SRI VIDYA COLLEGE OF ENGINEERING & TECHNOLOGY

COURSE PLAN (THEORY)

ACADEMIC YEAR: 2018-2019

			L	P	T	C
Subject Code	CE8403					
Subject Title	APPLIED HYDRAULICS ENGINEERING		3	0	0	3
Year / Dept / Sem	II/CIVIL/IV	Regulation Year	2018			
Faculty Name / Design / Dept	Ms.B.KRISHNA PRIYA /AP/CIVIL					
Course Prerequisite	1.The students must have more knowledge about Fluid mechanics and Machinery is essential in solving variety of problems Involving flow of fluids. 2.They have details about types of fluids and its flow and basic Concepts about turbines and pumps.					

SYLLABUS

CE8403 APPLIED HYDRAULICS ENGINEERING **L T P C 3 0 0 3**

UNIT I UNIFORM FLOW

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow .

UNIT II GRADUALLY VARIED FLOW

Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

UNIT III RAPIDLY VARIED FLOW

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

UNIT IV TURBINES

Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic Curves of Turbines- Draft tube and cavitation.

UNIT V PUMPS

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels - Savings in work done.

Total : 45Periods

TEXT BOOKS:

1. Subramanya.K ,"Flow in open channels", Tata McGraw Hill, New Delhi, 2000.
2. Modi P.N and Seth.S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
3. Chandramouli P.N.,"Applied Hydraulic Engineering", Yes Dee Publishing Pvt. Ltd.,.2017.

REFERENCES:

1. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2. Hanif Chaudhry.M., "Open Channel Flow", Second Edition, Springer, 2007.
3. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
4. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
5. Subramanya.K., " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
6. Jebamalar.A., Sasikumar.M., "Applied Hydraulic Engineering", Manus Publications,2015.

Course Objectives (CO)	To introduce the students to various hydraulic engineering problems Like open channel flows and hydraulic machines.
Course Outcomes (CO)	CO1- The students will be able to apply their knowledge of fluid Mechanics in addressing problems in open channels. CO2- They will have knowledge in hydraulic machineries (pumps and Turbines). CO3- They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions. CO4- To apply Bernoulli's equation and the concept of total energy to solve for flow and velocity in frictionless closed – conduit problems. CO5- To apply fundamentals of flow continuity principle to solve water balance problems and understand the principles of conservation of energy and momentum. CO6- To draw the specific energy graphical diagrams and to assess the changes in flow depth and velocity in presence of a hump or lateral constriction in open channel systems under non-uniform conditions to determine when and why hydraulic jump occurs.
Expected Course Outcomes (ECO)	At the end of the course, the students should be able to: ECO1: The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels. ECO2: They will possess the skills to solve problems in uniform, gradually

	and varied flows in steady state conditions. ECO3: They will have knowledge in hydraulic machineries (pumps and turbines).

PROGRAM OUTCOMES (POs)

Engineering graduates will be able to:

1. ENGINEERING KNOWIEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. PROBLEM ANALYSIS: identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principals of mathematics, natural sciences and engineering sciences.

3. DESIGN/ DEVELOPMENT OF SOLUTIONS: Design solutions for complex engineering problems and design systems components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural societal, and environmental considerations.

4. CONDUCT INVESTIGATIONS COMPLEX PROBLEMS: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

5. MODERN TOOL USAGE: Create, select, and apply appropriate techniques resources, and modern engineering and it tools including production and modeling to complex engineering activities with an understanding of the limitations.

6. THE ENGINEERING AND SOCIETY: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices.

7. ENVIRONMENT AND SUSTAINABLITY: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. ETHICS: Apply ethical principles and commit to professional and responsibilities and norms of the engineering practices.

9. INDIVIDUAL AND TEAM WORK: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary setting.

10. COMMUNICATION: Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effectives reports and design documentations, make presentations, and give and receive clear instructions.

11. PROJECT MANGMENT AND FINANCE: Demonstrate knowledge and understanding of the engineering and management principals and apply these to one's own work as a member and leader in a team to manage project and in multidisciplinary environments.

12. LIFE LONG LEARNING: Recognize the need for and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological change.

Mapping of CO & PO(Specify the PO's) - *(Fill the col.s with the legend given below)*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	1	-	1	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	1	1	-	-	-	-	-
CO6	-	2	2	-	-	-	1	-	-	-	-	-

Bridging the Curriculum Gap (Additional Topics beyond syllabus/Seminars/Assignments)	BCG1: Boundary Layer BCG2: Submersible Pump
Related Website URLs	W1:http://nptel.ac.in/courses/112103174/pdf/mod5.pdf W2: http://www.enerpac.com/en/basic-hydraulics W3: http://www.veltech.edu.in/ppt
Related Video Course Materials (min. 3 no.s)	V1: http://www.youtube.com/watch?v=splvwSMAKd0 V2: http://www.youtube.com/watch?v=5oKWAZMIEzo V3: http://www.youtube.com/watch?v=7DpKkcttQOw

