

Course title: Energy lab – I (Power system lab and heat transfer lab)				
Course code: ENR 101		No. of credits: 2	L-T-P: 0-0-56	Learning hours: 56
Pre-requisite course code and title (if any): NA				
Department: Department of Energy and Environment				
Course coordinator: Dr. Naqui Anwer			Course instructor(s): Dr. Naqui Anwer/ Dr. Som Mondal	
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Course type: Core			Course offered in: Semester 1	
Course description				
<p>To work in power industry, it is very important to develop an expertise to handle various power system equipments like synchronous machine, DC machine, Induction machine, transformers and transmission lines. This laboratory is designed to give students a hands-on experience on different equipment of electrical power system.</p> <p>Heat Transfer is one of the important subjects which is commonly applied in renewable energy, industrial, commercial and domestic systems. The experiments are designed to provide exposure of practical aspects of the various theoretical concepts developed under the various courses. The laboratory consists of experiments on various conductive, convective, radiative, boiling and condensing mechanisms of heat transfer.</p>				
Course objectives				
<ul style="list-style-type: none"> ▪ To provide hand-on experience on experimental set ups/prototypes related to power system and heat transfer. ▪ To provide practical learning about construction and operation of power system equipments and heat transfer equipments. 				
Course contents				
Module	Topic	L	T	P
1	Transmission & Distribution			
	ABCD parameters of short, medium and long transmission lines To determine the performance of transmission line under different loading condition.	0 0	0 0	3 2
2	Induction Machine			
	To vary the speed of an induction motor by varying voltage and to change the direction of rotation.	0	0	2
	To perform the no load test and block rotor test on an induction motor. To perform the load test on an induction motor.	0 0	0 0	3 2
3	Transformer			
	To operate two transformers in parallel and study the load sharing between them.	0	0	3
	To perform the OC and SC test and Polarity test.	0	0	2
	Sumpner's back to back test on a transformer and determine the circuit model parameters. To calculate regulation at full and unity power factor of a single phase transformer.	0 0	0 0	2 2
4	DC Machines			
	To study speed control of DC motor above the normal range by field control and to plot speed vs field current characteristics. To obtain load characteristics of DC shunt motor.	0 0	0 0	3 3
5	Power System Analysis			
	To understand reactive power and power factor in single-phase and three- phase circuits.	0	0	3
	To find the OCC and SCC of an alternator. To simulate the different types of faults in a power system.	0 0	0 0	3 3
6	Conduction			
	Measurement of thermal conductivity of an insulating slab.	0	0	3

7	Natural Convection Measurement of heat transfer coefficient in natural convection on vertical cylinder.	0	0	3
8	Radiation Measurement of emissivity of a gray surface.	0	0	3
9	Heat Exchanger Estimation of overall heat transfer coefficient for tube in tube type heat exchanger in counter flow mode. Estimation of overall heat transfer coefficient for shell and tube heat exchanger with water on both sides. Estimation of overall heat transfer coefficient for shell and tube heat exchanger with thermic fluid on one and water on the other side.	0 0 0	0 0 0	2 3 3
10	Forced Convection Measurement of convective heat transfer coefficient in a pipe by forced convection.	0	0	3
Total		0	0	56
Evaluation criteria				
<ul style="list-style-type: none"> ▪ Practical Records: 20% ▪ Viva voce: 30% ▪ Continuous evaluation: 50% 				
Learning outcomes				
<ul style="list-style-type: none"> ▪ Students shall be able to understand the characteristics and behaviour of various power system equipments and heat transfer systems through experimental verification. ▪ Students are expected to learn the integrated operation and mathematical modelling of the power system equipments. 				
Pedagogical approach				
Students complete a procedure given in the laboratory manual to determine the behaviour of the equipments/prototypes/experimental set ups and produce the expected characteristics.				
Materials				
Recommended readings				
D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Tata McGraw-Hill, 3 rd edition, 2014 D.P. Kothari and I.J. Nagrath, "Electrical Machines", Tata McGraw-Hill, 4 th edition, 2010 Prabha Kundur, "Power System Stability and Control", McGraw-Hill Inc., 1994 YA Cengel and AJ Ghajar, "Heat and Mass Transfer: Fundamentals and Applications", Tata McGraw-Hill, 4 th edition, 2011 Robert Alan Granger, "Experiments in Heat Transfer and Thermodynamics", Cambridge University Press, 1994				
Additional information (if any): NA				
Student responsibilities				
Attendance, feedback, discipline: as per university rules.				

Course Reviewers

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