


Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: POWER PLANT ENGINEERING		
	Scheme (L:T:P) : 4:0:0	Total Contact Hours: 52	Course Code: 15ME63B
	Type of Course: Lectures, Self Study & Quiz	Credit : 04	Core/ Elective: Elective
CIE: 25 Marks		SEE:100 Marks	

Prerequisites: Knowledge of Mathematics, Thermodynamics, Mechanics of machines, Work shop technology, Fluid mechanics and machinery.

Course Objectives:

Apply knowledge of mechanical engineering related to power generation systems, their control and economics in different type of power plants for their operation and maintenance.

Course Outcomes:

On successful completion of the course, the students will be able to attain CO:

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Analyze economics of power plants and list factors affecting the power plants and interpret the performance of power plants based on load variations	<i>R/U</i>	2	05
CO2	Identify elements and their functions of, hydro power plants.	<i>R/U/A</i>	2	10
CO3	Identify elements and their functions and operations of steam power plants.	<i>R/U/A</i>	2	10
CO4	Identify elements and their functions and operations of nuclear and gas turbine power plants	<i>R/U/A</i>	2	10
CO5	Identify elements and their functions and operations of Solar, wind and diesel power plants	<i>R/U/A</i>	2	09
CO6	Know the Social and Economical issues of power plants	<i>R/U</i>	2,5,6,7	08
		Total sessions		52

Legend: R: Remember U: Understand A: Application

COURSE-PO ATTAINMENT MATRIX



Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
POWER PLANT ENGINEERING	0	3	0	0	1	1	1	0	0	0
Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed. Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO. If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3 If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2 If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1 If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed										

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set for SEE/Marks			Marks weightage	weightage (%)
			R	U	A		
1	INTRODUCTION & ECONOMICS OF POWER PLANT	05	5	5	-	10	7
2	HYDRO POWER PLANT	10	5	10	15	30	21
3	THERMAL POWER PLANT	10	5	10	10	25	17
4	NUCLEAR POWER PLANT & GAS TURBINE POWER PLANTS	10	10	10	10	30	21
5	SOLAR, WIND AND DIESEL POWER PLANTS.	09	5	15	10	30	21
6	PLANT SAFETY AND ENVIRONMENTAL IMPACT OF POWER PLANT	08	5	15	-	20	13
	Total	52	35	65	45	145	100

Legend: R; Remember, U: Understand A: Application

UNIT I: INTRODUCTION & ECONOMICS OF POWER PLANT 5 Hrs

Power plant-Introduction, Classification - Location of power plant- Choice of Power plant-Terminology used in power plant: Peak load, Base load, Load factor, Load curve, demand factor- Various factor affecting the operation of power plant- Load sharing- cost of power-tariff methods-factors involved in fixing of a tariff.

UNIT II: HYDRO POWER PLANT 09 HRS

Hydro electric power plant- Introduction, storage and poundage, Selection of sites for hydro electric power plant-General layout and essential elements of Hydro electric power plant and its working-Classification of the plant- base load plant, peak load plant, Run off river plant, storage river plant, pumped storage plant, mini and micro hydel plants, governing of



hydraulic turbines-impulse turbine- reaction turbine, selection of turbines, Advantages and disadvantages-limitations of hydro electric power plant.

UNT III: THERMAL POWER PLANT

11 HRS

Thermal power plant -General layout – working-Site Selection–materials required for thermal power plants, coal handling and its methods, stages in coal storage, Fuel burning-Stoker firing-overfeed stoker –under feed stokers-chain grate stoker, Pulverized fuel handling system-unit and central system, Pulverization of coal-Ball mill, Ash handling system- Gravity system- electrostatic precipitation (ESP) system-Feed water treatment- Mechanical method, Advantages and disadvantages-limitations of Thermal power plant.