S.No	Topic Name	Book	Page. No	Teaching Aids	No of hrs	Cumulative hrs
	UNIT I UNIFORM FLOW					
	Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow					
1	Definition and differences between pipe flow and open channel flow - Types of Flow	R6	1.1-1.6	Class Room Teaching	1	1
2	Properties of open channel - Fundamental equations	R6	1.7-1.13	Class Room Teaching	1	2
3	Velocity distribution in open channel	R6	1.14-1.15	Class Room Teaching	1	3
4	Steady uniform flow	T1	4,19	Class Room Teaching	1	4
5	Chezy equation	R6	1.15-1.18	Class Room Teaching	1	5
6	Manning equation	R6	1.19-1.34	Class Room Teaching	1	6
7	Best hydraulic sections for uniform flow	R6	1.34-1.68	Class Room Teaching	2	8
8	Specific energy	R6	1.69-1.70	Class Room Teaching	2	10
9	Specific force	R6	1.71-1.72	Class Room Teaching	1	11
10	Critical flow	R6	1.73-1.98	Class Room Teaching	1	12

11	Tutorials – University question problems	UQ	-	Class Room Teaching	1	13
12	Tutorials – University question problems	UQ	-	Class Room Teaching	1	14

UNIT II GRADUALLY VARIED FLOW

Dynamic equations of gradually varied flows-Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

1	Dynamic equations of gradually varied and spatially varied flows	R6	2.1	Class Room Teaching	2	16
2	Types of flow profiles	R6	2.10-2.29	Class Room Teaching	2	18
4	Classifications	R6	2.30	Class Room Teaching	1	19
5	Direct step method	R6	2.30,2.31	Class Room Teaching	2	21
6	Standard step method	R6	2.32-2.41	Class Room Teaching	2	23
7	Control section	R6	2.42-2.46	Class Room Teaching	1	24
8	Break in grade & computation	T1	187-196	Class Room Teaching	1	25
9	Tutorials – University question problems	UQ	-	Class Room Teaching	1	26

UNIT III- RAPIDLY VARIED FLOW

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

1	Application of the momentum equation for RVF	R6	3.1-3.6	Class Room Teaching	2	27
2	Hydraulic jumps	R6	3.7-3.8	Class Room Teaching	2	29
3	Hydraulic jumps & its types	R6	3.8-3.25	Class Room Teaching	2	31
4	Application of the momentum equation for RVF	R6	3.11-	Class Room Teaching	2	33
5	Energy dissipation-celerity	R6	705-784	Class Room Teaching	2	35
6	Rapidly varied unsteady flows	T1	3.27-3.30	Class Room Teaching	2	37
7	Positive and negative surges	UQ	3.31-3.34	Class Room Teaching	1	38
8	Tutorials – University question problems	UQ	-	Class Room Teaching	2	40

UNIT IV – TURBINES

. Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic Curves of Turbines- Draft tube and cavitation.

1	Impact of Jet on flat, stationary and moving	R6	4.1-4.31	Class Room Teaching	2	42
	Classification of Turbines – Pelton wheel	R6	5.1-5.21	Class Room Teaching	1	43
3	Reaction turbines -Francis turbine	R6	5.22-5.31	Class Room Teaching	2	45
4	Propeller and Kaplan turbines	R6	5.32-5.4	Class Room Teaching	2	47
5	Impulse turbine-Performance of turbine	R6	5.41-5.64	Class Room Teaching	1	48
6	Specific speed	R6	6.26-6.29	Class Room Teaching	1	49
7	Characteristic Curves of Turbines	T1	578	Class Room Teaching	2	51
8	Draft tube and cavitation	T1	579-583	Class Room Teaching	1	52
9	Tutorials – University question problems	UQ	-	Class Room Teaching	1	53
10	Tutorials – University question problems	UQ	-	Class Room Teaching	2	55

UNIT V PUMPS

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels - Savings in work done.

1	Centrifugal pumps - Minimum speed to start the pump	R6	6.1-6.12	Class Room Teaching	2	56
2	NPSH - Cavitations in pumps	T1	478	Class Room Teaching	2	58
3	Operating characteristics	Own notes	-	Class Room Teaching	1	59
4	Multistage pumps	R6	7.22-7.30	Class Room Teaching	1	60
5	Reciprocating pumps - Negative slip	R6	7.31-7.38	Class Room Teaching	1	61
6	Flow separation conditions	Own notes	-	Class Room Teaching	1	62
7	Air vessels, indicator diagrams and its variations	T1	512	Class Room Teaching	2	63
8	Savings in work done Rotary pumps: Gear pump.	R6	7.31-7.38	Class Room Teaching	2	65
9	Tutorials – University question problems	UQ	-	Class Room Teaching	1	66
10	Tutorials – University question problems	UQ	-	Class Room Teaching	2	67

	Prepared by	*Approved by*
Signature	B. Krishna	
Name	Ms.B.KRISHNA PRIYA	Mr.P.GANESAN
Designation	Assistant Professor / CIVIL	Professor & HOD
Signed date	02-11-18.	02-11-18.

Endorsed