of characteristics curves.

## Course Teaching and Learning Activities

| Sl. No. | Weekly plan          | Activity  | CLO |
|---------|----------------------|---|-----|
| 1. 1.   | 1 <sup>st</sup> week | Properties of Fluids - Ideal and real fluid - Flow classification, stream lines, streak lines | 1   |
| 2. 2.   | 2 <sup>nd</sup> week | continuity equation, velocity, tangential, normal, local and convective acceleration          | 1   |

|       |                       |   |   |
|-------|-----------------------|---|---|
| 3. 3. | 3 <sup>rd</sup> week  | types of fluid motions, stream function, velocity potential function, flownet – tutorial problems   | 2 |
| 4.    | 4 <sup>th</sup> week  | Pressure at a point – pascal law - Hydrostatic law<br>Hydrostatic forces on immersed plane and curved surfaces, Buoyancy and <b>Quiz I</b>                      | 2 |
| 5.    | 5 <sup>th</sup> week  | and Bernoulli's equation, Energy correction factor, Coefficients of contraction   | 3 |
| 6.    | 6 <sup>th</sup> week  | Velocity and discharge, free vortex motion, Analysis of free liquid Jet, Cavitation.  | 3 |
| 7.    | 7 <sup>th</sup> week  | Laminar and turbulent flow - Reynold's number - Navier stoke equations of motion - shear stress and pressure gradient - Laminar flow between parallel plates    | 3 |
| 8.    | 8 <sup>th</sup> week  | <b>Quiz II</b> and Hagen Poiseuille equation for flow through circular pipes and tutorial problems  | 2 |
| 9.    | 9 <sup>th</sup> week  | Turbulence - Major losses - Darcy-Weisbach equation for flow through circular pipe - Friction factor  | 3 |
| 10.   | 10 <sup>th</sup> week | <b>Midterm Examination</b> Smooth and rough pipes - Moody diagram - Minor losses - pipes in series and parallel -   | 2 |
| 11.   | 11 <sup>th</sup> week | Equivalent length - water hammer phenomena orifice mouth piece, weirs, flow under sluice gates. <i>&amp; Group task.</i>  | 2 |
| 12.   | 12 <sup>th</sup> week | Centrifugal pump - minimum speed to start the pump – multistage Pumps –Positive displacement pumps – reciprocating pump   | 5 |
| 13.   | 13 <sup>th</sup> week | negative slip - flow separation conditions - air vessels -indicator diagram and its variation - savings in work done- Turbines – Classification and description | 4 |

### Course Assessment Methods

| Sl. No. | Assessment           | % Weightage |
|---------|----------------------|-------------|
| 1.      | Quiz (I & II)        | 15          |
| 2.      | Midterm examination  | 30          |
| 3.      | Group task           | 5           |
| 4.      | Summative assessment | 50          |

### Guidelines on grading

- i) Relative grading policy
- ii) The passing minimum shall be class mean by two or maximum by three, whichever is lower.

### Essential Learning material

1. Nagaratnam, S., *Fluid Mechanics*, Khanna Publishers, 1995.
2. Natarajan, M.K. *Principles of Fluid Mechanics*, Oxford & IBH Publishing Co, 1994.
3. Jagdish Lal, *Hydraulics and Fluid Mechanics*, Tata McGraw Hill, 2001.
4. Streeter V.L., *Fluid mechanics*, Tata McGraw Hill, 1998.

#### **Means/Processes for Student Feedback on Course**

Feedback may be collected through **Questionnaire**

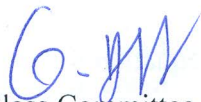
#### **Course Policy and attendance requirement**

Attendance requirement for summative assessment: 75%

However for genuine health and other extracurricular activities may be given due consideration of 15%.



Dr. R. Manjula  
Faculty in charge



Class Committee Chairman



HoD/ Civil Engg.