UNITIV: NUCLEAR POWER PLANT & GAS TURBINE POWER PLANTS 10 HRS

Nuclear power plant-introduction-nuclear fuels, nuclear fission and fusion, working of a nuclear power plant, types of reactors- pressurized water reactor- boiling water reactor, effects of nuclear radiation, different methods for nuclear waste disposal-low, medium and high level waste disposal, Advantages -disadvantages- limitations.

Gas turbine power plant- Schematic diagram & working of open and closed cycle gas turbine power plant, Components of Gas turbine–compressor, combustion chamber, gas turbine, vortex blading, gas turbine fuels, Gas turbine power plants in India - Namrup & Uran gas turbine power plants. Advantages -disadvantages- limitations of Gas turbine power plant

UNITV: SOLAR, WIND AND DIESEL POWER PLANTS.

9 HRS

Solar power plant-introduction-layout, Solar cell fundamentals & classification – maximum power point tracker (MPPT) and solar panel.

Wind power plant: introduction, -Factors affecting distribution of Wind energy, Variation of wind speed with height and time-Horizontal axis wind turbine (HAWT)-types of rotors- Vertical axis wind turbine- types of rotors- Wind energy conversion system (WECS) advantages and disadvantages-limitations of Wind power plant.

Diesel power plant- layout -Components and the working- Advantages -disadvantages-limitations.

UNIT VI: PLANT SAFETY AND ENVIRONMENTAL IMPACT OF POWER PLANT

08 Hrs

Social and Economical issues of power plant- Oxides of sulphur- oxides of carbon-oxides of nitrogen, Acid precipitation-Acid rain- acid snow- Dry deposition-acid fog, green house effect, air and water pollution from thermal power plants and its control, Thermal pollution from thermal power plants, noise pollution and its control, natural and artificial radio activity-nuclear power and environment- radiations from nuclear power plant effluents- high level wastes- methods to reduce pollution, global warming- its effects and control, standardization for environmental pollution.





TEXT BOOKS AND REFERENCE BOOKS

Sl.No.	Title of Books	Author	Publication
1.	Power plant engineering	Arora and Domkundwar	Dhanpat rai & CO (P) LTD
2.	Power plant engineering	P. K. Nag	McGraw Hill
3.	Power plant engineering	G. R. Nagpal	Khanna publishers
4.	Power Plant Engineering.	Dr. P. C. Sharma	S. K. Kataria
5.	A Text Book of Power Plant Engineering.	R K Rajput	Laxmi Publications,
6	Power plant technology	M.M. EL-Wakil	McGraw Hill
7	Power Plant Engineering.	C. Elanchezhian, L. Saravanakumar, B. Vijaya Ramnath	I.K. International Publishing House
8	Power Station Engineering and Economy.	Bernhardt G A Sarotzki, William A Vopat	Tata Mc Graw Hill
9	Nuclear Power Plant Engineering.	James H. Rust	Haralson Publishing Company
10	Steam power plant engineering.	Louis Allen Harding	J. Wiley & Sons, inc
11	Power Plant Engineering	A K Raja, Amit Prakash Srivastava and Manish Dwivedi	New age international Publishers

LIST OF SOFTWARES/ LEARNING WEBSITES:

- i. <http://nptel.ac.in/courses/112105051/>
- ii. https://www.youtube.com/watch?v=Ota2_LUuar0
- iii. https://www.youtube.com/watch?v=Ota2_LUuar0
- iv. <https://www.youtube.com/watch?v=3dJAtHaSQ98>
- v. <https://www.youtube.com/watch?v=xokHLFE96h8>
- vi. <http://www.tatapower.com/businesses/renewable-energy.aspx>
- vii. <http://www.cleanlineenergy.com/technology/wind-and-solar>
- viii. <https://www.youtube.com/watch?v=kbuLfXgw4Gs>
- ix. <https://www.youtube.com/watch?v=r9q80sSHxKM>
- x. https://www.youtube.com/watch?v=GZKKWz_tX1c
- xi. download other power plant related videos from youtube.com for study purpose .



SPECIAL INSTRUCTIONAL STRATEGIES

UNIT NO	UNIT NAME	STARATEGIES
1	Introduction & economics of power plant	Videos, Presentations, Discussions
2	Hydro power plant	Videos, Presentations, Industrial Visits, Demonstration,
3	Thermal power plant	Videos, Presentations, Industrial Visits, Demonstration,
4	Nuclear power plant & gas turbine power plants	Videos, Presentations, Industrial Visits, Demonstration
5	Solar, wind and diesel power plants.	Videos, Presentations, Industrial Visits, Demonstration,
6	Plant safety and environmental impact of power plant	Videos, Presentations, Industrial Visits, Demonstration,

SUGGESTED LIST OF STUDENT ACTIVITYS

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

- Each student should do any one of the following type activity or similar activity related to the course and before take up, get it approved from concerned Teacher and HOD.
- Each student should conduct different activity and no repeating should occur

1	Prepare list of various major power plants installed in Karnataka along with their total capacity.
2	Prepare charts of different high pressure boilers, gas turbine cycles, steam turbine power plant, wind turbine power plant, solar power plant, etc. on half imperial drawing sheet. Attach the same with term work.
3	Visit websites of NTPC, BHEL,, NHPC, NPCIL, GEDA, SUZLON, GE, SIEMENS, ENERCON and KPC etc and find out the technical information about their machineries or Plants.
4	Download technical specifications/ catalogues, videos or any other suitable presentations on gas turbine power plant
5	Download technical specifications/ catalogues, videos or any other suitable presentations on Hydro power plant.
6	Visit diesel power plant available in your institute/ nearer to your institute and understand different elements, working, circuits, and specifications.



Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests(Average of three tests will be computed)	20	Blue books	1,2,3,4,5,6
				Student activities	05	Activity sheets	1,2,3,4,5,6
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

CIE- Continuous Internal Evaluation SEE- Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Note to IA verifier: *The following documents to be verified by CIE verifier at the end of semester*

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks evaluated through appropriate rubrics.
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods



RUBRICS MODEL

RUBRICS FOR ACTIVITY(5 Marks)						
Dimension	Unsatisfactory	Developing	Satisfactory	Good	Exemplary	Student Score
	1	2	3	4	5	
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collect much information; but very limited relate to the topic	Collects some basic information; most refer to the topic	Collects a great deal of information; all refer to the topic	Ex: 4
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties but unreliable.	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team roles	5
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Normally does the assigned work	Always does the assigned work without having to be reminded.	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Talks good; but never show interest in listening others	Listens, but sometimes talk too much	Listens and speaks a fair amount	2
Average / Total marks=(4+5+3+2)/4=14/4=3.5=4						

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned faculty (Course Coordinator) for assessing the given activity.

Note to IA verifier: The following documents to be verified by CIE verifier at the end of semester

4. Blue books (20 marks)
5. Student suggested activities report for 5 marks
6. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Method



MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks		
Ex: I test/6 th week of sem 10-11 Am	IVSEM	POWER PLANT ENGINEERING	20		
	Year: 2016-17	Course code:15ME63B			
Name of Course coordinator :			Units:1,2 Co: 1,2		
Note: Answer all questions					
Question no	Question	MAR KS	CL	CO	PO
1	List the various factors considered for location of power plants OR Explain a) Peak load b) Base load	05	R	1	2
2	Explain load sharing.	05	U	1	2
3	Explain with a neat sketch the governing of impulse turbine.	05	U	2	2
4	Explain the storage river plant, pumped storage plant.	05	U	2	2



MODEL QUESTION PAPER

IV- Semester Diploma Examination

Course Title: **POWER PLANT ENGINEERING**

Time: **3 Hours**]

[Max Marks: **100**

Note: Answer any **SIX from Part A** and any **SEVEN from Part B**

PART-A

6x5=30 marks

1. Define a) Peak load b) Base load
2. List the various factors affecting the operation of power plant
3. List the advantages and disadvantages of hydro electric power plants
4. List the advantages of gas turbine power plant with nuclear power plant
5. List the Factors affecting distribution of Wind energy.
6. List the advantages of wind power plant
7. List Social and Economical issues related to power plants
8. List the limitations of nuclear power plant.
9. List the fuels used in thermal power plant.

