JEPPIAAR ENGINEERING COLLEGE
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF INSTITUTION

To build Jeppiaar Engineering College as an institution of academic excellence in technology and management education, leading 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, dissemination of knowledge** and interact with **national and international communities.**
- To equip students with ethical **values, and life skills** that would enrich their lives and enable them to meaningfully contribute to the **progress of the 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.**

PROGRAM OUTCOMES (POs)

1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2 **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.

3 **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

4 **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.

5 **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.

6 **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.

7 **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.

8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10 **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.

11 **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.

12 **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.

VISION OF THE DEPARTMENT

The Department of Electrical and Electronics Engineering strives to be a Centre of Excellence in education and technical research, in the endeavour of which the Department will continually update the teaching methodologies, progress in the emerging technologies and continue to play a vital role in the development of the society.

MISSION OF THE DEPARTMENT

M1	To develop the ability to **learn** and work creatively that would enhance the ability of both students and faculty to do **innovative research**.
M2	To **create** and maintain state-of-the art facilities which provide students and faculty with opportunities to analyse, apply and **disseminate knowledge globally**.
M3	To impart the knowledge in essential interdisciplinary fields which will enhance the **interpersonal skills**, team work, professional **ethics** and make them work effectively for their own benefit and the **betterment of the society**.
M4	Prepare students for **lifelong learning** of theoretical and **practical concepts** to face intellectual, **economical** and career challenges.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 01	Strengthen the knowledge in Electrical and Electronics Engineering to enable them **work** for modern industries by promoting energy conservation and sustainability.
PEO 02	Enrich analytical, creative and critical **logical reasoning** skills to solve problems faced by emerging domains of electrical and electronics engineering industries worldwide.
PEO 03	Develop effective communication and inter-personal skills to work with enhanced team spirit in multidisciplinary projects with a broader **ethical**, professional, economical and **social** perspective.
PEO 04	Prepare the students either to establish **start ups** or to pursue **higher education** at reputed institutions.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO 1	**Professional Skills:** Apply the knowledge of Mathematics, Science and Engineering to solve real time problems in the field of **Power Electronics, Electrical Drives, Power Systems, Control Systems and Instrumentation**.
PSO 2	**Research and Innovation:** Analyze and synthesize circuits by solving complex engineering problems to obtain the **optimal solution** using effective software tools and hardware prototypes in the field of robotics and renewable energy systems.
PSO 3	**Product development:** Develop concepts and **products** by applying ideas of electrical domain into other diversified engineering domains.

ME 8792 POWER PLANT ENGINEERING L T P C
3 0 0 3

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 9
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 9
Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbinepower plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 9
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 measuresfor Nuclear Power plants

UNIT IV POWER FROM RENEWABLE ENERGY 9
Hydro Electric Power Plants – Classification, Typical Layout and associated components includingTurbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), SolarThermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9
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.

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. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.

Course code& Name: M**E8792 & Power Plant Engineering**
Degree/Programme: **B.E/EEE** Semester: **II** Section: **A, B**
Duration: **JUNE – DEC 2018** Regulation: **2017/AUC**
Name of the Staff: Dr.Sasi Kumar & Ms.K.S.Kavitha Kumari

AIM: To under different types of power plant and its functions and their flow lines and issues related to power sectors. .

OBJECTIVES:

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

COURSE OUTCOMES:

C	Course Outcomes
C2.06.1	Understanding of Thermal Power Plant Operation, turbines, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems
C2.06.2	Understanding working of gas power Cycle and Combined Cycle Power Plants
C2.06.3	Gain knowledge of working of Nuclear power plant including working of different types of reactors and safety measures.
C2.06.4	Understanding working of hydroelectric power plant and discussing various renewable energy systems
C2.06.5	Understanding of Power Plant Economics and Discussing environmental and safety aspects of power plant operation

