FLUID MECHANICS AND HYDRAULICS		Semester	IV
Course Code	BCV402	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory/Practical		

Course Learning objectives: This course will enable students to

- Understand the Fundamentals of properties of fluids, fluid pressure measurement and hydrostatic law
- Learn the Principles of kinematics, hydrodynamics and its applications
- Study the Flow measurements and design of pipes
- Understand the design of open channels and energy concepts
- Understand the Working principles of hydraulic turbines and pumps

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinkingand enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills suchas the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

MODULE-1

Fluids and their properties – compressibility, surface tension, capillarity, Pascal's law, hydrostatic law, fluid pressure measurement using simple and differential manometers, Total pressure and center of pressure on vertical and inclined plane surfaces. **L2,L3**

MODULE-2

Kinematics- Types of flow, continuity equation in Cartesian coordinates, velocity potential, stream function, flow nets, Dynamics-Euler's equation of motion, Bernoulli's equation, Application- Venturimeter, Orifice meter, Pitot tube. **L2,L4**

MODULE-3

Classification of orifice and mouthpiece, hydraulic coefficients, discharge over rectangular, triangular and Cipoletti notch, Flow through pipes- major and minor losses, pipes in series and parallel, equivalent pipe, concept of water hammer and surge tanks. **L2,L4**

MODULE-4

Open channel hydraulics- classification of flow, Most economical channel sections-rectangular, triangular, trapezoidal, circular, Uniform flow, specific energy-rectangular channels, on-uniform flow, hydraulic jump-equation and applications, GVF equation-types. **L2,L4**

MODULE-5

Momentum equation, Impact of jet on stationary and moving curved vanes Turbines-types, Pelton wheel-working proportions, velocity triangles Francis turbine- working proportions, velocity triangles Centrifugal pumps-work done, efficiency, multi-stage pumps. **L2,L4**

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments	
1	Verification of Bernoulli's equation	L1,L2
2	Calibration of Venturimeter/Orifice meter	L1,L2
3	Determination of hydraulic coefficients of small vertical orifice	L1,L2
4	Calibration of triangular notch	L1,L2
5	Determination of Cd for Cipoletti notch	L1,L2
6	Determination of major losses in pipes	L1,L2
7	Determination of Cd for ogee/broad crested weir	L1,L2
8	Determination of efficiency of jet on flat and curved vanes	L1,L2
9	Determination of Cd of Venturiflume	L1,L2
10	Demo of determination of efficiency of centrifugal pump	L1,L2
11	Demo of determination of efficiency of Francis/Kaplan turbine	L1,L2
12	Demo of determination of efficiency of Pelton wheel	L1,L2

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Explain the fundamental properties of fluids and solve problems on fluid pressure and hydrostatics.
- Apply the principles of kinematics and dynamics of fluid flow to solve problems on velocity and pressure.
- Compute the discharge through pipes, notches and weirs.
- Design the turbines and open channels of different sections and to estimate the energy loss in hydraulic jump.
- Able to interpret the experimental results of discharge, efficiency based on the test conducted in the laboratory.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25marks.**
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks).**
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks.**
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks.**
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books:

Text Books:

1. P.N. Modi and S.M. Seth-Hydraulics and Fluid Mechanics, including Hydraulic machines, standard Book House, New Delhi
2. K Subramanya- Fluid Mechanics and Hydraulic Machines, Tata McGraw-Hill, New Delhi
3. R.K. Bansal- A text book of Fluid Mechanics and Hydraulic Machines- Laxmi Publications, New Delhi
4. Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford- Fluid Mechanics, Tata McGraw Hill publishing Co Ltd, New Delhi
5. J.F. Douglas. M. Gastric, John Warfield, Lynne Jack – Fluid Mechanics, Pearson, Fifth edition.
6. K. Subramanya- Fluid Mechanics and Hydraulic Machines, Problems and Solutions, Tata McGrawhill, New Delhi.
7. S K SOM and G.Bis was – " introduction to Fluid Mechanics and Fluid Machines, Tata Mcg raw Hill, New Delhi.

Web links and Video Lectures (e-Resources):

- YouTube Videos

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning:

- Visit to hydro- electric power plant
- Visit to sites to visualise the flow measuring devices, viz., weirs, spillways, etc.

CO & PSO - PO Mapping (Individual Teacher has to fill)

Mapping of Course Outcomes and Program specific outcomes to Program Outcomes																
Course outcomes	Program outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

Note: Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.

H.O.D.
Dept. of Civil Engineering
Alva's Institute of Engg. & Technology
Mijar, Moodbidri - 574 225