SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Mechanical Engineering Department
B. Tech. Semester VII

Course Name: **Hydel & Wind Systems** **Subject Code: BTME19723**
Type of course: **Honors**
Prerequisite: Fluid Mechanics, Engineering Thermodynamics, Energy Sources
Course Outline: The course is designed to provide knowledge of various renewable energy sources like Hydel energy & Wind energy systems and their applications in the present context and need.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
4	0	0	4	60	25	15	0	0	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course.

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Introduction:** Overview of Hydropower Systems, Preliminary Investigation, Preparation of Reports and Estimates, Review of World Resource, Cost of Hydroelectric Power, Basic Factors in Economic Analysis of Hydropower Projects, Project Feasibility, Load Prediction and Planned Development.	12	22%
2	**Power Station Operation and Maintenance**: Governing of Water Turbines, Function of Turbine Governor, and Conditions for Governing stability, Surge Tank Oscillation and Speed Regulative Problem of Turbine Governing Future.	10	16%

3	**Reservoirs**: Problem of Management, Maintenance of Civil Engineering Works, Maintenance of Electrical Engineering Works.	**08**	**14%**
4	**Measurement And Instrumentation:** Instrumentation, Beau fort number, Gust parameters, Wind Type, Power Law Index, Betz constant, Terrain value.	**10**	**16%**
5	**Windmill Structures and Standards:** Energy in wind, study of wind applicable to Indian standards, Steel Tables, Structural Engineering **Variables In Wind Energy Conversion Systems:** Variables in wind energy conversion systems, wind power density, power in a wind stream, wind turbine efficiency, Forces on the blades of a propeller, Solidity and selection curves.	**10**	**16%**
6	**Wind Turbines and Characteristics:** HAWT, VAWT, Wind Turbine design, power duration curves, wind rose diagrams, study of characteristics, actuator theory, controls and instrumentations, Blade Element Theory. **Wind Energy Storage:** Grid-combination of diesel generator, Battery storage, wind turbine circuits, Wind farms, fatigue stress, Hybrid Systems	**10**	**16%**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

Percentage Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**20**	**20**	**20**	**15**	**10**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyse, **E:** Evaluate **C:** Create and above Levels
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Wind Energy Explained: Theory, Design and Application	J. F. Manwell and J. G. McGowan, A. L. Rogers	Wiley	2009	3rd
2.	Hydropower: Renewable Energy Essentials	Jeff Caldwell	Larsen and Keller Education	2019	--
3.	Wind and Solar Power Systems	Mukund. R. Patel	Taylor & Francis	2021	3rd
4.	Non-conventional Energy Resources	B. H. Khan	McGraw Hill Publishing Company Ltd.	2017	3rd
5.	Renewable Energy Resources	John Twidell	Routledge	2021	4th

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Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Define basic concepts of hydro electric energy system and their operations.	30
CO-2	Describe the maintenance, development & reservoir of hydel systems.	20
CO-3	Illustrate the wind energy technology, wind structure and conversion of energy in wind energy system.	30
CO-4	Evaluate the potential of wind energy conversion systems.	20

Mapping of (CO's) with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	**3**	**2**	**2**	**1**	**1**	**0**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**
CO-2	**0**	**1**	**3**	**2**	**2**	**0**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**
CO-3	**2**	**1**	**0**	**2**	**2**	**0**	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**3**	**1**
CO-4	**0**	**2**	**2**	**0**	**2**	**2**	**2**	**0**	**3**	**2**	**2**	**0**	**3**	**3**	**3**
Rationale*	**5**	**6**	**7**	**5**	**7**	**2**	**9**	**5**	**7**	**6**	**5**	**3**	**7**	**10**	**8**

Rationale - Mapping of CO's with PO's and CO's with PSO's:
It states that the course will develop Engineering Knowledge, addresses societal, health, safety, legal and cultural issues, it focuses on individual and team work and better communication. Course also focuses on knowledge of Hydel & Wind Systems.

This course highly maps with PO 7 and PSO 2, 3. It states that the course will develop Environment and sustainability. This Course also focuses on Engineering knowledge, Problem analysis, Design / development of solutions, Conduct investigations of complex problems, Modern tool usage, The engineer and society, Ethics, Individual and teamwork, Communication, Project management and finance, Life-long learning.

Assignments to be given as per the requirement of the course.

List of Open learning website: https://nptel.ac.in/courses/103103206