PIPM 8004	Energy Conservation and Audit	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Graduate in Engineering/Science discipline				
Co-requisites	Basic understanding about energy consumption patterns				

Course Objectives

1. To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of energy conservation and energy auditing.
2. To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding energy conservation and energy auditing.

Course Outcomes

On completion of this course, the students will be able to exhibit

CO1. Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing

CO2. Ability to analyse the viability of energy conservation projects

CO3. Capability to integrate various options and assess the business and policy environment regarding energy conservation and energy auditing

CO4. Advocacy of strategic and policy recommendations on energy conservation and energy auditing

Catalog Description

We use energy faster than it can be produced - Coal, oil and natural gas - the most utilized sources take thousands of years for formation. Energy resources are limited, for example India has approximately 1% of world's energy resources but it has 16% of world population. Most of the energy sources we use cannot be reused and renewed i.e. non-renewable energy sources constitute 80% of the fuel use. It is forecasted that majority of our energy resources may last only for few hundred years or so. Saving energy also helps in reducing energy cost and pollution. Thus, from sustainable development, pollution and economics perspectives, energy conservation is import for a country. In this course, students will be engaged to help them acquire technical and commercial knowledge and skills associated with energy conservation and energy auditing. Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies. We will combine traditional lectures with other active teaching methodologies, such as group discussions, cooperative group solving problems, quizzes, presentations, etc. Class participation is a fundamental aspect of this course. Students will be encouraged to actively take part in all group activities and to give an oral group presentation. Students will be expected to interact with media resources, such as, web sites, YouTube videos, blogs, and newspapers articles.

Course Content

Unit I: 6.0 lecture hours

Global trend in energy conservation; Energy conservation act 2001, Energy conservation act (Amendment) 2010; Bureau of Energy Efficiency – genesis and mandate; Energy Conservation and Building Codes

Unit II: 12.0 lecture hours

Energy GDP elasticity – World and India; Energy consumption – Steel industry; Energy consumption – Cement industry; Energy efficiency in power sector – World and India

Unit III: 9.0 lecture hours

Energy conservation opportunities in power sector; Supply side management; Demand side management; Case studies

Unit IV: 9.0 lecture hours

Energy audit; Phases in energy auditing; Energy bills; Energy rate schedules; Energy accounting; Energy audit report format; Case studies ; Green buildings; Financing energy conservation – PAT mechanism; Policy support for energy conservation

Text Books

1. Capehart B.L., Turner W.C., Kennedy W.J. (2011). Guide to Energy Management (7th Edition). Fairmont Press. ISBN: 1439883483.
2. Patrick D.R., Fardo S.W., Richardson R.E., Fardo B.W. (2014). Energy Conservation Guidebook (3rd Edition). Fairmont Press. ISBN: 1482255693.

Reference Books

1. Kreith F., Goswami D.Y. (2007). Energy Management and Conservation Handbook. CRC Press. ISBN: 9781420044294.

Modes of Evaluation (100 Marks)

Quiz: 20 marks
Assignment/Presentation: 30 marks
Written Exam (End-semester): 50 marks

Examination Scheme

Components	Internal Assessment (Quiz/Assignment/Presentation/Extempore)	End-Semester Exam (Written Exam)
Weightage (%)	50%	50%

Relationship between the Course Outcomes (COs) and Program Outcomes (POs/PSOs)

Mapping between COs and POs		
	Course Outcomes	**Mapped Programme Outcomes**
CO1	Conceptual knowledge of the technology, economics and regulation related issues associated with energy conservation and energy auditing	**PO1, PO8, PSO1, PSO2**
CO2	Ability to analyse the viability of energy conservation projects	**PO2, PSO3, PSO5**
CO3	Capability to integrate various options and assess the business and policy environment regarding energy conservation and energy auditing	**PO3, PSO4, PSO5**
CO4	Advocacy of strategic and policy recommendations on energy conservation and energy auditing	**PO4, PO6, PO8 , PSO4, PSO5**

Program Outcomes

PO1: Students will be able to develop and evaluate alternate managerial choices and identify optimal solutions.

