SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur– 603203.

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

VI SEMESTER

1909608 POWER PLANT ENGINEERING

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Prepared by

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SRM VALLIAMMAI ENGINEERING COLLEGE
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DEPARTMENT OF MECHANICAL ENGINEERING
1909608 POWER PLANT ENGINEERING

UNIT I - COAL 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 (2 Marks)

Q.No.	Questions	BT Level	Competence
1.	Define Compounding of steam turbines.	BT-1	Remembering
2.	List out the factors with which the unit size of the power plant is being decided.	BT-1	Remembering
3.	Explain, What do you understand by the term FBC?	BT-2	Understanding
4.	On what factors does the unit size of a power plant depend?	BT-3	Applying
5.	What is boiler efficiency?	BT-1	Remembering
6.	What is super critical boiler?	BT-1	Remembering
7.	Define supercritical steam cycle.	BT-1	Remembering
8.	Define condenser efficiency and vacuum efficiency.	BT-1	Remembering
9.	What is pass-out turbine and when is it used?	BT-3	Applying
10.	Why thermal power plants are not suitable for supplying fluctuating loads?	BT-3	Applying
11.	Why majority of coal based thermal power plants are located near seashore?	BT-2	Understanding
12.	What is stoker? Classify it.	BT-1	Remembering
13.	Define steam rate and heat rate.	BT-1	Remembering
14.	Define surface and jet condenser.	BT-1	Remembering

15.	What are binary cycles? Give one example.	BT-2	Understanding
16.	List the various types of impurities present in feed water.	BT-1	Remembering
17.	Reason out why cogeneration is quite viable in sugar industries compare to that in other industries.	BT-2	Understanding
18.	What are the requirements of a modern surface condenser?	BT-3	Applying
19.	List out the subsystems of thermal power plant.	BT-1	Remembering
20.	List any two advantages of combined cycles.	BT-1	Remembering
21.	What is the mechanism of pulverized fuel firing system?	BT-3	Applying
22.	State the sources of air leakage in condenser.	BT-2	Understanding
23.	List out the major advantages of high pressure boilers in modern thermal power plants.	BT-1	Remembering
24.	What are the factors affecting cooling of water in cooling tower?	BT-3	Applying
25.	State the advantages of balanced draught system.	BT-2	Understanding

PART - B (13 Marks)

Q.No.	Questions	Marks	BT Level	Competence
1.	Draw the Reheat Regenerative Rankine cycle of a thermal power plant with P-V and T-S diagram. Write its various formulas.	13	BT-3	Applying
2.	Explain with a neat sketch the working of a thermal electric power plant station and discuss the function of major components in it.	13	BT-4	Analyzing
3.	Draw a line diagram of fluidized bed boiler with a neat sketch. What are the advantages of it?	13	BT-4	Analyzing
4.	Draw a neat diagram of Lamont boiler and explain its working.	13	BT-4	Analyzing
5.	Draw a neat line diagram of Benson boiler and discuss its relative merits and demerits.	13	BT-4	Analyzing
6.	With a neat sketch explain the working principle of Loeffler boiler and discuss its relative merits and demerits.	13	BT-4	Analyzing
7.	Describe briefly the pulverized coal firing system and its relative advantages and disadvantages.	13	BT-6	Creating

8.		Explain about the modern ash handling system with a neat block diagram.	13	BT-2	Understanding
9.		Explain the principle involved in the preparation of coal and what are the methods of preparation.	13	BT-2	Understanding
10.		Explain about fuel handling system in coal based thermal power plant with a neat sketch.	13	BT-2	Understanding
11.	(i)	Explain any one of the draught system with a neat sketch.	6	BT-2	Understanding
	(ii)	List out the unique features that make circulating fluidized bed boilers more attractive than other solid fuel fired boilers.	7	BT-1	Remembering
12.		Explain about the cogeneration plant with neat sketch and derive its efficiency.	13	BT-2	Understanding
13.	(i)	What do you understand by the cogeneration of power and process heat? and Explain its thermodynamic advantage.	8	BT-6	Creating
	(ii)	Argue: various steps involved in water treatment.	5	BT-5	Evaluating
14.		Define binary cycle? Explain the layout and operation of the mercury-steam binary cycle power plant?	13	BT-6	Creating
15.		Steam at 10 bar and 0.95 dry is available. Find the final dryness fraction of steam for each of the following operations, using a steam table values. 160 kJ of heat is removed per kg of steam at constant pressure. It is cooled at constant volume till its temperature falls to 140oC. (Vg = 0.5084 m3/kg) Steam expands isentropically in the steam turbine developing 200 kJ of work per kg of steam flow and pressure becomes 0.5 bar. Steam table values:	13	BT-6	Creating
16.		A steam power plant operates on a theoretical reheat cycle. Steam at boiler is 150 bar and 550oC expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550oC and it expands through the low pressure turbine to a condensate at 0.1 bar, draw T-S and h-S diagrams. Find the	13	BT-5	Evaluating

Steam table values (Question 15):

Pressure	hf (kJ/kg)	hfg (kJ/kg)	Vg (m3/kg)
10 bar	762.6	2013.6	0.1943
0.5 bar	340.6	2305.4	0.5084

	Quality of steam of turbine exhaust Cycle efficiency Steam rate in kg/kW hr.			
17.	Discuss about the different types of cooling towers? Explain anyone with a neat sketch.	13	BT-2	Understanding
18.	Differentiate between forced draught and induced draught cooling tower.	13	BT-5	Evaluating
	PART - C (15 Marks)			
Q. No.	**Questions**	**Marks**	**BT Level**	**Competence**
1.	Explain about the natural draught system and derive the equation to determine the height of chimney with a neat diagram.	15	BT-5	Evaluating
2.	Explain in detailed about the Boiler safety management.	15	BT-4	Analyzing
3.	List out the control and supervisory instruments that are provided for the safe and effective operation of a turbine and write short notes about the purpose of each instrument.	15	BT-5	Evaluating
4.	Explain in detailed about the coal based Thermal power stations in Tamil Nadu.	15	BT-4	Analyzing
5.	A steam generator comprises a boiler, a superheater, an economiser and an air preheater. The feed water enters the economiser at 140OC and leaves as saturated liquid. Air is preheated from a temperature of 25 OC to 250 OC. Steam leaves the boiler drum at 60bar, 0.98 dry and leaves the superheater at 450 OC. When using coal with a C.V of 25 MJ/kg, the rate of evaporation is 9 kg steam per kg coal and the air fuel ratio is 15:1 by mass. Neglecting heat losses and pressure drops, estimate the heat transfer per kg fuel in each component and the efficiency of the steam generator. What are the percentages of the total heat absorption taking place in the economiser, boiler and the superheater, respectively? