PIPM 7001	Power Generation and Power Station Management	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Graduate in Engineering/Science discipline				
Co-requisites	--				

Course Objectives

1. To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Power Generation and Power Station Management.
2. To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies in the field of Power Generation and Power Station Management.

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 various power generation and power station management

CO2. Ability to analyse the viability of various power generation options

CO3. Capability to integrate various options and assess the business and policy environment regarding power generation from various energy resources

CO4. Advocacy of strategic and policy recommendations on implementation of power generation projects

Catalog Description

Power (Electricity) is critical to the socio-economic development of any society. The demand and supply of electricity are dynamic in nature as they vary due to its dependence on various factors. Additionally, power can't be stored at large scale and thus there is imminent need to ensure balance between its demand and supply to ensure commercial viability. Moreover, due to climate change and pollution concerns, nations worldwide are integrating more and more renewable energy options for power generation. In this course, students will be engaged to help them acquire technical and commercial knowledge and skills associated with power generation and power station management. 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: 4.5 lecture hours

Introduction; Need for Power; Faraday's Law of Electromagnetic Induction; Understanding Power Sector - Reforms and Acts before Electricity Act 2003, Electricity Act 2003, Impact of Electricity Act 2003; Current Issues in Power Sector - AT&C Losses, Tariff Revision, Coal Supply, etc.

Unit II: 6.0 lecture hours

Introduction; Terminologies: Load Factor, Capacity Factor, Reserve Factor, Demand Factor, Diversity Factor, Plant Use Factor; Load Curve and Load Duration Curve; Base Load, Intermediate Load and Peak Load; Impact of Load Factor on Power Plant Economics; Thermal Efficiency and Heat Rate and its impact on Power Plant Economics; Cost Comparison of Power Generation from various technologies.

Unit III: 3.0 lecture hours

Working Principles of Coal Fired TPP; Hydro Electric Power Plant; Wind Farm; Solar Photovoltaics; Solar Thermal Power Plant; Biomass Fired Power Plant; Tidal Power Plant; Geothermal Power Plant; Ocean Thermal Energy Conversion

Unit IV: 6.0 lecture hours

Rankine Cycle; Concept of Mean Temperature of Heat Addition; Effect of the following on the Thermal Efficiency of Steam Power Plant: Variation in Steam Condition, Reheating, Regeneration; Feedwater Heaters; Optimum Degree of Regeneration; Subcritical vs Supercritical; Typical Layout of a Coal Fired Thermal Power Plant; Cogeneration.

Unit V: 6.0 lecture hours

Rankine Cycle; Concept of Mean Temperature of Heat Addition; Effect of the following on the Thermal Efficiency of Steam Power Plant: Variation in Steam Condition, Reheating, Regeneration; Feedwater Heaters; Optimum Degree of Regeneration; Subcritical vs Supercritical; Typical Layout of a Coal Fired Thermal Power Plant; Cogeneration; Combined Cycle Power Plants

Unit VI: 4.5 lecture hours

Fire-Tube and Water-Tube Boilers; Schematic Layout of a Boiler; Coal Handling, Ash Handling, Power Generation and Control in a Coal Fired TPP

Unit VII: 6.0 lecture hours

Technical, Commercial and Regulatory Issues associated with Hydroelectric Power Plant, Nuclear Power Plant, Solar (PV and Thermal) Power Plant, Wind Power Plant, Biomass Power Plant; Integration of Various Power Generation Options to the Grid; Future of Indian Power Sector

Text Books

1. Nag P.K. (2017). Power Plant Engineering (4th Edition). McGraw Hill Education. ISBN: 9339204042.

2. Wood A.J., Wollenberg B.F. (2010). Power Generation, Operation and Control (2nd Edition). Wiley. ISBN: 8126508388.

Reference Books

1. Black and Veatch (2005). Power Plant Engineering. CBS Publishers and Distributors. ISBN: 8123905580.
2. El-Wakil M.M. (2010). Power Plant Technology. McGraw Hill Education. ISBN: 0070702446.