Mapping of Course Outcomes(COs), Course(C),ProgramSpecificOutcomes (PSOs)with Program Outcomes. (POs)– [Levels of correlation:3 (High),2 (Medium), 1(Low)]

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C2.06.1	3	3	-	3	-	2	-	-	-	-	-	3	3	3	2
C2.06.2	3	3	2	3	-	2	-	-	-	-	-	3	3	3	1
C2.06.3	3	3	2	3	-	-	-	-	-	-	-	3	3	3	2
C2.06.4	3	3	1	3	-	-	-	-	-	-	-	3	3	3	1
C2.06.5	3	3	1	3	3	-	-	-	-	-	-	3	3	3	1

UNIT - I COAL BASED THERMAL POWER PLANTS						Target Periods: 10
Sl N o	**Contents**	**CO Statement**	**Book Reference & Page No**	**Delivery method**	**Delivery Periods**	**Knowledge Level**
1	Rankine cycle - improvisations	C2.06.1	TB1:44	Chalk & board / PPT	**1**	R & U
2	Layout of modern coal power plant, Super Critical Boilers	C2.06.1	TB1:70	Chalk & board / PPT	**2**	R & U
3	FBC Boilers, Turbines, Condensers, Steam & Heat rate	C2.06.1	TB1:45	Chalk & board / PPT	**2**	R, U, An
4	Subsystems of thermal power plants	C2.06.1	TB1:74	Chalk & board / PPT	**2**	R, U, An
5	Fuel and ash handling, Draught system, Feed water treatment.	C2.06.1	TB1:393	Chalk & board / PPT	**1**	R, U, An
6	Binary Cycles and Cogeneration systems	C2.06.1	TB2:79	Chalk & board / PPT	**1**	R,U, A

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS						Target Periods:10
Sl No	**Contents**	**CO Statement**	**Book Reference & Page No**	**Delivery method**	**Delivery Hrs**	**Knowledge Level**
1	Otto	C2.06.2	TB1:222	Chalk & board / PPT	**1**	R, A, An
2	Diesel	C2.06.2	TB1:288	Chalk & board / PPT	**1**	R, U, A, An
3	Dual & Brayton Cycle	C2.06.2	TB1:119&107	Chalk & board / PPT	**1**	R, U, A, An
4	Analysis & Optimisation	C2.06.2	TB1:632	Chalk & board / PPT	**2**	R, U, A, An
5	Components of Diesel Turbine power plants.	C2.06.2	TB1:734	Chalk & board / PPT	**1**	R, U, A, An
6	Components of Gas Turbine power plants.	C2.06.2	TB1:748	Chalk & board / PPT	**1**	R, A, An
7	Combined Cycle Power Plants.	C2.06.2	TB1:106	Chalk & board / PPT	**1**	A, An, E
8	Integrated Gasifier based Combined Cycle systems	C2.06.2	TB1:129	Chalk & board / PPT	**1**	R, U

UNIT III NUCLEAR POWER PLANTS						Target Periods: 7
Sl No	**Contents**	**CO Statement**	**Book Reference & Page No**	**Delivery method**	**Delivery Hrs**	**Knowledge Level**

1	Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants	C2.06.3	TB1:311	Chalk & board / PPT	**1**	R, U, An
2	Working of Nuclear	C2.06.3	TB1:319	Chalk & board / PPT	**2**	R, U, A, An
3	Reactors : Boiling Water Reactor (BWR)	C2.06.3	TB1:612	Chalk & board / PPT	**1**	R, U, A, An
4	Pressurized Water Reactor (PWR), CANada Deuterium-	C2.06.3	TB1:610	Chalk & board / PPT	**1**	R, A,
5	Uranium reactor (CANDU), Breeder	C2.06.3	TB1:617	Chalk & board / PPT	**2**	R, U, A,
6	Gas Cooled and Liquid Metal Cooled Reactors	C2.06.3	TB1:615	Chalk & board / PPT	**1**	R, U, A, An
7	Safety measures for Nuclear Power plants	C2.06.3	TB1:620	Chalk & board / PPT	**1**	R, U, A, An

