

JEPPIAAR ENGINEERING COLLEGE

Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK



VII SEMESTER

ME6701 – POWER PLANT ENGINEERING

Regulation – 2013

JEPPIAAR ENGINEERING COLLEGE

Vision of Institution

To build Jeppiaar Engineering College as an institution of academic excellence in technological and management education to become a world class university.

Mission of Institution

- To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking.
- To participate in the production, development and dissemination of knowledge and interact with national and international communities.
- To equip students with values, ethics and life skills needed to enrich their lives and enable them to meaningfully contribute to the progress of society.
- To prepare students for higher studies and lifelong learning, enrich them with the practical and entrepreneurial skills necessary to excel as future professionals and contribute to Nation's economy.

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

JEPPIAAR ENGINEERING COLLEGE
DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department

To create excellent professionals in the field of Mechanical Engineering and to uplift the quality of technical education on par with the International Standards.

Department Mission

1. **To reinforce** the fundamentals of Science and Mathematics to **Mechanical Engineering and critically and relatively investigate** complex **mechanical systems and processes**.
2. To engage in the **production, expansion and practice** of **advanced engineering applications** through knowledge sharing activities by interacting with global communities and industries.
3. To **equip** students with **engineering ethics, professional roles, corporate social responsibility** and life skills and **apply** them for the betterment of society.
4. **To promote** higher studies and lifelong learning and entrepreneurial skills and **develop** excellent professionals for empowering nation's economy.

PEO's

1. To **enrich** the technical knowledge of **design, manufacturing and management of mechanical systems** and **develop creative and analytical thinking** in research.
2. To **relate, strengthen and develop** the **theoretical knowledge of the Mechanical Engineering** by exhibiting various concepts applied through diverse industrial exposures and experts' guidance.
3. **Facilitate** the students to communicate effectively on complex social, professional and engineering activities with strict adherence to ethical principles.
4. **Create awareness for independent and life long learning and develop the ability to keep abreast of modern trends and adopt them for personal technological growth of the nation.**

PSO's

1. To understand the basic concept of various mechanical engineering field such as design, manufacturing, thermal and industrial engineering.
2. To apply the knowledge in advanced mechanical system and processes by using design and analysis techniques.
3. To develop student's professional skills to meet the industry requirements and entrepreneurial skills for improving nation's economy stronger.

ME 6701- POWER PLANT ENGINEERING

COURSE OUTCOMES

C401.1	Students will be able to interpret the layout of various power plants and Boiler's operation
C401.2	Students will be able to explain about the components of Steam power plant and its operations.
C401.3	Students will be able to explain about the components and operations of Nuclear and Hydel power plants
C401.4	Students will be able to illustrate the components and operation cycles of diesel and Gas turbine power plant.
C401.5	Students will be able to classify the components, operations, and applications of various power plants and Economics of plants.

SYLLABUS

OBJECTIVES:

Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 10

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 10

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 7

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR)*, *Pressurized Water Reactor (PWR)*, *CANada Deuterium-Uranium reactor (CANDU)*, Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 10

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT VENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS **8**

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the Students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.

Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.

REFERENCES:

1. M.M. El-Wakil, Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, Power Plant Engineering, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.



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Jeppiaar Nagar, Rajiv Gandhi Salai – 600 119

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

Subject : ME6701-POWER PLANT ENGINEERING

Year / Sem : IV/VII

UNIT ICOAL BASED THERMAL POWER PLANTS

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

PART-A

CO Mapping : C701.1

Q.No.	Questions	BT Level	Competence	PO
1	What do you understand by the term boiler draught?	BTL-1	Remembering	PO7,PO2
2	Define steam rate and heat rate?	BTL-1	Remembering	PO7,PO2
3	What are the different sources of energy available for power generation? How long they can last?	BTL-1	Remembering	PO7,PO2
4	Why thermal plants are not suitable for supplying fluctuating loads?	BTL-1	Remembering	PO7,PO6
5	List the four important circuits of the steam power plant.	BTL-1	Remembering	PO1,PO7
6	Comment on the thermal efficiency of a steam power plant.	BTL-1	Remembering	PO7,PO10
7	Define the overall efficiency of a steam power plant.	BTL-1	Remembering	PO1,PO7
8	Define air standard cycle efficiency.	BTL-1	Remembering	PO2,PO7
9	State how the steam boilers are classified.	BTL-1	Remembering	PO7,PO8
10	Define boiler mountings and accessories.	BTL-1	Remembering	PO9,PO1
11	Why are super heaters used in steam power plants?	BTL-1	Remembering	PO9,PO4
12	What is the necessity of feed pump in thermal power plant?	BTL-1	Remembering	PO1,PO7
13	Mention the two types of feed water heaters in a steam power plant.	BTL-4	Analysing	PO7
14	What is the function of deaerator in a thermal power plant?	BTL-1	Remembering	PO1

15	Write the use of water level indicator in boiler.	BTL-1	Remembering	PO1
16	What are the accessories used in a boiler?	BTL-1	Remembering	PO1
17	List out the major advantages of high pressure boilers in modern thermal power plants.	BTL-1	Remembering	PO1,PO7
18	Distinguish between fouling and slagging.	BTL-4	Analysing	PO2
19	Define super critical boilers.	BTL-1	Remembering	PO1
20	What is super-critical boiler? Give any two advantages.	BTL-1	Remembering	PO1
21	What are types of fluidized bed boilers?	BTL-1	Remembering	PO1
22	What is meant by compounding of steam turbines?	BTL-1	Remembering	PO1
23	Explain the need of compounding in steam turbines.	BTL-2	Understanding	PO2,PO9
24	What is the function of governors in steam turbine?	BTL-1	Remembering	PO4
25	What are the different methods of governing steam turbines?	BTL-1	Remembering	PO4
26	Enumerate the energy losses in steam turbines.	BTL-1	Remembering	PO2
27	What is the purpose of condenser?	BTL-1	Remembering	PO1
28	Explain any two types of surface condensers.	BTL-2	Understanding	PO1
29	What is a pulverized and why it is used?	BTL-1	Remembering	PO12
30	What is ESP? State its use	BTL-2 BTL-1	Understanding Remembering	PO12
31	Mention the various modern ash handling systems.	BTL-4	Analysing	PO11, PO12
32	What is stoker? Classify it.	BTL-1	Remembering	PO11, PO12

PART-B&PART-C

1	Draw a general layout of steam power plant with neat diagram and explain the working of different circuits.	BTL-1	Remembering	PO1,PO6,PO12
2	Explain the following with neat diagram:(i) Benson boiler (ii) Anyone type of cogeneration power plant.	BTL-1	Remembering	PO1,PO8
3	Draw a general layout of thermal power plant and explain the working of different circuits.	BTL-2	Understanding	PO1,PO6,PO12
4	Describe the working of a high pressure boiler with super heaters.	BTL-2	Understanding	PO1,PO6,PO10
5	Draw a neat diagram of Lamont boiler and explain its working.	BTL-2	Understanding	PO1,PO7, PO12
6	What do you understand by fluidized bed combustion?	BTL-1	Remembering	PO1,PO7, PO12
7	Write short notes on the requirements of surface condensers	BTL-1	Remembering	PO2,PO4, PO11
8	Explain in detail the coal handling system with a suitable block diagram.	BTL-2	Understanding	PO1,PO7, PO12
9	Describe the different types of over feed stokers and discuss its merits and demerits of each over others	BTL-2	Understanding	PO1,PO2, PO9,PO11
10	Why is coal pulverized? Explain any one type of pulverized systems used now-a-days	BTL-2	Understanding	PO1,PO6,PO8

11	With the help of a neat sketch describe the working of any one type of ash handling system	BTL-2	Understanding	PO1,PO7,PO9, PO12
12	Differentiate between forced draught and induced draught cooling tower.	BTL-4	Analysing	PO1,PO2,PO7, PO12

UNIT IIDIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

PART-A

CO Mapping : C701.2

Q.No.	Questions	BT Level	Competence	PO
1	What is reheating and regeneration of gas turbine?	BTL-1	Remembering	PO1,PO7
2	Name the various gas power cycles	BTL-1	Remembering	PO2
3	What is a thermodynamic cycle?	BTL-1	Remembering	PO2
4	Why is Carnot cycle not used in real applications?	BTL-1	Remembering	PO1
5	What is and air-standard cycle? Why such cycles are conceived?	BTL-1	Remembering	PO2
6	Mention the four thermodynamic processes involved in Diesel cycle	BTL-1	Remembering	PO4
7	Mention the various processes of dual cycle.	BTL-1	Remembering	PO2
8	List down the various processes of the Brayton cycle	BTL-1	Remembering	PO2
9	Define Air standard efficiency or Diesel cycle.	BTL-1	Remembering	PO2
10	How does the change in compression ratio affect air standard efficiency of an ideal Otto cycle?	BTL-1	Remembering	PO4
11	Define cut-off ratio	BTL-1	Remembering	PO1
12	Which cycle is more efficient with respect to the same compression ratio?	BTL-1	Remembering	PO2PO8
13	Name the factors that affect air standard efficiency of Diesel cycle.	BTL-1	Remembering	PO1,PO4
14	What is the effect of cut-off ratio on the efficiency of Diesel cycle when the compression ratio is kept constant?	BTL-1	Remembering	PO1,PO4
15	Define the terms actual thermal efficiency and relative efficiency.	BTL-1	Remembering	PO1
16	What is meant by Atkinson cycle?	BTL-1	Remembering	PO1
17	Mention a few characteristics of Diesel power plant.	BTL-1	Remembering	PO7
18	Under what circumstance will you recommend Diesel power plants?	BTL-1	Remembering	PO2,PO12

19	What are the components present in the Diesel electric power plants	BTL-1	Remembering	PO1
20	Name the various types of Diesel engine used for Diesel power plant.	BTL-1	Remembering	PO2
21	What are the different types of engines used in power generation? State their application domain.	BTL-1	Remembering	PO6,PO8,PO10
22	How is solid injection system classified?	BTL-1	Remembering	PO7
23	What are the different types of lubrication system in a Diesel power plant?	BTL-1	Remembering	PO2,PO11,PO12
24	What are the equipment's of Diesel engine power plant?	BTL-1	Remembering	PO1
25	What are the methods used for starting a Diesel engine?	BTL-1	Remembering	PO2,PO9,PO12
26	What is the basic difference between a Diesel engine and a steam turbine?	BTL-1	Remembering	PO6,PO11
27	Why is the maximum cycle temperature of gas turbine plant much lower than that of Diesel power plant?	BTL-1	Remembering	PO2,PO4,PO12
28	State the fuels used in the gas turbine power plants.	BTL-1	Remembering	PO1
29	What are the main units in a gas turbine power plant?	BTL-1	Remembering	PO1
30	What are the methods by which thermal efficiency of a gas turbine power plant be improved?	BTL-1	Remembering	PO4
31	What do you mean by regeneration in gas turbine power plant?	BTL-1	Remembering	PO1
32	How does regeneration improve the thermal efficiency of gas turbine cycle	BTL-1	Remembering	PO2

PART-B&PART-C

1	Discuss the essential components of the diesel power plant with neat layout.	BTL-2	Understanding	PO2,PO4,PO7 PO11,PO12
2	(i) Derive an expression for the work ratio using Brayton cycle. (ii) Discuss the working of any one type of combined cycle power plant.	BTL-6 BTL-2	Creating Understanding	PO2,PO6, PO11,PO8
3	Derive an expression for air the air standard efficiency of diesel cycle. Explain why the efficiency of Otto cycle is more than diesel cycle for the same compression ratio	BTL-6 BTL-2	Creating Understanding	PO4,PO8,PO9, PO11
4	How do you select engine for a diesel power plant? Draw a diesel power plant and explain its major components	BTL-2	Understanding	PO2,PO7, PO12
5	Explain the construction and working of gas turbine power plant with a layout	BTL-2	Understanding	PO1,PO7, PO12
6	Discuss the working of combined cycle power plant.	BTL-2	Understanding	PO9,PO10,PO11

7	With neat diagram, explain the working principle of the combined MHD and steam open cycle power plant.	BTL-2	Understanding	PO1PO7, PO12
8	Discuss the working of combined cycle: power plant.	BTL-2	Understanding	PO2,PO10,PO11,P O12

UNIT IINUCLEAR POWER PLANTS

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR)*, *Pressurized Water Reactor (PWR)*, CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

PART-A

CO Mapping : C701.3

Q.No.	Questions	BT Level	Competence	PO
1	What is critical mass of nuclear fuel?	BTL-1	Remembering	PO1
2	What are isotopes?	BTL-1	Remembering	PO1
3	Name the different types of fuels used in nuclear reactors.	BTL-1	Remembering	PO2,PO7
4	What is known as binding energy?	BTL-1	Remembering	PO1,PO7
5	What is “half life” of nuclear fuels?	BTL-1	Remembering	PO1,PO4
6	What do you mean by mass defect?	BTL-1	Remembering	PO4
7	How can nuclear fussion be caused?	BTL-1	Remembering	PO4
8	What do you understand by moderation?	BTL-1	Remembering	PO2,PO7
9	What is known as moderating ratio?	BTL-1	Remembering	PO1
10	What is four factor formula?	BTL-1	Remembering	PO2
11	Explain the function of nuclear reactor.	BTL-2	Understanding	PO11
12	What are the essential components of a nuclear reactor?	BTL-1	Remembering	PO2
13	Explain the function of the moderator	BTL-2	Understanding	PO2,PO11
14	Name the three moderators commonly used in nuclear power reactor.	BTL-1	Remembering	PO1,PO2
15	Why is shielding of a Nuclear reactor necessary?	BTL-1	Remembering	PO2,PO6
16	Define the term “Breeding”.	BTL-1	Remembering	PO1
17	What is a gas cooled nuclear reactor?	BTL-1	Remembering	PO1
18	What is LMFBR? Why is a liquid metal the preferred coolant in a fast breeder reactor?	BTL-1	Remembering	PO1,PO10,PO12
19	What are the components of pressurized water reactor nuclear power plant?	BTL-1	Remembering	PO1,PO7
20	What are the criteria used for evaluation of nuclear plant safety?	BTL-1	Remembering	PO7,PO11,PO12

21	List some of the disadvantages of Nuclear power plant	BTL-1	Remembering	PO6,PO8,
22	How do you cater for safety of Nuclear power plant?	BTL-1	Remembering	PO6,PO10
23	What are the advantages and disadvantages of breeder reactor?	BTL-1	Remembering	PO11,PO12
24	What factors control the selection of a particular type of a reactor?	BTL-1	Remembering	PO2
25	What are the essential components of a nuclear reactor?	BTL-1	Remembering	PO1
26	What are the conditions to be satisfied to sustain nuclear fission process? OR Give the requirements of chain reaction.	BTL-1	Remembering	PO2
27	How are the nuclear reactors classified?	BTL-1	Remembering	PO8,PO9,PO12
28	Distinguish between PHWR and LMFBR	BTL-4	Analysing	PO9,PO10,PO12
29	State the major reasons for nuclear accidents that classified under moderate frequency.	BTL-1	Remembering	PO6,PO4,PO12
30	State the major reasons for nuclear accidents that classified under severe accidents.	BTL-1	Remembering	PO6,PO4,PO12
31	What are the major reasons for nuclear accidents that classified under lower probability?	BTL-1	Remembering	PO6,PO4,PO12

PART-B & PART-C

Q.No.	Questions	BT Level	Competence	PO
1	(i) Explain CANDU (Canadian-Deuterium-Uranium) reactor with neat diagram also mention its merits and demerits. (ii) Discuss about the safety measures adopted in modern nuclear plants.	BTL-2	Understanding	PO2,PO6,PO4, PO10,PO12
2	What is meant by uranium enriched? Describe some methods of Uranium enrichment	BTL-1	Remembering	PO1,PO4,PO9,PO11
3	Explain the Construction and working of nuclear power plant with a layout.	BTL-2	Understanding	PO1,PO9,PO12
4	Explain the different types of nuclear reactions and initiation of nuclear reactions	BTL-2	Understanding	PO1,PO7,PO12
5	Explain with a neat sketch a boiling water reactor.	BTL-2	Understanding	PO1,PO7,PO10
6	Explain the working of pressurized water reactor	BTL-2	Understanding	PO1,PO7,PO10
7	What is chain reaction? How it is maintained? What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples'	BTL-2 BTL-4	Understanding Analysing	PO1,PO7,PO10
8	Discuss the various factors to be considered while	BTL-2	Understanding	

selecting the site for nuclear power station.			
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UNIT IV POWER FROM RENEWABLE ENERGY

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

PART-A

CO Mapping : C701.4

Q.No.	Questions	BT Level	Competence	PO
1	Define the term “Hydrology”.	BTL-1	Remembering	PO1
2	What is hydrograph?	BTL-1	Remembering	PO1
3	For which purposes hydro projects are developed?	BTL-1	Remembering	PO2,PO7
4	What is the purpose of using dams?	BTL-1	Remembering	PO6,PO7
5	Define Run-off.	BTL-1	Remembering	PO1
6	Classify power plants on the basis of traditional use.	BTL-2	Understanding	PO2,PO11
7	List out the important parameters of a turbine.	BTL-1	Remembering	PO1
8	Give an example for a low head turbine, a medium head turbine and a high head turbine.	BTL-1	Remembering	PO2
9	What are reaction turbines? Give examples.	BTL-1	Remembering	PO2
10	What is a draft turbine?	BTL-1	Remembering	PO1
11	What is the function of draft tube?	BTL-1	Remembering	PO1
12	What are the different types of spill ways?	BTL-1	Remembering	PO1,PO7, PO10
13	Define unit speed of turbine.	BTL-1	Remembering	PO1
14	What is the significance of specific speed of hydraulic turbines?	BTL-1	Remembering	PO1
15	What is a surge tank?	BTL-1	Remembering	PO1
16	What is draft tube? In which type of turbine it is mostly used?	BTL-1	Remembering	PO1, PO7
17	What is the necessity of draft tubes? List the types	BTL-1	Remembering	PO9, PO10
18	Write the function of draft tube in turbine outlet.	BTL-1	Remembering	PO2
19	What are the factors to be considered in selecting turbines?	BTL-1	Remembering	PO1,PO7
20	On what basis hydraulic turbines are selected?	BTL-1	Remembering	PO2,PO6,PO8
21	What do you understand by zero energy houses?	BTL-1	Remembering	PO6,PO7,PO11
22	List any four advantages of wind turbine.	BTL-1	Remembering	PO7,PO12
23	What are the advantages of pumped storage plant?	BTL-1	Remembering	PO8,PO12

