RAGHU ENGINEERING COLLEGE

AUTONOMOUS

(Approved by AICTE, New Delhi, & Permanently Affiliated to JNTU-GV, Vizianagaram)

NBA & NAAC A+ grade Accredited institute

Dakamarri, Bheemili Mandal, Visakhapatnam Dist. – 531 162 (A.P.)

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INSTITUTE VISION

Envisioning to be a world class technical institution by synergizing quality education with ethical values.

INSTITUTE MISSION

- **To encourage training and research in cutting-edge technologies.**
- **To develop and strengthen strategic links with the industry.**
- **To kindle the zeal among the students and promote their quest for academic excellence.**
- **To encourage extra-curricular activities along with good communication skills.**

QUALITY POLICY

RAGHU Engineering College underscores ethical values along with innovative teaching through an interactive, activity-based pedagogy, establishes the best of infrastructural facilities, inculcates engineering temper among the students through the use of the latest Information and Communication Technologies and strives for an efficient, responsive and transparent administration in all areas

Department of Civil Engineering

VISION

To become a pioneer in the field of civil engineering by providing high quality education and research to serve the public consistently with competitive spirit professional ethics.

MISSION

- M1: Provide quality knowledge and advance skills to the students in order to expertise theoretically and practically in the areas of civil engineering.
- M2: Improve the professional potentiality of the students and staff through educational programs to expand the knowledge in the field of civil engineering
- M3: Inculcate healthy competitive spirit towards the higher education and successful career in the field of civil engineering to serve the nation ethically.

PROGRAMME EDUCTIONAL OBJECTIVES(PEOs)

- PEO 1: Employ a practicing civil engineer in construction, design, testing, and allied fields.
- PEO 2: Engaging in self-directed learning research or undertaking higher studies in the rapidly changing civil engineering environment.

- PEO 3: Create new methods/processes to meet the needs of society with their civil engineering knowledge.

MAPPING OF MISSION STATEMENTS WITH PEOs

MS/PEO	PEO 1	PEO 2	PEO 3
MS 1	3	3	2
MS 2	3	3	2
MS 3	3	3	2

1-Slight, **2**- Moderate, **3**- Substantial

PROGRAM OUTCOMES	
Graduates of Civil Engineering Will:	
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of 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.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer 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 practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 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 effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO 1: Analyze, design and execute the civil engineering structures with good knowledge in engineering, mathematics & basic sciences.	
PSO 2: Follow the economic, environmental and safety factors involved in the construction industry.	

Mapping of PEOs with POs and PSOs

PEO/PO	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
PEO 1	3	3	3	2	3	2	2	2	3	3	3	3	3	3
PEO 2	3	3	3	2	3	2	2	1	3	3	3	3	3	2
PEO 3	3	3	3	3	3	1	1	1	2	3	2	3	3	2

1-Slight, **2**- Moderate, **3**- Substantial

2301103 HYDRAULICS AND HYDRAULIC MACHINES							
(Civil Engineering)							
Programme &Branch	B. Tech & CE	Sem	Category	L	T	P	Credit
Prerequisites	Fluid Mechanics	4	PC	3	0	0	3

Course Objectives:

1. To understand and describe the dynamics of fluid flow in open channels for different flow regimes and conditions.
2. To formulate and validate empirical relationships to predict flow behavior in both scaled models and full-scale prototypes.
3. To calculate and analyze the forces generated by fluid jets impacting various types of vanes.
4. To apply principles of fluid mechanics to the design of efficient turbines tailored to specific hydraulic environments.
5. To assess and interpret the operational performance of different types of pumps under a range of working conditions.

Preamble:	The study of hydraulics and hydraulic machines is fundamental to understanding and designing systems that utilize fluid flow for practical applications. This course provides comprehensive insights into the behavior of fluids in open channels, the principles of hydraulic similitude, the dynamics of jet impacts, and the operation of various hydraulic machines such as turbines and pumps.

Course Contents:

Unit-1	**Open Channel Flow**	Contact Hours: 9

Uniform Flow: Types of channels - Types of flows - Velocity distribution - Chezy's and Manning's formulae for uniform flow - Most Economical sections, Critical flow: Specific energy-critical depth - computation of critical depth

Non-Uniform Flow: Steady Gradually Varied flow-Dynamic equation, Rapidly varied flow, hydraulic jump, energy dissipation.

Unit-2	**Hydraulic Similitude**	Contact Hours: 9

Dimensional analysis-Rayleigh’s method and Buckingham's pi theorem-study of Hydraulic models - Geometric, kinematic and dynamic similarities-dimensionless numbers - model and prototype relations.

Unit-3	**Impact of Jets**	Contact Hours: 9

Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency.

Unit-4	**Hydraulic Turbines**	Contact Hours: 9

Layout of a typical Hydropower installation —Heads and efficiencies - classification of turbines. Pelton wheel - Francis turbine — Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency. Draft tube —surge tanks-unit and specific quantities, performance characteristics-geometric similarity-Cavitation.

Unit-5	**Hydraulic Pumps**	Contact Hours: 9

Centrifugal Pumps: Pump installation details-classification-work done- Mano metric head-minimum starting speed-losses and efficiencies-specific speed, - performance of pumps-characteristic curves- NPSH- Cavitation. **Reciprocating Pumps**: Introduction, classification, components, working, discharge, indicator diagram, work done and slip.	
Total Hours: 45	
Text Books:	
1	Open Channel flow by K. Subramanya, Tata McGraw Hill Publishers
2	Fluid Mechanics by Modi and Seth, Standard book house.
3	Open Channel Hydraulics by V.T. Chow, Mcgraw Hill Publishers
Reference Books:	
1	Fluid Flow in Pipes and Channels by G.L. Asawa, CBS
2	Fluid Mechanics and Machinery by C.S.P. OJHA, R. BERNDTSSON and P.N. Chandramouli, Oxford Higher Education.
3	Fluid Mechanics and Machinery by Md. Kaleem Khan, Oxford Higher Education.
Web References:	
1	https://nptel.ac.in/courses/105105203
2	https://www.youtube.com/watch?v=JQmkQQVYnJU

COURSE OUTCOMES: Upon completion of the course, students shall have ability to		BT Mapped (Highest Level)
CO 1	Explain the behavior of flow in open channels under various flow conditions.	L2
CO 2	Develop empirical relationships among the physical variables associated with the flow phenomenon in both model and prototype scenarios	L4
CO 3	Determine the hydrodynamic forces exerted by the fluid jet on flat, inclined, and curved vanes.	L4
CO 4	Design turbines considering diverse hydraulic conditions.	L4
CO 5	Evaluate the performance characteristics of pumps operating under various conditions.	L4

Mapping of Cos with POs and PSOs														
COs/POs	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
CO 1	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO 4	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO 5	3	-	-	-	-	-	-	-	-	-	-	3	3	-
1 – Slight, 2 – Moderate, 3 – Substantial														

ASSESSMENT PATERN - THEORY							
TEST	Remembering (K2)%	Understanding (K2)%	Applying (K2)%	Analyzing (K2)%	Evaluating (K2)%	Creating (K2)%	Total%
MID-1	20	30	50				100
MID-2	10	20	35	35			100
SEE	10	20	30	40			100
*± 3% may be varied							