UNIT IV POWER FROM RENEWABLE ENERGY **Target Periods:10**

Sl No	Contents	CO Statement	Book Reference & Page No	Delivery method	Delivery Hrs	Knowledge Level
1	Hydro Electric Power Plants	C2.06.4	TB1:630	Chalk & board / PPT	**1**	R, U
2	Classification	C2.06.4	TB1:648	Chalk & board / PPT	**1**	R, U, A, An
3	Typical Layout and associated components including Turbines	C2.06.4	TB1:640	Chalk & board / PPT	**2**	R, U, A, An
4	Principle, Construction and working of Wind	C2.06.4	TB1:861	Chalk & board / PPT	**1**	R, U, A, An
5	Principle, Construction and working of Tidal	C2.06.4	TB1:883	Chalk & board / PPT	**1**	R, U, A, An
6	Solar Photo Voltaic (SPV),	C2.06.4	TB1:870	Chalk & board / PPT	**1**	R, U, A, An
7	SolarThermal, Geo Thermal	C2.06.4	TB1:850	Chalk & board /	**1**	R, U, A, An
8	Biogas and Fuel Cell power systems	C2.06.4	TB1:841	Chalk & board /	**1**	R, U, A, An

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS **Target Periods:8**

Sl No	Contents	CO Statement	Book Reference & Page No	Delivery method	Delivery Hrs	Knowledge Level
1	Power tariff types,	C2.06.5	TB1:359-364	Chalk & board / PPT	**1**	R, U, A, An
2	Load distribution parameters, load curve	C2.06.5	TB1:364-380	Chalk & board / PPT	**2**	R, U, A, An

3	Comparison of site selection criteria	C2.06.5	TB1:401-408	Chalk & board / PPT	**1**	R, U, A, An
4	relative merits & demerits	C2.06.5	TB1:408	Chalk & board / PPT	**2**	R, U, A, An
5	Capital & Operating Cost of different power plants	C2.06.5	TBI:511	Chalk & board / PPT	**1**	R, U, A, An
6	Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants	C2.06.5	TBI: 580	Chalk & board / PPT	**2**	R, U, A, An

R- Remember, U- Understand, A- Apply, An- Analyze, E- Evaluate & C- Create.

Books:Text/Reference:

S.No		Title of the Book	Author	Publisher	Year
1	**TB1**	Power Plant Engineering	P.K. Nag	Tata McGraw – Hill Publishing Company Ltd.,	2008
2	**RB1**	Power Plant Technology	M.M. El-Wakil	Tata McGraw – Hill Publishing Company Ltd	2010
3	**RB2**	Renewable energy	Godfrey Boyle	Oxford University Press	2004
4	**RB3**	Standard Handbook of Power Plant Engineering	Thomas C. Elliott, Kao Chen and	McGraw – Hill,	1998

Comments Given by the Scrutinizing Committee Members	
Signature of the Scrutinizing	
Signature of the HOD	

UNIT I COAL BASED THERMAL POWER PLANTS
PART A TWO MARKS QUESTIONS AND ANSWERS

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, stream 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 ,erction, 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 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.

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.

13. Mention the two types of feed water heaters in a steam power plant.

(AU (EEE) DEC'10)

(i) Open feed water heater.
(ii)Closed feed water heater.

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.

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.

16. What are the accessories used in a boiler? (AU.(MECH)May'13)

(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.

17. List out the major advantages of high pressure boilers in modern thermal power plants. (AU.(MECH)DEC '12 & DEC'13)

- 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.

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.

19. Define super critical boilers. (AU.(MECH) Nov'07)

Boilers only with economizer and super heater are called super critical boilers.

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.