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 various power generation and power station management	**PO1, PO8, PSO1, PSO2**
CO2	Ability to analyse the viability of various power generation options	**PO2, PSO3, PSO5**
CO3	Capability to integrate various options and assess the business and policy environment regarding power generation from various energy resources	**PO3, PSO4, PSO5**
CO4	Advocacy of strategic and policy recommendations on implementation of power generation projects	**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	3	3	3
PO 2	3	3	2	3
PO 3	3	3	3	2
PO 4	1	1	1	1
PO 5	1	1	1	1
PO 6	2	1	2	2
PO 7	1	1	1	1
PO 8	3	3	2	3
PSO 1	3	3	3	3
PSO 2	3	2	3	3
PSO 3	3	3	3	2
PSO 4	3	3	3	3
PSO 5	3	2	3	3

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
PIPM 7001	Power Generation and Power Station Management	3	3	3	1	1	2	1	3	3	3	3	3	3

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

Model Question Paper

Name: **Enrolment No:**	

Course: PIPM 7001 – Power Generation and Power Station Management
Programme: MBA (Power Management) **Semester: ODD-2017-18**
Time: 03 hrs. **Max. Marks: 100**

Section – A (2 marks * 10 = 20 Marks)
Fill in the blanks with the most suitable option. The options are given in front of each question**.**

1.	In a sub-critical thermal (coal) power plant, the role of steam drum is to _____. (Heat water, Heat water and steam, Separate steam from water).	**[2]**	**CO1**
2.	The role of control rods in a nuclear power station is to _____ free neutrons. (control the speed of, absorb, reflect)	**[2]**	**CO1**
3.	_____ is not a part of a hydro power station. (Penstock, Surge tank, Deaerator, Draft tube)	**[2]**	**CO1**
4.	Supercritical power plants have _____ heat rates compared to subcritical power plants. (Higher, Lower, Equal, Astronomical)	**[2]**	**CO1**
5.	Electricity Act 2003 aims to create a _____ regime in the Indian Power Sector. (Monopoly, Market Based, Strictly Regulated, Highly Governed)	**[2]**	**CO1**
6.	Water walls are made up of _____. (Risers, Downcomers, Steam drum, Concrete)	**[2]**	**CO1**
7.	Air preheater (APH) deals with _____. (Incoming air only, Flue gases only, Both incoming air and flue gases, none of these)	**[2]**	**CO1**
8.	Of all the components of boiler, _____ faces the flue gases at highest temperature. (Reheater, Radiant Superheater, Convective Superheater, Steam Drum)	**[2]**	**CO1**
9.	The function of primary air is to _____ pulverized coal. (Transport, Dry, Transport and Dry, Combust)	**[2]**	**CO1**
10.	_____ is the predominant mode of heat transfer in economizer. (Conduction, Convection, Radiation)	**[2]**	**CO1**
	Section – B (10 marks * 6 = 60 Marks)		
11.	Considering past trend, forecast the role of Hydro and Nuclear power plants in India's power sector.	**[10]**	**CO4**
12.	Operating a coal fired power plant at higher steam pressure and higher steam temperature within the designed range is always beneficial. Explain.	**[10]**	**CO2**
13.	Discuss the main parameters that are used to assess the performance of thermal power plants.	**[10]**	**CO2**
14.	From the perspective of satisfying the electricity needs of a country like India, it is unfair to compare 1 MW of thermal power (coal or gas based) capacity with 1 MW of renewable power (solar or wind) capacity. Justify.	**[10]**	**CO3**
15.	Operation and maintenance of a hydro power plant is comparatively simpler as compared to that of a coal fired power station. Justify.	**[10]**	**CO3**
16.	Discuss the following data on cost of power supply and revenue realization in India and explain its impact on power sector:	**[10]**	**CO2**

Year	cost of supply (paise/unit)	Realization(paise/unit)	
		Including Agriculture	Only Agriculture
2004-05	254	209	75.68
2005-06	260	221	76.36
2006-07	276	227	74.23
2007-08	293	239	77.27
2008-09	340	263	87.13
2009-10	355	268	88.70
2010-11	398	303	119.75
2011-12	455	330	135.14
2012-13	501	376	148.67
2013-14	518		175
2014-15	520		

Source:- PFC Reports on the performance of State Power Utilities

	Section – C (20 marks * 1 = 20 Marks) **Answer any one question from this section:**		
17.	Explain the various challenges faced by India's power sector and suggest remedies.	**[20]**	**CO1, CO2, CO3, CO4**
18.	Discuss current scenario of rural electrification in India and the challenges associated with it. Suggest remedial measures for more effective and accelerated rural electrification.	**[20]**	**CO1, CO2, CO3, CO4**