24	What is the purpose of flywheel which is used in an IC engine?	BTL-1	Remembering	PO6,PO7,PO9 PO10
25	What is the function of flywheel?	BTL-1	Remembering	PO1,PO7, PO12
26	What are the components of tidal power plants?	BTL-1	Remembering	PO1,PO7
27	What are the different methods of producing electricity with tides?	BTL-1	Remembering	PO1,PO4,PO10,PO12
28	What is a solar cell?	BTL-1	Remembering	PO1
29	What are the classifications of geothermal energy?	BTL-1	Remembering	PO2,PO6,PO7
30	What are the types of geothermal power plants?	BTL-1	Remembering	PO2,PO6,PO7
31	What is bio gas? Give the advantages.	BTL-1	Remembering	PO1,PO7,PO12
32	List the difference between Francis and Kaplan turbine	BTL-1	Remembering	PO2,PO8

PART-B& PART-C

1	What are the essential elements of hydro power plant? Explain with a neat sketch.	BTL-2	Understanding	PO1,PO6,PO7,PO12
2	Explain the working of Pelton turbine with a neat diagram. What is the function of a draft tube?	BTL-2	Understanding	PO1,PO6,PO7,PO12
3	Describe the working of a low head hydro plant with a neat diagram	BTL-2	Understanding	PO1,PO6,PO7,PO12
4	Compare and contrast Kaplan turbine and Francis turbine.	BTL-4	Analyzing	PO1,PO2,PO7, PO10
5	Discuss various components of wind energy system	BTL-2	Understanding	PO1,PO9, PO10,PO12
6	Explain with a neat sketch a pumped storage power plant.	BTL-2	Understanding	PO1,PO7,PO12
7	Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
8	Draw a schematic diagram of a solar power plant and explain the operation of it. Also mention its merits and demerits.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
9	Explain the construction and working of geothermal power plant and tidal power plants.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
10	Define the terms anaerobic digestion, Fermentation and What are the advantages and disadvantages of floating drum plant Give the list of the materials used for biogas generation.	BTL-1	Remembering	PO1,PO7,PO8,PO10, PO12
11	Describe the principle of a fuel cell and discuss the choice of fuels required	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12
12	(i) Explain the construction and working of fuel cell also mention its merits and demerits. (ii) List the advantages and disadvantages of wind	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12

	energy system.			
13	Explain with a neat sketch working of a distributed (Parabolic) trough Solar Power Plant.	BTL-2	Understanding	PO1,PO7,PO8,PO10, PO12

UNIT VENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

PART-A

CO Mapping : C701.5

Q.No.	Questions	BT Level	Competence	PO
1	What is main objective of tariff?	BTL-1	Remembering	PO1
2	Define law of conservation of Energy.	BTL-1	Remembering	PO1
3	What is the significance of incremental rate for a power plant	BTL-1	Remembering	PO2,PO6
4	What are the various operating costs of fired steam power plant?	BTL-1	Remembering	PO6,PO10,PO11
5	Define demand for electricity	BTL-1	Remembering	PO6,PO7,PO12
6	Define "Diversity factor".	BTL-1	Remembering	PO1
7	Define plant use factor	BTL-1	Remembering	PO1
8	What are the major factors that Decide the economics of power plants?	BTL-1	Remembering	PO1,PO6,PO7,PO11
9	What do you understand by load duration curves?	BTL-1	Remembering	PO2
10	State the importance of load curves.	BTL-1	Remembering	PO1
11	What is the significance of load curve?	BTL-1	Remembering	PO1
12	What is the use of load curves in power plant?	BTL-1	Remembering	PO1,PO8
13	How does the fuel cost related to the load and the cost of power generation?	BTL-1	Remembering	PO6,PO11
14	What are fixed?	BTL-1	Remembering	PO1
15	Define flat rate tariff.	BTL-1	Remembering	PO1
16	List the types of tariffs to calculate energy rate.	BTL-1	Remembering	PO1
17	How the tariff for electrical energy is arrived?	BTL-1	Remembering	PO2,PO10
18	Define depreciation.	BTL-1	Remembering	PO1
19	Mention any four methods for calculating depreciation.	BTL-1	Remembering	PO7,PO11,PO12
20	What is the reason for the operating cost of hydel power plant being high?	BTL-1	Remembering	PO2,PO8,PO9,PO10
21	How can be the cost of power generation reduced?	BTL-1	Remembering	PO9,PO11,PO12
22	What are the factors that contribute for energy cost?	BTL-1	Remembering	PO1,PO8,PO11
23	List out four important factors to be considered for the selection of site for power plants.	BTL-1	Remembering	PO4,PO11,PO12
24	What are the different pollutions in the flue gas?	BTL-1	Remembering	PO7
25	What are the methods used for reduction of SO ₂ pollutant?	BTL-1	Remembering	PO1,PO7
26	What are the methods used for controlling the NO _x ?	BTL-1	Remembering	PO2,PO8,PO12

27	What is Acid rain?	BTL-1	Remembering	PO7
28	What is the equipment used to control the particulates?	BTL-1	Remembering	PO1,PO6,PO12
29	List down the nuclear waste disposal methods.	BTL-1	Remembering	PO1,PO6,PO7,PO12
30	What are the various methods followed to transport solid waste?	BTL-1	Remembering	PO1,PO6,PO7,PO12
31	What are operating costs?	BTL-1	Remembering	PO1,PO9,PO11
32	What are the costs involved in fired steam power plant?	BTL-1	Remembering	PO1,PO11
PART-B& PART-C				
1	Explain the methods to control pollution in thermal and nuclear power plants	BTL-2	Understanding	PO7,PO8
2	Write an explanatory note on the economics of power generation	BTL-2	Understanding	PO8,PO10,PO11
3	What is meant by load factor and diversity factor?	BTL-1	Remembering	PO1,PO2
4	Elucidate the objectives and requirements to tariff and general form of tariff.	BTL-2	Understanding	PO4,PO9,PO11
5	What are the elements which contribute to the cost of, the electricity? And how can the cost power generation be reduced?	BTL-1	Remembering	PO6,PO8,PO9,PO11
6	Explain briefly the various methods used to, calculate the depreciation cost.	BTL-2	Understanding	PO1,PO8,PO10,PO11
7	What are the fixed and operating costs of steam power plant?How are they accounted for fixing cost of electricity?	BTL-1	Remembering	PO1,PO8,PO10,PO11
8	Explain the analysis of pollution from thermal power plants.What is methods used for control the pollutants?	BTL-2	Understanding	PO1,PO7,PO10,PO12
9	Write short notes on nuclear waste disposal.	BTL-1	Remembering	PO1,PO7,PO8,PO10, PO12
10	(i) Explain the site selection criterion of hydro power plant. (ii)A peak load on the thermal power plant is 75 MW. The loads having maximum demands of 35 kW, 20 MW, 15 MW and 18 MW are connected to the power plant. The capacity of the plant is 90 MW and annual load factor is 0.53. Calculate the average load on power plant, energy supplied per year, demand factor and diversity factor.	BTL-2	Understanding	PO1,PO2,PO4, PO7,PO12

UNIT ICOAL BASED THERMAL POWER PLANTS

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

PART-A

1. What do you understand by the term boiler draught? (AU Nov/Dec 2016)

Boiler draught may be defined as the small difference between the pressure of outside air and that of gases within a furnace or chimney at the grate level, which causes flow of air/hot flue

gases to take place through boiler.

2. Define steam rate and heat rate? (AU Nov/Dec 2016)

Heat rate is the common measure of system efficiency in a steam power plant. It is defined as "the energy input to a system, typically in Btu/kWh, divided by the electricity generated, in kW." Mathematically:

$$\text{Heat Rate (BTU/kWh)} = \frac{\text{Input Energy (BTU/hr)}}{\text{Output Power (kW)}}$$

Steam rate: It is defined as the rate of steam flow (kg/hr) required for producing unit shaft output (1 kW)

3. What are the different sources of energy available for power generation? How long they can last? (AU May 2014)

1. Steam
2. Gas or air
3. Diesel and petrol
4. Nuclear
5. Renewable energy sources such as solar, wind, geothermal, tidal, wave, MHD etc

4. Why thermal plants are not suitable for supplying fluctuating loads?

(AU (EEE) May 2014)

Thermal plants are not suitable for supplying fluctuating loads because any change in load demand requires the corresponding change in the output energy. In thermal power plants, the input energy is produced by burning the coal. So, there is always a large time lapse between the change in energy output and input which is not desirable. Therefore, such power stations are used only as base load stations and it supplies the constant power.

5. List the four important circuits of the steam power plant.

(AU (MECH) DEC 2014 & (EEE) DEC 2013)

- a. Feed water and steam flow circuit
- b. Coal and ash circuit
- c. Air and gas circuit
- d. Cooling water circuit

6. Comment on the thermal efficiency of a steam power plant. (AU.(EEE)DEC'12)

Thermal efficiency is a dimensionless performance which is a measure of a device using thermal energy such as internal combustion engine, steam turbine or steam engine, boiler and furnace or refrigerator.

7. Define the overall efficiency of a steam power plant. (AU.(EEE) DEC'10)

Overall efficiency is defined as the combined efficiency of boiler, steam turbine, condenser and pump

8. Define air standard cycle efficiency. (AU.(MECH)DEC'13)

It is the ratio of work done during the process to the heat supplied.

Air Standard efficiency = Work done/Heat supplied.

Where Work done = Heat supplied - Heat rejected.

