

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS & ELECTRICAL DRIVES (45)

ENERGY EFFICIENT ELECTRICAL SYSTEMS

SUBJECT CODE: 2724510

SEMESTER: II

Type of course: Engineering Science (Electrical)

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
		PA	ALA		ESE	OEP				
3	2#	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Electrical Systems Different sources of energy - Primary and Secondary energy, Commercial and Non commercial energy, Renewable and Non-Renewable energy, Overall Electrical system, load management, power factor issues, capacitor sizing & location, performance assessment of PF capacitors, case studies.	08	20
2	Energy Audit Need, types, benchmarking and audit instruments, case studies.	04	10
3	Lighting Systems Basic terms, Domestic/commercial/industrial lighting systems, performance characteristics of lamps, energy efficient practices in lighting systems, Electronic ballast, Occupancy sensors, Energy efficient lighting controls, case studies.	12	30
4	Electric Motors Types, Characteristics, selection of motors, Factors affecting energy efficiency, Energy efficient control & starting, Energy efficient motors, Variable speed drives, Case studies.	12	30
5	Energy Efficient Electrical System Technologies Maximum demand controllers, Automatic power factor controllers, Energy efficient transformers, Energy efficient pumps & fans.	04	10

Reference Books:

1. Books of Energy Management & Auditors, Bureau of Energy Efficiency, <http://beeindia.in/> volume 1, 2, 3 & 4.
2. IEEE Bronze Book: IEEE Standard 739-1995 – IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 1996.
3. Steven R. Patrick, Dale R. Patrick, Stephen W. Fardo, “Energy Conservation Guidebook”, The Fairmont Press, Inc., 1993.
4. S.C. Tripathy, “Electric Energy Utilization and Conservation”, Tata McGraw Hill, 1991.
5. Sunil S. Rao, “Utilization generation & conservation of electrical energy”, Khanna Publishers, 2011.

Course Outcome:

After learning the course the students should be able to:

- Understand power factor issues and criterion for selection as well as location of capacitor for power factor improvement.
- Perform energy audit for different types of premise
- Analyze the characteristics of different types of lamps
- Compare efficiency of different types of electric motors.
- Understand working of energy efficient motors and their control.
- Analyze efficiency of pumps.
- Understand the concepts of energy efficiency transformers.
- Analyze energy efficient practices adopted for different electrical apparatus.

List of Experiments:

- To analyze selection and location of capacitor for power factor improvement.
- To determine performance characteristics of different lamps.
- To analyze performance of electronics ballast.
- To investigate efficiency of an induction motor under different loading condition.
- To investigate energy saving of an induction motor drives using variable frequency drive.
- To analyze efficiency of solar cell under different operating conditions.
- To compare efficiency of different types of motors.
- To investigate efficiency of pump under different loading condition.
- To measure efficiency of three phase transformer at different loading condition.
- To design & simulate automatic power factor controller.

Design based Problems (DP)/Open Ended Problem:

Course coordinator has to define at least 3 open ended problems related to the course.

Major Equipment:

Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.

List of Open Source Software/learning website:

- E-materials available at the website of Bureau of Energy Efficiency:
http://beeindia.in/content.php?page=miscellaneous/useful_download.php
- PSIM (Demo version): Software is useful for simulation and analysis of electronic circuits.
- MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website