21. What are types of fluidized bed boilers? (AU.(MECH)DEC'13)

1. Bubbling fluidized bed boilers (BFB).
2. Circulating fluidized bed boilers (CFB).

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.

23. Explain the need of compounding in steam turbines.

(AU (MECH) Apr'03 & Apr'08)

In the simple impulse turbine, the expansion of stream 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

UNIT I COAL BASED THERMAL POWER PLANTS

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]**

2. Explain the following with neat diagram: (i) Benson boiler (ii) Anyone type of cogeneration power plant. **[AU Nov/Dec 2016]**

3. Draw a general layout of thermal power plant and explain the working of different circuits. **[AU APR 2005/MAY 20111/2013]**

4. Describe the working of a high pressure boiler with super heaters. **[AU MAY 2011]**

5. Draw a neat diagram of Lamont boiler and explain its working. **[AU DEC 2005/JULY 2013]**

6. What do you understand by fluidized bed combustion? **[AU MAY 2012]**

7. Write short notes on the requirements of surface condensers **.[AU MAY 2009]**

8. Explain in detail the coal handling system with a suitable block diagram. **[AU MAY 2011]**

9. Describe the different types of over feed stokers and discuss its merits and demerits of each over others. **[AU APR 2008]**

10. Why is coal pulverized? Explain any one type of pulverized systems used now-a-days. **[AU MAY 2012]**

11. With the help of a neat sketch describe the working of any one type of ash handling system. **[AU MAY 2011/MAY 2012]**

12. Differentiate between forced draught and induced draught cooling tower. **[AU MAY 2009/DEC 2012]**

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

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 stoke 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.

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.

13. Name the factors that affect air standard efficiency of Diesel cycle. (AU.Apr'97)

Compression ratio and Cut-off ratio.

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.

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.

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.

17. Mention a few characteristics of Diesel power plant. (AU.(MECH) DEC'12)

i. Diesel power plants are mainly used where high torque is required.
ii. Fuel and fluid characteristics mean that Diesel power plant could be operated with variety of different fuels depending on configuration.
iii. Hybrid possibilities are to combine with other power producing devices.

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.

19. What are the components present in the Diesel electric power plants? (AU.(MECH)Apr'08)

i. Engine
ii. Air intake system
iii. Engine starting system
iv. Fuel system
v. Exhaust system
vi. Cooling system
vii. Lubricating system

20. Name the various types of Diesel engine used for Diesel power plant. (AU.(MECH) May'13)

1. Small size Diesel engine.
2. Medium size Diesel engine
3. Large size Diesel engine.
4.

21. What are the different types of engines used in power generation? State their application domain. (Anna .Univ.(MECH)May'11)

1. Diesel engines
2. Dual engines

22. How is solid injection system classified? (AU.(EEE)June'13)

1. Individual pump and nozzle system
2. Unit injector system
3. Common rail system
4. Distributor system.

23. What are the different types of lubrication system in a Diesel power plant? (AU.(MECH)May'14)

1. Wet sump lubrication
2. Dry sump lubrication
3. Mist lubrication system.

24. What are equipment's of Diesel engine power plant? (AU.(MECH)Nov'07)

1. Pneumatic starter

2. Air compressor
3. Air-conditioning and
4. Coolant circulation pump.

25. What are the methods used for starting a Diesel engine?(AU.(MECH)Nov'07)

1. Starting by an auxiliary engine
2. Use of electric motors or starters
3. Compressed air system

26. What is the basic difference between a Diesel engine and a steam turbine? (AU.(EEE)DEC'12)

The basic difference is that Diesel engine is internal combustion (IC) engine whereas the steam turbine is external combustion engine.

27. Why is the maximum cycle temperature of gas turbine plant much lower than that of Diesel power plant? (AU(MECH)May'09)

Air alone is combusted in gas turbine plant instead of air-Diesel combustion in the Diesel power plant.

28. State the fuels used in the gas turbine power plants. (AU.(EEE)May'11)

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.

29. What are the main units in a gas turbine power plant? (AU (MECH)DEC'13 & (EEE) DEC'11)

1. Compressor
2. Combustion chamber
3. Turbine

30. What are the methods by which thermal efficiency of a gas turbine power plant be improved? (AU.(EEE)May'12 & DEC'12)

1.Intercooling
2.Reheating
3.Regenerator
4.Combination of intercooling reheating and regenerator.

31. What do you mean by regeneration in gas turbine power plant?(AU.(EEE)June'13)

The partial bleeding of steam from the turbine to preheat the air to reduce the fuel consumption and increase the efficiency is called regeneration.

32. How does regeneration improve the thermal efficiency of gas turbine cycle? (AU.(MECH)DEC'14)

Regeneration reduces the energy requirement from the fuel thereby increasing the efficiency of the cycle.

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

PART-B

1. Discuss the essential components of the diesel power plant with neat layout. [AU Nov/Dec 2016]
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]
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]**
4. How do you select engine for a diesel power plant? Draw a diesel power plant and explain its major components **[AU MAY 2014]**
5. Explain the construction and working of gas turbine power plant with a layout **[AU DEC 2013]**
6. Discuss the working of combined cycle power plant **[AU MAY 2011/MAY 2013]**
7. With neat diagram, explain the working principle of the combined MHD and steam open cycle power plant. **[AU NOV 2008]**
8. Discuss the working of combined cycle: power plant. **[AU MAY 2011/MAY 2013]**

UNIT-3 NUCLEAR POWER PLANT

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 fussion 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 bombard 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=Number of neutrons in any particular generation/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)

- 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_2O), water (H_2O), 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 tonuclear fission in the reactor. For example, the gas cooled reactor is with CO_2gas 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 standsfor 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)

- 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:

i. No moderators is required
ii. High breeding is possible.
iii. It giveshigh power density than other reactors.

iv. High efficiency in the order of 40% can be obtained.
v. It has better fuelutilzation.
vi. Absorption of neutrons is low.

Disadvantages:

i. It has to be cooled with liquid sodium.
ii. It is even moree complicated and expensive than a normal reactor.
iii. 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)

i. Neutrons energy
ii. Type of fuel
iii. Type of coolant.
iv. SFR: Sodium Fast Reactor
v. SCWR: Super-Critical Water-Cooled Reactor.
vi. 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)

i. Reactor core
ii. Moderator
iii. Control rods
iv. Reflector
v. Cooling system
vi. Reactor vessel
vii. 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 classifieds?(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 ass fuel.

b) Enriched Uranium reactorin which Uranium used in this reactor contains 5 to 10% ofU^{235}.

(iii) According to the type of coolantused

a) water cooled reactors in which ordinary of heavy water is usedas 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 usd

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.

UNIT-3 NUCLEAR POWER PLANT

PART-B

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]**
2. What is meant by uranium enrichened? Describe some methods of Uraniurn enrichment **[AU JUNE 2010]**
3. Explain the Construction and working of nuclear power plant with a layout**.**
   [AU DEC 2010, 2012, 2013]
   [AU Nov/Dec 2016]
4. Explain the different types of nuclear reactions and initiation of nuclear reactions.
   [AU JUNE 2013]
5. Explain with a neat sketch a boiling water reactor. **[AU DEC 2007,2005/NOV 2007]**
6. Explain the working of pressurized water reactor. **[AU MAY 2011,2014/DEC 2014]**
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 20007]
8. Discuss the various factors to be considered while selecting the site for nuclear power station. **[AU DEC 2014]**

UNIT-4 POWER FROM RENEWABLE ENERGY

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.

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.

3. **For which purposes hydro projects are developed? (AU.(EEE)DEC'13)**
   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.

4. **What is the purpose of using dams? (AU.(EEE)DEC'12)**
   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.

5. **Define Run-off. (AU.(EEE)DEC'13)**
   Runoff is defined as the movement of land water to the ocean mainly in the form of rivers, lakes and streams.

6. **Classify power plants on the basis of traditional use. (AU.(MECH)May'11)**
   i. Concrete gravity dam type hydroelectric power plant.
   ii. Embankment dam type hydroelectric power plant.

7. **List out the important parameters of a turbine. (AU.(MECH)Nov'07)**
   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.
   v.

8. **Give an example for a low heat turbine , a medium head turbine and a high head turbine. (AU.(MECH)Nov'02)**

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.

9. **What are reaction turbines? Give examples. (AU.(MECH)Apr'03)**
   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

10. What is a draft turbine? (AU.(EEE)DEC'10)

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.

11. What is the function of draft tube? (AU.(EEE)DEC'11 & June'13)

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.

12. What are the different types of spill ways? (AU.(EEE)DEC'11)

i. Chute spillway
ii. Stepped spillway
iii. Bell-mouth spillway.

13. Define unit speed of turbine. (AU.Nov'03)

Unit speed is defined as the speed of turbine when working under a unit head.

Unit speed $N_S = N/\sqrt{H}$

14. What is the significance of specific speed of hydraulic turbines? (AU.(MECH) May'09 & May'11)

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.

15. What is a surge tank? (AU.(EEE)May'10)

A surge tank is a small reservoir or tank in which the water level rises or falls to reduce.

16. What is draft tube? In which type of turbine it is mostly used? (AU(MECH) Nov'03 & Nov'04)

The tube which increases the outlet velocity of turbines is known as draft tube. So , the head is saved by fitting a draft tube.

17. What is the necessity if draft tubes? List the types.(AU.(MECH) May'09 & May'11)

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.

Types of draft tube:

Draft tubes are classified into two types.

(i) Straight conical or concentric tube.
(ii) Elbow type
(iii) Moody spreading type

18. Write the function of draft tube in turbine outlet. (AU.(MECH) Apr'05)

1. It allows the turbine to be set above tail-water level without loss of headfor doing the inspection and maintenance.
2. It regains the major portion of the kinetic energy delivered from the runner by the diffusion action.

19. What are the factors to be considered in selecting turbines?
(AU.(MECH)May'14 &(EEE) May'12)

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.

20. On what basis hydraulic turbines are selected? (AU.(MECH).DEC'12)

1. Water availability
2. Water storage
3. Water head
4. Various geological investigations
5. Environmental aspects
6. Consideration of water pollution effects.

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.

22. List any four advantages of wind turbine. (AU.(EEE)DEC'10)

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.

23. What are the advantages of pumped storage plant? (AU.(EEE)DEC'10)

a. It is free from effects of environment pollution.
b. Such plants are readily adoptable to automation as well as remote control.

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.

25. What is the function of flywheel? (AU.Nov'05 & DEC'06)

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 dulling 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
2. 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

- Provides a non-polluting and renewable source of energy.
- Efficient way of energy conversion (saves fuelwood).
- Leads to improvement in the environment, and sanitation and hygiene.
- Provides a source for decentralized power generation.

- Leads to employment generation in the rural areas.
- 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 be 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.

UNIT-4 POWER FROM RENEWABLE ENERGY

PART-B

1. What are the essential elements of hydro power plant? Explain with a neat sketch**.** **[AU NOV 2008/MAY 2011/DEC 2012]**
2. Explain the working of Pelton turbine with a neat diagram. What is the function of a draft tube? **[AU NOV 2012/MAY 2012]**
3. Describe the working of a low head hydro plant with a neat diagram. **[AU DEC 2014]** [AU Nov/Dec 2016]
4. Compare and contrast Kaplan turbine and Francis turbine. **[AU APR 2004]**
5. Discuss various components of wind energy system. **[AU DEC 2014]**
6. Explain with a neat sketch a pumped storage power plant **[AU NOV 2007/MAY 2010, DEC 2012]**
7. Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches. **[AU NOV 2008]**
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]**
9. Explain the construction and working of geo thermal power plant and tidal power plants. **[AU MAY 2011]**
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]**
11. Describe the principle of a fuel cell and discuss the choice of fuels required. **[AU DEC 2013]**
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]**
13. Explain with a neat sketch working of a distributed (Parabolic) trough Solar Power Plant. **[AU DEC 2012]**