9. State how the steam boilers are classified. (AU.(MECH)DEC'14)

Steam boilers are classified on the basis of boiler pressure, fuel, boiler material, boiler tube type, circulation, method of combustion, type of support, furnace construction, furnace position, use, erection, mobility, ASME code and heat source.

10. Define boiler mountings and accessories. (AU.(EEE)May'11)

The devices which are used for functioning with the safe operation of a boiler are called boiler mountings. The devices which are used to increase the efficiency of the boiler are called boiler accessories.

11. Why are super heaters used in steam power plants? (AU.(EEE) DEC'12)

The steam produced in the boiler is in the state of saturated condition. The moisture in the steam will

<p>affect turbine blades and cause corrosion. To avoid it, the super heater is used. It is used to increase the temperature of steam and improve the efficiency.</p>
<p>12. What is the necessity of feed pump in thermal power plant?(AU.(EEE)DEC'11) Feed pump is a pump which is used to deliver the feed water to the boiler. The quantity of water supplied should be at least equal to the amount of evaporation which is supplied to the engine.</p>
<p>13. Mention the two types of feed water heaters in a steam power plant. (AU (EEE)DEC'10)</p> <p>(i) Open feed water heater. (ii) Closed feed water heater.</p>
<p>14. What is the function of deaerator in a thermal power plant?(AU.(EEE)May'12) A deaerator is a device widely used for the removal of air and other dissolved gases from the feed.</p>
<p>15. Write the use of water level indicator in boiler. (AU.(EEE)DEC'13) The water level indicator constantly determines the level of water in the boiler shell.</p>
<p>16. What are the accessories used in a boiler?(AU.(MECH)May'13)</p> <p>(i) Feed water pump (ii) Injector (iii) Pressure reducing valve (iv) Economiser (v) Air pre heater (vi) Super heater (vii) Steam drier or separator (viii) Steam trap.</p>
<p>17. List out the major advantages of high pressure boilers in modern thermal power plants. (AU.(MECH)DEC '12 & DEC'13)</p> <ul style="list-style-type: none"> • The tendency of scale formation is eliminated due to high velocity of water through tubes. • Light weight tubes with better heating surface arrangement can be used. The space required is less. The cost foundation, time of erection and total cost are minimised due to less weight of tubes. • Due to use of forced circulation, there is more freedom in the arrangement of surface, tubes and boiler components. • All parts are uniformly heated. So, the danger of overheating is reduced and thermal stress problem is eliminated.
<p>18. Distinguish between fouling and slagging. (AU.(MECH) May'09) Slagging is the formation of molten or partially fused deposits on furnace walls or convection surfaces exposed to radiant heat. Fouling is defined as the formation of deposit on convection heat surfaces such as super heater and reheater.</p>
<p>19. Define super critical boilers. (AU.(MECH) Nov'07) Boilers only with economizer and super heater are called super critical boilers.</p>
<p>20. What is super-critical boiler? Give any two advantages.(AU.(EEE) June'13) If boilers incorporate only economizer and super heater, they are called supercritical boilers. The super critical boilers are above 300MW capacity units available.</p>
<p>21. What are types of fluidized bed boilers? (AU.(MECH)DEC'13)</p> <p>1. Bubbling fluidized bed boilers(BFB). 2. Circulating fluidized bed boilers (CFB).</p>
<p>22. What is meant by compounding of steam turbines? (AU.Nov'10) Compounding is a method of absorbing the jet velocity in stages when the steam flows over moving blades.</p>
<p>23. Explain the need of compounding in steam turbines. (AU (MECH)Apr'03 & Apr'08)</p>

In the simple impulse turbine, the expansion of steam from the boiler pressure to condenser pressure takes place in a single stage turbine. The velocity of steam at the exit of turbine is very high. So, there is a considerable loss of kinetic energy. Also, the speed of the rotor is very high. There are several methods of reducing this speed to a lower value. Compounding is a method of absorbing the jet velocity in stages when the steam flows over moving blades.

24. What is the function of governors in steam turbine?(AU.(MECH)DEC'08)

The governors regulate the supply of steam to the turbine to maintain constant speed of the turbine as far as possible under varying load conditions.

25. What are the different methods of governing steam turbines?

(AU(MECH)Nov'04 & May'13)

- Throttle governing
- Nozzle control governing
- By pass governing
- Combination of throttle and nozzle governing or throttle and by pass governing.

26. Enumerate the energy losses in steam turbines.

(AU(MECH)June'09,May'11 & May'12)

- Losses in regulating valves
- Losses due to steam friction
- Losses due to Mechanical friction
- Losses due to leakage
- Residual velocity losses
- Carry over losses
- Losses due to wetness of steam
- Losses due to radiation.

27. What is the purpose of condenser?

(AU.(EEE)DEC'10)

The main purpose of a steam condenser in turbine is to maintain a low back pressure on the exhaust side of the steam turbine.

28. Explain any two types of surface condensers.

(AU.(MECH)May'14)

- (i) Down flow type
- (ii) Central flow condenser
- (iii)Evaporation condenser

29. What is a pulverized and why it is used? (AU.(MECH)May '14 &(EEE) DEC'14)

A pulverize or grinder is a Mechanical device for grinding many different types of materials.Pulverize mill is used to pulverize the coal for combustion in the steam generating furnaces of fossil fuel power plants.

30. What is ESP? State its use.(Anna .Univ.(MECH)DEC'14)

An electrostatic precipitator (ESP) is a filtration device which is used to remove fine particles such as dust and smoke from a flowing gas using the force of an induced electrostatic charge minimally impeding the flow of gases through the unit.

31. Mention the various modern ash handling systems.(AU (EEE)May'10)

- i. Gravitational separator
- ii. Cyclone separator
- iii. Packed type scrubber
- iv. Spray type wet collector
- v. Electrostatic precipitator(ESP)

32. What is stoker?Classify it.

(AU.(MECH)May'11)

Stoker is a feeding device which feeds solid fuels into the furnace in medium and large size power plants.

Types: (i) Overfeed stoker, and (ii) Underfeed stoker
PART-B
1. Draw a general layout of steam power plant with neat diagram and explain the working of different circuits. [AU Nov/Dec 2016] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
2. Explain the following with neat diagram:(i) Benson boiler (ii) Anyone type of cogeneration power plant. [AU Nov/Dec 2016] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
3. Draw a general layout of thermal power plant and explain the working of different circuits. [AU APR 2005/MAY 2011/2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
4. Describe the working of a high pressure boiler with super heaters. [AU MAY 2011] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
5. Draw a neat diagram of Lamont boiler and explain its working. [AU DEC 2005/JULY2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
6. What do you understand by fluidized bed combustion? [AU MAY 2012] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
7. Write short notes on the requirements of surface condensers .[AU MAY 2009] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
8. Explain in detail the coal handling system with a suitable block diagram. [AU MAY 2011] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
9. Describe the different types of over feed stokers and discuss its merits and demerits of each over others. [AU APR 2008] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
10. Why is coal pulverized? Explain any one type of pulverized systems used now-a-days. [AU MAY 2012] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
11. With the help of a neat sketch describe the working of any one type of ash handling system. <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
12. Differentiate between forced draught and induced draught cooling tower. [AU MAY 2009/DEC 2012] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>

UNIT IIDIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS
Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.
PART-A
1. What is reheating and regeneration of gas turbine? [AU Nov/Dec 2016] Reheating is applied in a gas turbine in such a way that it increases the turbine work without increasing

the compressor work or melting the turbine materials. When a gas turbine plant has a high pressure and low pressure turbine a reheater can be applied successfully. Reheating can improve the efficiency up to 3 %. A reheater is generally is a combustor which reheat the flow between the high and low pressure turbines.

Regeneration process involves the installation of a heat exchanger in the gas turbine cycle. The heat-exchanger is also known as the recuperator. This heat exchanger is used to extract the heat from the exhaust gas. This exhaust gas is used to heat the compressed air. This compressed and pre-heated air then enters the combustors. Regenerated Gas turbines can improve the efficiency more than 5 %.

2. Name the various gas power cycles. [AU Nov/Dec 2016]

Otto Cycle, Diesel Cycle, Dual Cycle & Brayton Cycle.

3. What is a thermodynamic cycle?

(AU.Oct'97)

Thermodynamic cycle is defined as the series of processes performed on the system so that the system attains its original state.

4. Why is Carnot cycle not used in real applications?

(AU.DEC'10)

- i. In a Carnot cycle, all four processes are reversible but there is no process reversible in actual practice.
- ii. There are two processes to be carried out during compression and expansion. During isothermal process, the piston moves very slowly and the piston moves as fast as possible during adiabatic process. This speed variation during the same stroke of the piston is not possible.
- iii. It is not possible to avoid friction between moving parts completely.

5. What is and air-standard cycle? Why such cycles are conceived?

(AU.Oct'96, Oct'97, Nov'10, May'11, DEC'12 & May'14)

Cycle is defined as the series of operations or processes performed on a system so that the system attains its original state. The thermodynamic cycles which use air as the working fluid are known as air standard cycles. Air standard cycles are conceived to simplify the analysis of IC engines.

6. Mention the four thermodynamic processes involved in Diesel cycle. (AU.Apr'08)

- i. One reversible adiabatic compression
- ii. One constant pressure processes
- iii. One reversible adiabatic expansion and
- iv. One constant volume.

7. Mention the various processes of dual cycle.

(AnnaUniv.Apr'96)

1. Isentropic compression
2. Constant volume heat addition
3. Constant pressure heat addition
4. Isentropic expansion and
5. Constant volume heat rejection.

8. List down the various processes of the Brayton cycle.

(AU.Oct'96)

1. Isentropic compression
2. Constant pressure heat supplied
3. Isentropic expansion and
4. Constant pressure heat rejection.

9. Define Air standard efficiency or Diesel cycle.

(AU.DEC'08)

Air standard efficiency is defined as the ratio of work done by the cycle to the heat supplied to the cycle

10. How does the change in compression ratio affect air standard efficiency of an ideal Otto cycle?

(AU.Apr.'08)

The efficiency of otto cycle increases with increase in compression ratio and vice versa.

11. Define cut-off ratio.

(AU.May'14)

Cut off ratio is defined as the ratio of volume after heat addition to the volume before heat addition.

<p>12. Which cycle is more efficient with respect to the same compression ratio? (AU.Oct'95) For the same compression ratio, Otto cycle is more efficient than Diesel cycle.</p>
<p>13. Name the factors that affect air standard efficiency of Diesel cycle. (AU.Apr'97) Compression ratio and Cut-off ratio.</p>
<p>14. What is the effect of cut-off ratio on the efficiency of Diesel cycle when the compression ratio is kept constant? (AU.Apr'03) When the cut-off ratio of Diesel cycle increases, the efficiency of cycle is decreased when the compression ratio is kept constant and vice versa.</p>
<p>15. Define the terms actual thermal efficiency and relative efficiency. (AU.DEC'12) Actual efficiency is defined as the ratio of work output by the cycle to the heat input to the cycle. Relative efficiency is defined as the ratio between actual efficiency and air standard efficiency.</p>
<p>16. What is meant by Atkinson cycle? (AU.(MECH)DEC'12) The cycle with two adiabatic processes for both compression and expansion, one constant volume process for heat addition and one constant pressure process for heat rejection is called Atkinson cycle.</p>
<p>17. Mention a few characteristics of Diesel power plant. (AU.(MECH) DEC'12)</p> <ol style="list-style-type: none"> Diesel power plants are mainly used where high torque is required. Fuel and fluid characteristics mean that Diesel power plant could be operated with variety of different fuels depending on configuration. Hybrid possibilities are to combine with other power producing devices.
<p>18. Under what circumstance will you recommend Diesel power plants? (AU.(MECH)DEC'14) Diesel power plants are mainly recommended where the fuel prices or reliability of supply favor oil over coal where the water supply is limited and relatively small loads.</p>
<p>19. What are the components present in the Diesel electric power plants? (AU.(MECH)Apr'08)</p> <ol style="list-style-type: none"> Engine Air intake system Engine starting system Fuel system Exhaust system Cooling system Lubricating system
<p>20. Name the various types of Diesel engine used for Diesel power plant. (AU.(MECH) May'13)</p> <ol style="list-style-type: none"> Small size Diesel engine. Medium size Diesel engine Large size Diesel engine.
<p>21. What are the different types of engines used in power generation? State their application domain. (Anna .Univ.(MECH)May'11)</p> <ol style="list-style-type: none"> Diesel engines Dual engines
<p>22. How is solid injection system classified? (AU.(EEE)June'13)</p> <ol style="list-style-type: none"> Individual pump and nozzle system Unit injector system Common rail system Distributor system.
<p>23. What are the different types of lubrication system in a Diesel power plant? (AU.(MECH)May'14)</p> <ol style="list-style-type: none"> Wet sump lubrication Dry sump lubrication Mist lubrication system

<p>24. What are equipment's of Diesel engine power plant? (AU.(MECH)Nov'07)</p> <ol style="list-style-type: none"> 1. Pneumatic starter 2. Air compressor 3. Air-conditioning and 4. Coolant circulation pump.
<p>25. What are the methods used for starting a Diesel engine?(AU.(MECH)Nov'07)</p> <ol style="list-style-type: none"> 1. Starting by an auxiliary engine 2. Use of electric motors or starters 3. Compressed air system
<p>26. What is the basic difference between a Diesel engine and a steam turbine? (AU.(EEE)DEC'12)</p> <p>The basic difference is that Diesel engine is internal combustion (IC) engine whereas the steam turbine is external combustion engine.</p>
<p>27. Why is the maximum cycle temperature of gas turbine plant much lower than that of Diesel power plant? (AU(MECH)May'09)</p> <p>Air alone is combusted in gas turbine plant instead of air-Diesel combustion in the Diesel power plant.</p>
<p>28. State the fuels used in the gas turbine power plants. (AU.(EEE)May'11)</p> <p>Residual liquid fuels, the residue left after the profitable light fractions have been extracted from the crude have been used in gas turbines to some extent.</p>
<p>29. What are the main units in a gas turbine power plant? (AU (MECH)DEC'13 & (EEE) DEC'11)</p> <ol style="list-style-type: none"> 1. Compressor 2. Combustion chamber 3. Turbine
<p>30. What are the methods by which thermal efficiency of a gas turbine power plant be improved? (AU.(EEE)May'12 & DEC'12)</p> <ol style="list-style-type: none"> 1. Intercooling 2. Reheating 3. Regenerator 4. Combination of intercooling reheating and regenerator.
<p>31. What do you mean by regeneration in gas turbine power plant?(AU.(EEE)June'13)</p> <p>The partial bleeding of steam from the turbine to preheat the air to reduce the fuel consumption and increase the efficiency is called regeneration.</p>
<p>32. How does regeneration improve the thermal efficiency of gas turbine cycle? (AU.(MECH)DEC'14)</p> <p>Regeneration reduces the energy requirement from the fuel thereby increasing the efficiency of the cycle.</p>
<p>PART-B& PART-C</p>
<p>1. Discuss the essential components of the diesel power plant with neat layout. [AU Nov/Dec 2016]</p> <p><i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>2. (i) Derive an expression for the work ratio using Brayton cycle. (ii)Discuss the working of any one type of combined cycle power plant. [AU Nov/Dec 2016]</p> <p><i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>3. Derive an expression for air the air standard efficiency of diesel cycle. Explain why the efficiency of Otto cycle is more than diesel cycle for the same compression ratio. [AU NOV 2010/MAY2014]</p>

<i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>	
4.	How do you select engine for a diesel power plant? Draw a diesel power plant and explain its major components [AU MAY 2014] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
5.	Explain the construction and working of gas turbine power plant with a layout [AU DEC 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
6.	Discuss the working of combined cycle power plant [AU MAY 2011/MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
7.	With neat diagram, explain the working principle of the combined MHD and steam open cycle power plant. [AU NOV 2008] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>
8.	Discuss the working of combined cycle: power plant.[AU MAY 2011/MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i>

UNIT III NUCLEAR POWER PLANTS

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.*

PART-A

1.	What is critical mass of nuclear fuel? [AU Nov/Dec 2016] A critical mass is the smallest amount of fissile material needed for a sustained nuclear chain reaction
2.	What are isotopes? (AU.(EEE)DEC'13) Some elements exist in different forms. Mass number of these forms is different but the atomic number is the same. They are known as isotopes of the element.
3.	Name the different types of fuels used in nuclear reactors. (AU.(EEE)DEC'12) Uranium, Plutonium and Thorium.
4.	What is known as binding energy? (AU.(EEE) DEC'11) The energy released at the moment of combination of two nucleons to form nucleus of an atom is called "binding energy".
5.	What is "half life" of nuclear fuels? (AU.(MECH) Nov'08) The radioactive half-life for a given radioisotope is a measure of the tendency of nucleus to "DECAY" or "disintegrate" and it is based purely upon that probability.
6.	What do you mean by mass defect? (AU.(EEE) June'13) During the interaction two or more particles to combine together, the total mass of the system will decrease and it will be less than the sum of the masses of the individual particles. The stronger the interaction becomes and more the mass will decrease. It decrease the mass of the system called mass defect.
7.	What is nuclear fission? (AU.(MECH) May'11,(EEE) May'11 & May'12) or How can nuclear fission be caused? (AU. (EEE)DEC'10) Nuclear fission is the process of splitting the nucleus into two almost equal fragments accompanied by the release of heat. In other words, it is the process of splitting the unstable heavy nucleus into two fragments of approximately equal mass when bombarded with neutrons.
8.	What do you understand by moderation? (AU.DEC'04)

