SCHEME OF COURSE WORK:

Course Details:

Course Title	VIRTUAL LAB ON MULTIPHASE FLOW					
Course Code	19ME22M3	**LTPC**	**0**	**0**	**3**	**1.5**
Program	M.Tech.					
Specialization	Thermal Engineering					
Semester	I					
Prerequisites	Advanced Heat Transfer					
Course to which is a prerequisite	NA					

Course Outcomes:

CO1	Examine the Taylors bubble formation in vertical circular conduits and compute its velocity.
CO2	Evaluate the formation of gas liquid two phase flows in vertical tubes and in natural circulation loop.
CO3	Analyze the characteristics of an airlift pump and evaporation losses from a cryogenic vessel
CO4	Determine the bubble generation, growth and departure from a submerged orifice and steam condensation in micro channels.
CO5	Test for the conductivity probes and signals in two -phase flows.

Program Outcomes:

PO Code	**Program Outcome (PO)**
PO1	exhibit in-depth knowledge in thermal engineering specialization
PO2	think critically and analyse complex engineering problems to make creative advances in theory and practice
PO3	solve problem, think originally and arrive at feasible and optimal solutions with due consideration to public health and safety of environment
PO4	use research methodologies, techniques and tools, and will contribute to the development of technological knowledge
PO5	apply appropriate techniques, modern engineering tools to perform modeling of complex engineering problems with knowing the limitations
PO6	understand group dynamics, contribute to collaborative multidisciplinary scientific research
PO7	demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors
PO8	communicate complex engineering problems with the engineering community and society, write and present technical reports effectively
PO9	engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously
PO10	exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community
PO11	examine critically the outcomes of actions and make corrective measures

Course Outcome Vs Program Outcomes

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**

CO1	S	S	S	M					M		
CO2	S	S	S	M					M		
CO3	S	S	S	M					M		M
CO4	S	S	S	M					M		
CO5	S	S	S	M					M		M

S - Strongly correlated, M - Moderately correlated, Blank - No correlation

Assessment Methods:

Day to Day Evaluation (Record and Observation): 20M
Two mid-term examination at the end of each cycle: 20M
End Semester Examination: 60M

Teaching-Learning and Evaluation

Week	Topic/Content	CO	Sample Questions	Teaching-Learning Strategy	Assessment method & Schedule
1	Lecture on Multiphase Flow				
2	Rise of Taylor Bubble Through Vertical Circular Conduits	CO1	Describe how to determine the rise velocity of bubble	Practical Demo and Exercise the practical on virtual mode	Day to day to evaluation Observation (10M) and Record submission (10M)
3	Gas-Liquid Two-Phase Flow through a Vertical Tube	CO2	Describe various regimes of flow		
4	Evaporation Loss from a Cryogenic Vessel	CO2	What are cryogenics and their applications? How to store the cryogenics?		
5	Characteristics of an Air Lift Pump	CO3	Explain the working principle and applications of airlift pump?		
6	**Cycle – 1 : Mid test**				
7	Conductivity Probes and Signals in Two-Phase Flow	CO5	What are conductivity probes and their applications?	Practical Demo and Exercise the practical on virtual mode	Day to day to evaluation Observation (10M) and Record submission (10M)
8	Bubble Generation, Growth and Departure from a Submerged Orifice	CO4	Explain the bubble generation and growth		
9	Virtual Lab on Steam Condensation in Micro channels	CO4	What are micro channels and explain the condensation of steam in them		
10	Two phase flow in a natural circulation loop	CO5	What is a naturally circulated loop? Explain the working and construction of it		
	Mid Term Examination-II				
End Term Examination					