PART-B

7x10=70 marks

1. Explain Demand factor and Load curve
2. Explain the various considerations while calculating cost of electrical energy.
3. Make use of Sketch explain the layout of hydro power plant
4. Make use of Sketch explain ash handling system
5. Make use of Sketch explain electrostatic precipitation (ESP) system
6. Explain the various methods involved in disposing of nuclear wastes
7. Explain briefly about green house effect.
8. Explain briefly about radiations from nuclear power plant effluents.
9. Explain with a neat sketch unit and central pulverizing systems.
10. Make use of Sketch explain the line diagram nuclear power plant



MODEL QUESTION BANK

Diploma in Mechanical Engineering IV Semester

Course title: POWER PLANT ENGINEERING

Note: The paper setter is of liberty to set the questions on his/her discretion based on cognitive levels notified for that unit. They have to follow only blue print of SEE question paper format. The model question bank is only for reference to students/course coordinator to initiate the process of teaching-learning only.

CO1 Analyze economics of power plants and list factors affecting the power plants and interpret the performance of power plants based on load variations

R-Remember

1. Define power plant
2. List the source of energy
3. List classifications of Power plants
4. List the various factors considered for location of power plants
5. List the various factors affecting the operation of power plant
6. List the principal factors involved in fixing of tariff

U-Understanding

11. Explain with reasons for considering the various factors in identifying the plant locations
12. Explain the importance of load curve in power generation
13. Explain Power plant economics
14. Explain Various factor affecting the operation of power plant
15. Explain Demand factor and Load curve
16. Explain load factor and Demand factor
17. Explain the various types of electrical energy tariffs
18. Explain the choice of power plant
19. Explain load sharing.
20. Explain various considerations while calculating cost of electrical energy.
21. Explain Power plant economics
22. Explain i) Demand factor ii) Load curve
23. Explain i) load factor ii) Demand factor
24. Explain a) Peak load b) Base load

CO2: Identify elements and their functions of, hydro power plants.

REMEMBERING

1. List the essential components of hydro electric power plant.
2. List the different types of hydroelectric power plant
3. List the advantages and disadvantages of hydro electric power plants
4. List the different factors to be considered while selecting the site for hydroelectric power plant.

UNDERSTANDING



1. Explain briefly the necessity of storage and poundage.
2. Explain a typical layout of a hydro electric plant.
3. Explain briefly the essential elements of a hydroelectric power plant.
4. Explain briefly the working the hydroelectric power plant.
5. Explain the base load plant, peak load plant and Run off river plant.
6. Explain the mini and micro hydel plants.
7. Explain with a neat sketch the governing of impulse turbine.
8. Explain with a neat sketch the governing of reaction turbine.
9. Explain briefly the factors involved in selection of turbines

APPLICATION

1. Make use of the Sketch, explain the storage river plant, pumped storage plant
2. Make use of the Sketch, explain the layout of hydrol power plant

CO3: Identify elements and their functions and operations of steam power plants

REMEMBERING

1. List the fuels used in thermal power plant.
2. List the classification of fuel firing.

UNDERSTANDING

3. Explain briefly the working of thermal power plant.
4. Explain the various factors considered for site selection for thermal power plant.
5. Explain different basic materials required for thermal power plants.
6. Explain the different methods of coal handling systems.
7. Explain methods used for coal storage.
8. Explain the principle of overfeed and underfeed stokers.
9. Explain with a neat sketch chain grate stokers.
10. Explain with a neat sketch unit and central pulverizing systems.
11. Explain briefly pulverizing of coal
12. Explain with a neat sketch mechanical feed water treatment.
13. Explain with a neat sketch ball mill.
14. Explain feed water treatment process.

APPLICATION

14. Make use of the Sketch, explain the general layout modern thermal power plant.
15. Make use of the Sketch, explain ash handling system
25. Make use of the Sketch. explain Gravity system
26. Make use of the Sketch ,explain electrostatic precipitation (ESP) system

CO4: Identify elements and their functions and operations of nuclear and gas turbine power plants..

REMEMBERING

1. Define nuclear fusion and nuclear fission
2. Name the different nuclear fuels used for nuclear power plant
3. List the advantages and limitations of nuclear power plant.
4. List the components of gas turbine power plant
5. List the advantages of gas turbine power plant with nuclear power plant
6. List the advantages and limitations of open cycle and closed cycle gas turbine

UNDERSTANDING

1. Compare between nuclear fusion and fission.



2. Explain with a neat sketch nuclear power plant.
3. Explain pressurized water reactor (PWR) with a neat sketch.
4. Explain with a neat sketch boiling water reactor (BWR).
5. Explain the effects of nuclear radiation on environment.
6. Explain briefly low, medium and high level waste disposals.
7. Explain with a neat sketch open cycle gas turbine power plant.
8. Explain with a neat sketch closed cycle gas turbine power plant.
9. Explain with a neat sketch the following components of gas turbine
 - a) Compressor b) Combustion chamber,
10. Explain with a neat sketch the following components of gas turbine
 - a) Gas turbine b) Vortex blading

APPLICATION

1. Choose the various methods involved in disposing of nuclear wastes
2. Make use of the sketch explain closed cycle gas turbine power plant
3. Make use of the sketch explain open cycle gas turbine power plant
4. Make use of the sketch explain the line diagram nuclear power plant

CO5: Identify elements and their functions and operations of solar, wind and diesel power plants

REMEMBERING

1. Define solar period
2. List the Factors affecting distribution of Wind energy.
3. List the advantages of wind power plant
4. List and explain the types of rotors for HAWT.
5. List and explain the types of rotors for VAWT
6. List the Advantages and disadvantages of diesel power plant

UNDERSTANDING

1. Classify the different types of solar cells.
2. Explain briefly about solar cells.
3. Explain maximum power point tracker (MPPT).
4. Explain solar panel.
5. Explain the Variation of wind speed with height and time.
6. Explain with a neat sketch Horizontal axis wind turbine (HAWT).
7. Explain with a neat sketch vertical axis wind turbine(VAWT)
8. Explain with a neat sketch Wind energy conversion system (WECS).

APPLICATION

1. Make use of the Sketch, explain a layout of diesel power plant.
2. Make use of the Sketch, explain the various Components of diesel power plant.
3. Make use of the Sketch, explain working of diesel power plant.

CO6: Know the Social and Economical issues of power plant

REMEMBERING

1. List Social and Economical issues related to power plants.
2. List the reasons for air pollutions due to power plant
3. List the water pollutants arise due to power plant
4. List the methods to control global warming by power plants.
5. List the methods suggested for developing the power plant without pollution



UNDERSTANDING

1. Explain about Acid precipitation, Acid rain and acid snow.
2. Explain about Dry deposition and acid fog.
3. Explain briefly about green house effect.
4. Explain the various water and air pollution caused by thermal power plants and its control.
5. Explain about noise pollution caused by power Discuss about Thermal pollution from thermal power plants.
6. Explain briefly about natural and artificial radio activity.
7. Explain briefly about radiations from nuclear power plant effluents.
8. Explain briefly about high level wastes and their disposal.
9. Explain the contribution of power plants for global warming and its effects
10. Explain the purpose of standardization of environmental pollution.
11. Explain the measure to be taken by power plants to avoid air pollution
12. Explain the measure to be taken by power plants to avoid water pollution
13. Explain the measure to be taken by power plants to avoid Noise pollution

