SCHEME OF COURSE WORK:

Course Details:

Course Title	Thermal Engineering Lab					
Course Code	19ME2204	**LTPC**	**0**	**0**	**3**	**1.5**
Program	M.Tech.					
Specialization	Thermal Engineering					
Semester	I					
Prerequisites	Applied Thermodynamics, Heat Transfer					
Course to which is a prerequisite	NA					

Course Outcomes:

CO1	Find the compressibility factor of real gases and dryness fraction of steam
CO2	Evaluate the performance of variable compression engines, air conditioning systems, heat pipe and refrigeration system
CO3	Determine the overall heat transfer co-efficient for double pipe heat exchanger with parallel, counter flow and finned tube heat exchanger
CO4	Analyse exhaust gases, test the evacuated tube concentrator and test the performance of pin fin under natural convection and forced convection
CO5	Determine the efficiency of a solar air heater and moisture removal rate in an agricultural product by using solar air heater

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 modelling 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	M	M								
CO2	S	M	M								
CO3	S	M	M	M							
CO4	S	M	M								
CO5	S	M	M						M		

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

Assessment Methods:

Assignment/Quiz/Seminar/Case Study, Mid term exam and End term examination.

Teaching-Learning and Evaluation

Week	List of Experiment	CO	Sample Questions	Teaching-Learning Strategy	Assessment method & Schedule
1	Introduction to Thermal Engineering Lab			Demonstration	No evaluation, Practice session
2	Compressibility factor measurement of different real gases	CO1	Determine the compressibility factor of real gas. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 9)
3	Dryness fraction estimation of steam	CO1	Determine the dryness fraction of steam. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 9)
4	Performance test on a variable compression ratio (VCR) diesel engine	CO2	Calculate the performance of a VCR Diesel engine {in terms of BP, IP, brake thermal efficiency, indicated thermal efficiency, mechanical efficiency, volumetric efficiency and BSFC} Write the experimental procedure. Write the results and discussion. Draw its performance curves.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 9)
5	Performance of an air-conditioning system	CO2	Calculate the COP of an air-conditioning test rig for the following observation. Also calculate amount of heat removed and moisture removed from the air flowing through the AC duct. Draw the schematic diagram of air-conditioning test rig. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 9)
6	COP of refrigeration system	CO2	Calculate the COP of a vapour compression refrigeration test rig for the following observation. Draw the schematic diagram of vapour compression refrigeration system. Write the experimental procedure. Write the results and discussion	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 9)`

7	Performance of heat pipe	CO2	Determine the performance of a heat pipe. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 9)
8	Revision of Cycle 1				
9	Mid Term Examination				
10	Double pipe heat exchanger with parallel/counter flow	CO3	Determine the effectiveness of concentric double pipe heat exchanger running parallel flow mode. Determine the effectiveness of concentric double pipe heat exchanger running counter flow mode. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 18)
11	Finned tube heat exchanger	CO3	Determine the effectiveness of concentric finned heat exchanger. Write the experimental procedure. Write the results and discussion	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 18)
12	Exhaust gas analysis with gas analyser.	CO1	Determine the exhaust gas emissions for a VCR Diesel engine at different engine loads. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 18)
13	Pin fin experiment under natural/forced convection heat transfer conditions	CO4	Determine heat transfer coefficient for external forced/natural convection flow over a pin fin. Write the experimental procedure. Write the results and discussion	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 18)
14	Measurement of thermal efficiency of a solar air heater	CO4	Conduct an experiment on solar air heater and determine its thermal efficiency. Write the experimental procedure. Write the results and discussion.	Demonstration of Experimental setup and Experimentation	Day to Day Evaluation and Record Submission, Mid term exam (week 18)
15	Determination of moisture removal rate	CO5	Conduct an experiment on solar air heater and determine percentage improvement in moisture removal	Demonstration of Experimental	Day to Day Evaluation and Record Submission,

	from agricultural products using a solar air heater		rate from agricultural products like bagasse, tomato pulp, mirchi etc. Write the experimental procedure. Write the results and discussion.	setup and Experimentation	Mid term exam (week 18)
16	Revision of Cycle 2				
17	Revision of Cycle 1,2				
18	Mid Term Examination-II				
19-20	End Term Examination				