The process of slowing down the speed of neutrons from high velocity without capturing them is known as moderation	
9. What is known as moderating ratio?	(AU.(EEE) DEC'10)
Multiplication ratio or reproduction factor of the system is defined as the number of neutron in any particular generation in total number of neutrons in the preceding generation. $K = \frac{\text{Number of neutrons in any particular generation}}{\text{Number of neutrons in the preceding generation}}$	
10. What is four factor formula?	(AU.(EEE) DEC'10)
The four-factor formula is also known as Fermi's four factor formula used in nuclear engineering to determine the multiplication of a nuclear chain reaction in an infinite medium.	
11. Explain the function of nuclear reactor.	(AU.(MECH)Apr'08 & May'11)
A nuclear reactor is similar to the furnace of a steam power plant or combustion chamber of a gas turbine plant. In the nuclear reactor, heat is produced due to nuclear fission chain reaction.	
12. What are the essential components of a nuclear reactor?	(AU.(EEE) May'10)
<ul style="list-style-type: none"> • Reactor core • Moderator • Control rods • Reflector • Cooling system • Reactor vessel • Biological shielding. 	
13. Explain the function of the moderator.	(AU(MECH) May'07 & May '11 & (EEE)DEC'12)
Moderator is a material which is used to slow down the neutrons from high velocities without capturing them. The fast moving neutrons are far less effective in causing the fission and for the escape from the reactor.	
14. Name the three moderators commonly used in nuclear power reactor.	(AU.(EEE)May'12)
Heavy water (D ₂ O), water (H ₂ O), Beryllium(Be), Graphite (G) and Helium(He) gas are commonly used moderators	
15. Why is shielding of a Nuclear reactor necessary?	(AU.(MECH)May'13) [AU Nov/Dec 2016]
Shielding is necessary to protect walls of the reactor vessels from radiation damage and it also protect the operating personnel from exposure to radiation. Thick layers of lead concrete or steel are provided all around the reactor. These layers absorb the gamma rays, neutrons etc.	
16. Define the term "Breeding".	(AU.Apr'05)
In a fast breeder reactor, the process of producing energy to self-sustain the nuclear fission chain reaction without using moderator is known as breeding. Enriched Uranium(U ²³⁵) or Plutonium is used as fuels which are surrounded by a thick blanket of fertile Uranium(U ²³⁸).	
17. What is a gas cooled nuclear reactor?	(AU.(MECH)DEC'14)
A Gas such as carbon dioxide is used to carry away the heat produced due to nuclear fission in the reactor. For example, the gas cooled reactor is with CO ₂ gas as coolant and graphite as moderator.	
18. What is LMFBR? Why is a liquid metal the preferred coolant in a fast breeder reactor?	(AU.(EEE)June'13)
LMFBR stands for Liquid Metal Fast Breeder Reactor. The liquid metal is always preferred as the coolant since it is an excellent heat transfer material. Ex: Sodium and Potassium.	
19. What are the components of pressurized water reactor nuclear power plant?	(AU.DEC'05)
<ul style="list-style-type: none"> • Reactor • Pressuriser 	

- Heat exchanger
- Coolant pump

20. What are the criteria used for evaluation of nuclear plant safety?(AU.Nov'07)

- There is no unreasonable risk.
- It has adequate protection of public health and safety.
- Risk is reasonably low.
- Safety is as high as reasonably achievable.
- It limits the risk by use of best technologies at acceptable economic costs.

21. List some of the disadvantages of Nuclear power plant.(AU.(EEE)DEC'10)

- Similar to fossil fuels, nuclear fuels are nonrenewable energy resources.
- If the accident occurs, large amount of radioactive material could be released into the environment.
- Nuclear waste also remains radioactive and it is hazardous to health for thousands of years.

22. How do you cater for safety of Nuclear power plant? (AU.(MECH)May'14)

Nuclear safety and security cover the actions taken to prevent nuclear and radiation accidents or to limit their consequences. The main safety concern is the emission of uncontrolled radiation into the environment which could cause harm to human both at the reactor site and off-site.

The nuclear power industry has improved the safety and performance of reactors and it has proposed new and safer reactor designs.

23. What are the advantages and disadvantages of breeder reactor? (AU.(MECH)May'11)

Advantages:

- No moderators is required
- High breeding is possible.
- It gives high power density than other reactors.
- High efficiency in the order of 40% can be obtained.
- It has better fuel utilization.
- Absorption of neutrons is low.

Disadvantages:

- It has to be cooled with liquid sodium.
- It is even more complicated and expensive than a normal reactor.
- It has potential for misuse of plutonium by terrorists.

24. What factors control the selection of a particular type of a reactor?(AU.DEC'04)

- Neutrons energy
- Type of fuel
- Type of coolant.
- SFR:Sodium Fast Reactor
- SCWR:Super-Critical Water-Cooled Reactor.
- VHTR:Very High Temperature reactor cooled with helium at 1000°C at the core for efficient production of hydrogen.

25. What are the essential components of a nuclear reactor? (AU.(EEE)May'10)

- Reactor core
- Moderator
- Control rods
- Reflector
- Cooling system
- Reactor vessel
- Biological shielding.

26. What are the conditions to be satisfied to sustain nuclear fission process? OR Give the requirements of chain reaction. (AU.(MECH)May'09,DEC'13 & (EEE) May'10)

- i. The chain reaction will become self-sustaining or self propagating only.
- ii. At least one fission neutron becomes available for causing fission of another nucleus.
- iii. The neutrons emitted in fission must have adequate energy to cause fission of other nuclei.
- iv. The number of neutrons produced must be able not only to sustain the fission process but also to increase the rate of fission.
- v. The fission process must liberate the energy.
- vi. It must be possible to control the rate of energy liberation.

27. How are the nuclear reactors classified?(AU.(MECH)May'11)

- (i)According to the neutrons energy.
 - A)fast reactors in which fast fission is caused by high-energy neutrons.
 - B)Intermediate or epithermal.
 - c)Low energy to Thermal reactors in which fission is due to slow moving neutrons.
- (ii)According to the fuel used
 - a) Natural fuel reactor in which natural Uranium is used as fuel.
 - b) Enriched Uranium reactor in which Uranium used in this reactor contains 5 to 10% of U^{235} .
- (iii)According to the type of coolant used
 - a)water cooled reactors in which ordinary or heavy water is used as coolants.
 - b) Gas cooled reactors in which CO_2, He, N_2, air etc. are used as coolants.
 - c)Liquid metal cooled reactors in which liquid metals such as sodium, bismuth and lead are used as coolants.
- iv)According to the type of moderators used
 - a.Graphite moderator reactor.
 - b.Beryllium moderator reactor.
 - c.Water moderator reactor.
- v)According to the construction of core
 - a.Cubical core reactor.
 - b.Cylindrical core reactor.
 - c.Spherical core reactor.
 - d.Annulus core reactor.
 - e.Slab core reactor.

28. Distinguish between PHWR and LMFBR.

(AU.(EEE) May'11)

S.No	PHWR	LMFBR
1	A nuclear power reactor commonly uses unenriched natural uranium as its fuel which uses heavy water (deuterium oxide D_2O) as its coolant and moderator.	A nuclear reactor is capable of generating more fissile material than it consumes.
2	Pressurized heavy water reactors (PHWR) running on natural uranium have a conversion ratio of 0.8.	The conversion ratio is higher than 1.
3	It is costly.	Its cost is comparatively less..

29. State the major reasons for nuclear accidents that classified under moderate frequency.

The major reasons for nuclear accidents of moderate frequency are imbalance in head rates, increase in thermal power and reduction in cooling effectiveness.

30. State the major reasons for nuclear accidents that classified under severe accidents.

The major reasons for nuclear accidents of severe category are large break of loss coolant, loss of power in reactor station and failure of reactor protection system.

31. What are the major reasons for nuclear accidents that classified under lower probability?

Cracks in coolant pipes and loss of flow are the major reasons for nuclear accidents of lower probability
PART-B& PART-C
<p>1. (i) Explain CANDU (Canadian-Deuterium-Uranium) reactor with neat diagram also mention its merits and demerits. (ii) Discuss about the safety measures adopted in modern nuclear plants. [AU Nov/Dec 2016] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>2. What is meant by uranium enriched? Describe some methods of Uranium enrichment. [AU JUNE 2010] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>3. Explain the Construction and working of nuclear power plant with a layout. [AU DEC 2010, 2012, 2013][AU Nov/Dec 2016] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>4. Explain the different types of nuclear reactions and initiation of nuclear reactions. [AU JUNE 2013] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>5. Explain with a neat sketch a boiling water reactor. [AU DEC 2007, 2005/NOV 2007] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>6. Explain the working of pressurized water reactor. [AU MAY 2011, 2014/DEC 2014] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>7. What is chain reaction? How it is maintained? What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples' [AU DEC 2004/NOV 2007] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
<p>8. Discuss the various factors to be considered while selecting the site for nuclear power station. [AU DEC 2014] Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</p>
UNIT IV POWER FROM RENEWABLE ENERGY
Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.
PART-A
<p>1. Define the term “Hydrology”. (AU.(EEE)DEC’10) Hydrology is the study of science concentrating the properties of the earth’s water and the movement of earth with respect to land.</p>
<p>2. What is hydrograph? (AU.(MECH)May’13) A hydrograph is a graph plotted for the rate of flow versus time past a specific point in a river or other channel or conduit carrying flow.</p>
<p>3. For which purposes hydro projects are developed? (AU.(EEE)DEC’13)</p> <ol style="list-style-type: none"> i. To meet the power needs during peak and off peak requirements. ii. To run of the river. iii. To obtain a clean process of power generation iv. To avoid suffering from the limitation of inflation on account of fuel consumption in the long run.
<p>4. What is the purpose of using dams? (AU.(EEE)DEC’12)</p>