PO2: Students will demonstrate effective application capabilities of their conceptual understanding of power generation, transmission, distribution, trading along with sustainability practices.

PO3: Students will be able to exhibit effective decision-making skills, employing analytical and critical thinking ability.

PO4: Students will demonstrate effective oral and written communication skills in the professional context.

PO5: Students will be able to work effectively in teams and demonstrate team-working capabilities.

PO6: Students will exhibit leadership and networking skills.

PO7: Students will demonstrate sensitivity towards ethical and moral issues and have ability to address them in the context of power management.

PO8: Students will demonstrate employability traits in line with the needs of changing dynamics of the industry**.**

PSO1: Students will demonstrate strong conceptual knowledge in fuel management, power generation, transmission, distribution, trading, energy management, financing and regulation, and sustainable development.

PSO2: Students will demonstrate effective understanding of functioning of power sector.

PSO3: Students will demonstrate analytical skills in identification and resolution of issues pertaining to fuel management, power generation, transmission, distribution, trading, energy management, financing and regulation, and sustainable development.

PSO4: Students will exhibit the ability to integrate technical, economic, social and regulatory frameworks for power sector planning and resource management.

PSO5: Students will exhibit deployable skills pertinent to the power sector.

Program Outcome / Course Outcome Mapping

Course Outcomes	**CO 1**	**CO 2**	**CO 3**	**CO 4**
PO 1	3	2	2	2
PO 2	2	3	2	2
PO 3	2	2	3	2
PO 4	2	2	2	3
PO 5	1	2	1	1
PO 6	2	2	2	3
PO 7	2	2	2	1
PO 8	3	1	2	3
PSO 1	3	2	2	2
PSO 2	3	2	2	2
PSO 3	2	3	2	2
PSO 4	2	2	3	3
PSO 5	2	3	3	3

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
PIPM 8004	Energy Conservation and Audit	3	3	3	2	1	2	2	3	3	3	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Model Question Paper

Name: **Enrolment No:**	UPES

Course: PIPM 8004 – Energy Conservation and Audit

Programme: MBA (Power Management) **Semester: ODD-2017-18**

Time: 03 hrs. **Max. Marks: 100**

Section – A (5 marks * 6 = 30 Marks)

Discuss the following in brief:

1.	Energy Conservation	**[5]**	**CO1**
2.	Energy Efficiency	**[5]**	**CO1**
3.	Energy Management	**[5]**	**CO1**
4.	Demand Side Management	**[5]**	**CO1**
5.	Supply Side Management	**[5]**	**CO1**
6.	Walk Through Audit	**[5]**	**CO1**
	Section – B (10 marks * 5 = 50 Marks)		
7.	Describe the basic format of an energy audit report.	**[10]**	**CO1**
8.	Briefly explain the working principle of a variable frequency drive that enables energy management in coal fired power plants.	**[10]**	**CO1**
9.	Worldwide, discoms don't appreciate sharp rise in peak demand of a consumer for a short duration and they have implemented penalty mechanisms to prevent the same. Explain the philosophy behind such mechanisms.	**[10]**	**CO2, CO3**
10.	Briefly discuss five components of rate schedules (energy bills).	**[10]**	**CO1**
11.	Demand Ratchet component of energy bill is a bit too harsh way of ensuring consumer discipline with respect to power consumption. Discuss.	**[10]**	**CO2, CO3**
	Section – C (20 marks * 1 = 20 Marks) Answer any one question from this section:		
12.	For conglomerates such as Tata that has group companies in the areas of financial services, consumer goods (electrical) and power distribution, demand side management is a wonderful opportunity. Justify.	**[20]**	**CO1, CO2, CO3, CO4**
13.	One unit of electricity saved by a consumer is equivalent to 3-4 units of units generated. Justify. Extend the same logic to discuss the benefits of energy management in comparison to capacity addition through new power plants.	**[20]**	**CO1, CO2, CO3, CO4**