UNIT-5 ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

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 rat 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-par tariff
e. Doherty rate or tree 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

C=Constant amount charged to the consumer during each bill period. This charge is independent of demand or total energy.

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.

19. Mention any four methods for calculating depreciation.

- Straight line method
- Sinking fund method
- Diminishing value method
- Net percent value method
- Double sinking fund method.

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.

21. How can be the cost of power generation reduced?

- Periodic maintenance.
- Installing waste heat recovery system.
- Using energy efficient devices such as insulated
- Compressors and insulated turbines.
- Using higher grade fuels.

22. What are the factors that contribute for energy cost?

- Cost of fuel.
- Cost of operating labour.
- Cost of maintenance labour and rnaterials.
- Cost of supplies

23. A. List out four important factors to be considered for the selection of site for power plants,

- 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.

24. What are the different pollutions in the flue gas?

- Oxides of nitrogen
- Oxides of sulphur
- Carbon monoxide
- Particulates.

25. What are the methods used for reduction of SO_2 pollutant?

- Adding lime stone (CaCO) to the coal
- Using wet scrubbers
- Using electro static precipitator.

26. What are the methods used for controlling the NOx?

- Reduction of temperature in combustion zone.
- Reduction of residence time in combustion zone.
- Increase in equivalence ratio in the combustion zone.

27. What is Acid rain?

CO, SO and NO contact the water during rainy season. So, I {SO+ and HNO: acids are formed and mixed with water during rainfall.

28. What is the equipment used to control the particulates?

- Scrubbers
- Cyclone separator
- Fabric filters
- Electro static precipitators.

29. List down the nuclear waste disposal methods.

- Disposal in sea.
- Disposal in land.
- Disposal by reduction process through chemical reaction.
- Disposal by solidification process.

30. What are the various methods followed to transport solid waste?

(i) Wet slurry method: This method uses water slurry to transport the material to the disposal area.

(ii) Pneumatic method: This method uses the air to transport solid wastes to the disposal. area.
(iii) Trucking.
(iv) Rail transport.
(v) Conveyor usually fixed or movable belt conveyor systems is used, and
(vi) Barge uses waterways to transport waste materials.

31. What are operating costs? (AU.(MECH)DEC'12 & May'14)

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.

32. What are the costs involved in fired steam power plant?(AU.Apr'05)

- Maintenance and repairs cost
- Operating labour cost
- Supervision cost

UNIT-5 ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

PART –B

1. Explain the methods to control pollution in thermal and nuclear power plants. **[AU Nov/Dec 2016]**
2. Write an explanatory note on the economics of power generation. **[AU DEC 2014]**
3. What is meant by load factor and diversity factor? **[AU APR 2005]**
4. Elucidate the objectives and requirements to tariff and general form of tariff. **[AU MAY 2013]**
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]**
6. Explain briefly the various methods used to, calculate the depreciation cost. **[AU MAY 2013]**
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]**
8. Explain the analysis of pollution from thermal power plants. What is methods used for control the pollutants?
9. Write short notes on nuclear waste disposal. **[AU APR 2008/NOV 2008]**
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. **[AU Nov/Dec 2016]**

Question Paper Code : 80670

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fifth Semester

Electrical and Electronics Engineering

ME 6701 — POWER PLANT ENGINEERING

(Common to Seventh Semester Mechanical Engineering (Sandwich and Mechanical Engineering))

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you understand by the term boiler draught?
2. Define steam rate and heat rate.
3. What is reheating and regeneration of gas turbine?
4. Name the various "gas power cycles".
5. What is critical mass of nuclear fuel?
6. Why shielding is necessary in nuclear power plants?
7. What is biogas? Give the advantages.
8. List the difference between Francis and Kaplan turbine.
9. What is main objective of tariff?
10. Define plant use factor.

PART B — (5 × 16 = 80 marks)

11. (a) Draw a general layout of steam power plant with neat diagram and Explain the working of different circuits. (16)

Or

(b) Explain the following with neat diagram :

(i) Benson boiler. (8)

(ii) Anyone type of cogeneration power plant. (8)

12. (a) Discuss the essential components of the diesel power plant with neat layout. (16)

Or

(b) (i) Derive an expression for the work ratio using Brayton cycle. (8)

(ii) Discuss the working of anyone type of combined cycle power plant. (8)

13. (a) (i) Explain CANDU(Canadian-Deuterium-Uranium) reactor with neat diagram also mention its merits and demerits. (10)

(ii) Discuss about the safety measures adopted in modern nuclear plants. (6)

Or

(b) Explain the construction and working of nuclear power plant with a layout. (16)

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

(ii) List the advantages and disadvantages of wind Energy system. (4)

Or

(b) Explain the layout of hydroelectric power plant with neat diagram. (16)

15. (a) Explain the methods to control pollution in thermal and nuclear power plants. (16)

Or

(b) (i) Explain site selection criterion of hydro power plant. (8)

(ii) A Peak load on the thermal power plant is 75 MW. The loads having maximum demands of 35 MW, 20 MW, 15 MW and 18MW 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. (8)

Question Paper Code : 27380

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Electrical and Electronics Engineering

ME 6701 — POWER PLANT ENGINEERING

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by super critical boiler?
2. What is pulveriser and why it is used?
3. Mention the major difference between otto cycle and diesel cycle.
4. Why power generation by gas turbine is more attractive than other turbines?
5. List the function of control rods.
6. How do you cater for safety of nuclear power plant?
7. Mention the various advantage of wind power.
8. What are the limitations of tidal power plant?
9. What is the significance of load curve?
10. What are the equipment used to control the particulates?

PART B — (5 × 16 = 80 marks)

11. (a) Write short notes on :
    (i) Ash handling system. (8)
    (ii) Different draught systems. (8)

Or

(b) Explain with a neat sketch the working of a thermal electric power plant station and discuss the function of major components in it. (16)

12. (a) Explain the working of open cycle and closed cycle gas turbine power plant and discuss its advantages and disadvantages. (16)

Or

(b) (i) Explain in detail about the construction and working of IGCC. (10)

(ii) Draw and explain PV and TS diagrams of Brayton cycle. (6)

13. (a) Explain with a neat diagram the various parts of nuclear power plant and mentioning the function of each part. (16)

Or

(b) (i) Explain CANDU reactor with neat sketch. Give its advantages and disadvantages. (8)

(ii) Explain what is chain reaction in connection with a nuclear reactor. (8)

14. (a) (i) Draw a schematic diagram of a hydro plant and explain the operation. (10)

(ii) Write a short note on Bio energy. (6)

Or

(b) (i) Briefly explain solar PV system. (8)

(ii) What are the various kinds of fuel cell and explain the working of anyone? (8)

15. (a) (i) Explain the analysis of pollution from thermal power plants. (10)

(ii) Elucidate the objectives and requirements to tariff and general form of tariff. (6)

Or

(b) (i) Write short note on Nuclear waste disposal. (8)

(ii) A central power station has annual factors as follows. Load factor = 60%, Capacity factor = 40% and use factor = 45%. Power station has a maximum demand of 15,000 KW. Determine the annual energy production, reserve capacity over and above peak load and hours per year not in service. (8)