<p>The dam is used in hydro power plants to increase the height of water level thereby increasing the capacity of reservoir. The dam also helps to increase the working head of the power plant.</p>	
<p>5. Define Run-off.</p>	<p>(AU.(EEE)DEC'13)</p>
<p>Runoff is defined as the movement of land water to the ocean mainly in the form of rivers,lakes and streams</p>	
<p>6. Classify power plants on the basis of traditional use.</p>	<p>(AU.(MECH)May'11)</p>
<p>i. Concrete gravity dam type hydroelectric power plant. ii. Embankment dam type hydroelectric power plant.</p>	
<p>7. List out the important parameters of a turbine.</p>	<p>(AU.(MECH)Nov'07)</p>
<p>i. Power output of the turbine. ii. Friction losses based on isentropic efficiency. iii. Maximum temperature which can be taken by the turbine. iv. Temperature at the exhaust of the turbine.</p>	
<p>8. Give an example for a low heat turbine , a medium head turbine and a high head turbine.</p>	<p>(AU.(MECH)Nov'02)</p>
<p>a) High head turbine(above 250m).e.g.Pelton wheel. b) Medium head turbine(60m to 250 m).e.g. Modern Francis turbine. c) Low head turbine(less than 60 m).e.g.Kaplan turbine.</p>	
<p>9. What are reaction turbines? Give examples.</p>	<p>(AU.(MECH)Apr'03)</p>
<p>In a reaction turbine,the runner utilizes both potential and kinetic energies. Here,a portion of potential energy is converted into kinetic energy before entering the turbine.eg.Francis and Kaplan turbine</p>	
<p>10. What is a draft turbine?</p>	<p>(AU.(EEE)DEC'10)</p>
<p>After passing through the runner, the water is discharged to the tailrace through a gradually expanding tube called draft tube. The pressure at the exit of the runner of a reaction turbine of generally less than atmospheric pressure. By passing through reduced size draft tube, the outer velocity of water is reduced and gain in useful pressure head is achieved to increase the output of turbine.</p>	
<p>11. What is the function of draft tube?</p>	<p>(AU.(EEE)DEC'11 & June'13)</p>
<p>1. It allows the turbine to be set above tail. Water level is without loss of head for doing inspection and maintenance. 2. It regains the major portion of the kinetic energy delivered from the runner by the diffuse action.</p>	
<p>12. What are the different types of spill ways?</p>	<p>(AU.(EEE)DEC'11)</p>
<p>i. Chute spillway ii. Stepped spillway iii. Bell-mouth spillway.</p>	
<p>13. Define unit speed of turbine.</p>	<p>(AU.Nov'03)</p>
<p>Unit speed is defined as the speed of turbine when working under a unit head. Unit speed $N_s = N/\sqrt{H}$</p>	
<p>14. What is the significance of specific speed of hydraulic turbines?</p>	<p>(AU.(MECH) May'09 & May'11)</p>
<p>1. To predict the behaviour of a turbine working under different conditions. 2. To make the comparison between the performances of turbine of same types with different sizes. 3. To compare the performance.</p>	
<p>15. What is a surge tank?</p>	<p>(AU.(EEE)May'10)</p>
<p>A surge tank is a small reservoir or tank in which the water level rises or falls to reduce.</p>	
<p>16. What is draft tube? In which type of turbine it is mostly used?</p>	<p>(AU(MECH) Nov'03 & Nov'04)</p>
<p>The tube which increases the outlet velocity of turbines is known as draft tube. So , the head is saved by fitting a draft tube.</p>	
<p>17. What is the necessity if draft tubes? List the types.</p>	<p>(AU.(MECH) May'09 & May'11)</p>

<ol style="list-style-type: none"> 1. To Decreases the pressure at the runner exit less than the atmospheric pressure in order to increase the working head. 2. To recover some of kinetic energy going to tail race as waste. <p>Types of draft tube: Draft tubes are classified into two types.</p> <ol style="list-style-type: none"> (i) Straight conical or concentric tube. (ii) Elbow type (iii) Moody spreading type
<p>18. Write the function of draft tube in turbine outlet. (AU.(MECH) Apr'05)</p> <ol style="list-style-type: none"> 1. It allows the turbine to be set above tail-water level without loss of head for doing the inspection and maintenance. 2. It regains the major portion of the kinetic energy delivered from the runner by the diffusion action.
<p>19. What are the factors to be considered in selecting turbines? (AU.(MECH)May'14 &(EEE) May'12)</p> <ol style="list-style-type: none"> 1. Rotational speed of the turbine 2. Specific speed 3. Maximum efficiency 4. Part load efficiency 5. Head 6. Types of water 7. Runaway speed 8. Cavitation 9. Number of turbine units 10. Overall cost.
<p>20. On what basis hydraulic turbines are selected? (AU.(MECH).DEC'12)</p> <ol style="list-style-type: none"> 1. Water availability 2. Water storage 3. Water head 4. Various geological investigations 5. Environmental aspects 6. Consideration of water pollution effects
<p>21. What do you understand by zero energy houses? (AU(EEE)June'13) A zero energy building is also known as a zero net energy(ZNE) or net-zero energy building(NZEB). It refers a building with zero net energy consumption and zero carbon emissions annually.</p>
<p>22. List any four advantages of wind turbine. (AU.(EEE)DEC'10)</p> <ol style="list-style-type: none"> i. Wind industry developers and manufacturers make lots of money by investing them due to government subsidies and cash incentives. ii. They make the environmentalists happy may be because man is finally punished against the earth.
<p>23. What are the advantages of pumped storage plant? (AU.(EEE)DEC'10)</p> <ol style="list-style-type: none"> a. It is free from effects of environment pollution. b. Such plants are readily adoptable to automation as well as remote control.
<p>24. What is the purpose of flywheel which is used in an IC engine?(AU.Apr'08) A flywheel is a heavy rotating mass which is placed between power source and driven member to act as a reservoir of energy. The primary function of flywheel is to act as an “energy accumulator:.. It will absorb the energy when the demand is less than the supply of energy and will release it when the demand is more than the energy being supplied.</p>
<p>25. What is the function of flywheel? (AU.Nov'05 & DEC'06)</p>

A flywheel used in machine serves as a reservoir which stores energy during the period when the supply of energy is more than the requirement and releases it during period when the requirement of energy is more than supply.

26. What are the components of tidal power plants? (AU.(MECH)May'09)

1. The dam or dyke
2. Sluice ways
3. The power house.

27. What are the different methods of producing electricity with tides? (AU.(MECH)May'11)

1. Single basin arrangement
 - a) Single ebb-cycle system
 - b) Single tide-cycle system
 - c) Double cycle system
- d) Double basic arrangement

28. What is a solar cell? (AU.(EEE)May'12 &DEC'12)

A solar cell is a device which directly converts the energy of light into electrical energy through the process of photovoltaic effect.

29. What are the classifications of geothermal energy? (AU.(EEE)DEC'11,DEC'12 & June'13)

- i. Hydrothermal convective systems
- ii. Geopressured resources
- iii. Petro-thermal or hot dry rocks
- iv. Magma resources
- v. Volcanoes.

30. What are the types of geothermal power plants? (AU.(MECH)DEC'13)

1. According to geothermal energy resources
 - a. Geothermal steams
 - b. Geothermal brine
 - c. Geothermal hot water
 - d. Hot rock
2. According to thermodynamic cycle
 - a. Steam turbine cycle
 - b. Binary cycle
 - c. Total flow concept.

31. What is bio gas? Give the advantages. [AU Nov/Dec 2016]

Biogas is a type of gas that is formed by the biological breakdown of organic matter in an oxygen deficient environment. It is counted as an ecofriendly biofuel. Biogas contains 60% methane and carbon dioxide. It can be employed for generating electricity and also as automotive fuel. Biogas can be used as a substitute for compressed natural gas (CNG).

Advantages

- a. Provides a non-polluting and renewable source of energy.
- b. Efficient way of energy conversion (saves fuelwood).
- c. Leads to improvement in the environment, and sanitation and hygiene.
- d. Provides a source for decentralized power generation.
- e. Leads to employment generation in the rural areas.
- f. Household wastes and bio-wastes can be disposed of usefully and in a healthy manner.

32. List the difference between Francis and Kaplan turbine.[AU Nov/Dec 2016]

Difference between Francis turbine and Kaplan turbine		
	Francis turbine	Kaplan turbine
1.	It needs one servomotor for regulation of direct vanes.	It requires servomotors for regulation of vanes with turning runner blades.
2.	Shaft might be placed horizontally and vertically.	Shaft of runner is for all time vertical.
3.	Precise speed range as of 50 to 250.	Precise speed ranges as of 250 to 850.
4.	Servomotor is located outside rotor shaft.	Servomotors are located inside hollow shaft of turbine runner.
5.	Flow of water is radially and mixed flow type.	It is simply axial flow turbine.
6.	Number of vanes is big (16 to 24 blades).	Number of vanes is little (3 to 8 blades).
7.	Runner vanes is not regulating.	Runner vanes are regulating.
8.	Turbine works by middle discharge at average head.	It works by high discharge by low heads.

PART-B& PART-C

1. What are the essential elements of hydro power plant? Explain with a neat sketch.

[AU NOV 2008/MAY 2011/DEC 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

2. Explain the working of Pelton turbine with a neat diagram. What is the function of a draft tube?

[AU NOV 2012/MAY 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

3. Describe the working of a low head hydro plant with a neat diagram. [AU DEC 2014]

[AU Nov/Dec 2016]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

4. Compare and contrast Kaplan turbine and Francis turbine. [AU APR 2004]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

5. Discuss various components of wind energy system. [AU DEC 2014]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

6. Explain with a neat sketch a pumped storage power plant

[AU NOV 2007/MAY 2010, DEC 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

7. Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches.

[AU NOV 2008]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

8. Draw a schematic diagram of a solar power plant and explain the operation of it. Also mention its merits and demerits.

[AU NOV 2009]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

9. Explain the construction and working of geo thermal power plant and tidal power plants.

[AU MAY 2011]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

10. Define the terms anaerobic digestion, Fermentation and What are the advantages and disadvantages of floating drum plant Give the list of the materials used for biogas generation.

[AU DEC 2014]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

11. Describe the principle of a fuel cell and discuss the choice of fuels required.

[AU DEC 2013]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

12. (i) Explain the construction and working of fuel cell also mention its merits and demerits.

(ii) List the advantages and disadvantages of wind energy system. [AU Nov/Dec 2016]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

13. Explain with a neat sketch working of a distributed (Parabolic) trough Solar Power Plant.

[AU DEC 2012]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

UNIT VENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

PART-A

1. What is main objective of tariff?

[AU Nov/Dec 2016]

- Recovery of cost of producing electrical energy at the power station.
- Recovery of cost on the capital investment in transmission and distribution systems.
- Recovery of cost of operation and maintenance of supply of electrical energy e.g., metering equipment, billing etc.
- A suitable profit on the capital investment.

2. Define law of conservation of Energy.

(AU(EEE)DEC'13)

Energy may be neither create nor destroyed but it can be transferred from one form to another form.

3. What is the significance of incremental rate for a power plant?(AU.DEC'04)

Boiler efficiency is defined as the ratio of heat energy used in system formation to the heat energy supplied by burning of fuel in the same period but the incremental heat rate is the reciprocal of boiler efficiency.

4. What are the various operating costs of fired steam power plant?(AU.Apr'05)

- a) Cost of fuel
- b) Lubricating oil, grease water cost
- c) Cost of maintenance and repairs
- d) Cost of operating labour
- e) Cost of supervision
- f) Taste.

5. Define demand for electricity.

(AU.(EEE)DEC'13)

It is defined as the electricity requirement during the period of time of high price or more stress

6. Define "Diversity factor".

(AU.DEC'05)

Diversity factor is defined as the ratio of sum of the individual maximum demand to the actual peak load of the system.

Diversity factor = Sum of individual maximum demand/Actual peak load of the system.

7. Define plant use factor.

[AU Nov/Dec 2016]

The ratio of the average power load of a plant to its rated capacity.

8. What are the major factors that Decide the economics of power plants?

(AU.(MECH)Apr'08)

- i. Connected load
- ii. Demand

- iii. Maximum demand
- iv. Demand factor
- v. Load factor
- vi. Capacity factor or plant capacity factor
- vii. Utilization factor
- viii. Reserve factor
- ix. Diversity factor
- x. Plant use factor

9. What do you understand by load duration curves?(AU.(MECH) May'14)

Re-arrangement of all load elements of load curve is in the order of decreasing magnitude.

10. State the importance of load curves. (AU.(MECH)May'11)

- a. To obtain the average load on the power station and the maximum demand of the power station.
- b. To know the incoming load thereby helping to decide the installed capacity of the power station.
- c. To decide the economical sizes of various generating units.

11. What is the significance of load curve? (AU(MECH)May'13)

The load curve gives full information about the incoming load and it helps to decide the installed capacity of the power station. It is also useful to decide the economical sizes of various generating units.

12. What is the use of load curves in power plant? (AU(MECH)Apr'08)

Load curve is a graphical representation which shows the power demands for every instant during certain time period. By drawing these load curves, the peak load can be identified. Therefore, the capacity of power plant can be judged.

These curves give full information about the incoming load and they help to decide the installed capacity of the power station. It is also useful to decide the economical sizes of various generating units

13. How does the fuel cost related to the load and the cost of power generation?

(AU.(MECH)Nov'08 & Apr'11)

The cost of power generation is directly proportional to the fuel cost because the operating cost is directly linked with the fuel cost.

14. What are fixed? (AU.(MECH)DEC'12 & May'14)

Fixed costs are the cost required for the installation of complete power plant. This cost includes the cost of land, buildings, equipment, transmission and distribution lines, cost of planning and designing the plant and many others. It also consists of interest, taxes, depreciation, insurance etc.

15. Define flat rate tariff. (AU (MECH)May'11 & DEC'13)

The charging of amount depending only on the connected load and fixed number of hours of use per month or year is called flat rate tariff.

16. List the types of tariffs to calculate energy rate. (AU (MECH)DEC'12)

- a. Flat demand rate
- b. Straight line meter rate
- c. Block meter rate
- d. Hopkinson demand rate of two-part tariff
- e. Doherty rate or two-part tariff.

17. How the tariff for electrical energy is arrived? (AU (MECH)May'11)

Tariff is calculated by the following equation.

$$E = Ax + By + C$$

Where

E = Total amount of bill for the period considered

A = Rate per kW of maximum demand

X = Maximum demand in kW

B = Energy rate per kWh

Y = energy consumed in kWh during the period considered

<p>C=Constant amount charged to the consumer during each bill period. This charge is independent of demand or total energy.</p>
<p>18. Define depreciation. It is the amount to be set aside per year from income to meet the depreciation caused by the age of service, wear and tear of machinery.</p>
<p>19. Mention any four methods for calculating depreciation.</p> <ul style="list-style-type: none"> • Straight line method • Sinking fund method • Diminishing value method • Net percent value method • Double sinking fund method.
<p>20. What is the reason for the operating cost of hydel power plant being high? No fuel cost is required for running the power plant.</p>
<p>21. How can be the cost of power generation reduced?</p> <ul style="list-style-type: none"> • Periodic maintenance. • Installing waste heat recovery system. • Using energy efficient devices such as insulated compressors and insulated turbines. • Using higher grade fuels.
<p>22. What are the factors that contribute for energy cost?</p> <ul style="list-style-type: none"> • Cost of fuel. • Cost of operating labour. • Cost of maintenance labour and materials. • Cost of supplies
<p>23. List out four important factors to be considered for the selection of site for power plants,</p> <ul style="list-style-type: none"> • Cost of land as well as taxes on land. • It should be near load centers. • It should be accessible by road, rail etc., • Sufficient quantity of cooling water should be available. • The selected site should be away from the populated area • Enough space should be available for future expansion of plants • The selected site should satisfy geological factors.
<p>24. What are the different pollutions in the flue gas?</p> <ul style="list-style-type: none"> • Oxides of nitrogen • Oxides of sulphur • Carbon monoxide • Particulates.
<p>25. What are the methods used for reduction of SO₂ pollutant?</p> <ul style="list-style-type: none"> • Adding lime stone (CaCO₃) to the coal • Using wet scrubbers • Using electro static precipitator.
<p>26. What are the methods used for controlling the NO_x?</p> <ul style="list-style-type: none"> • Reduction of temperature in combustion zone. • Reduction of residence time in combustion zone. • Increase in equivalence ratio in the combustion zone.
<p>27. What is Acid rain? CO, SO and NO contact the water during rainy season. So, H₂SO₄ and HNO₃ acids are formed and mixed</p>

with water during rainfall.
<p>28. What is the equipment used to control the particulates?</p> <ul style="list-style-type: none"> • Scrubbers • Cyclone separator • Fabric filters • Electro static precipitators
<p>29. List down the nuclear waste disposal methods.</p> <ul style="list-style-type: none"> • Disposal in sea. • Disposal in land. • Disposal by reduction process through chemical reaction. • Disposal by solidification process.
<p>30. What are the various methods followed to transport solid waste?</p> <p>(i) Wet slurry method: This method uses water slurry to transport the material to the disposal area.</p> <p>(ii) Pneumatic method: This method uses the air to transport solid wastes to the disposal area.</p> <p>(iii) Trucking.</p> <p>(iv) Rail transport.</p> <p>(v) Conveyor usually fixed or movable belt conveyor systems is used, and</p> <p>(vi) Barge uses waterways to transport waste materials.</p>
<p>31. What are operating costs? (AU.(MECH)DEC'12 & May'14)</p> <p>Operating cost includes the cost of fuel, cost of lubricating oil, greases, cooling water, cost of maintenance and repairs, operating labour cost, supervision cost and taxes.</p>
<p>32. What are the costs involved in fired steam power plant?(AU.Apr'05)</p> <ul style="list-style-type: none"> • Maintenance and repairs cost • Operating labour cost • Supervision cost
PART-B& PART-C
<p>1. Explain the methods to control pollution in thermal and nuclear power plants. [AU Nov/Dec 2016] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>2. Write an explanatory note on the economics of power generation. [AU DEC 2014] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>3. What is meant by load factor and diversity factor? [AU APR 2005] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>4. Elucidate the objectives and requirements to tariff and general form of tariff. [AU MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>5. What are the elements which contribute to the cost of, the electricity? And how can the cost power generation be reduced? [AU APR 2008] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>6. Explain briefly the various methods used to, calculate the depreciation cost. [AU MAY 2013] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>7. What are the fixed and operating costs of steam power plant? How are they accounted for fixing cost of electricity? [AU MAY 2011/2014] <i>Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:</i></p>
<p>8. Explain the analysis of pollution from thermal power plants. What is methods used for control the</p>

pollutants?

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

9. Write short notes on nuclear waste disposal.

[AU APR 2008/NOV 2008]

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no:

10. Explain the site selection criterion of hydro power plant.

(ii) A peak load on the thermal power plant is 75 MW. The loads having maximum demands of 35 kW, 20 MW, 15 MW and 18 MW are connected to the power plant. The capacity of the plant is 90 MW and annual load factor is 0.53. Calculate the average load on power plant, energy supplied per year, demand factor and diversity factor. **[AU Nov/Dec 2016]**

Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008 page no: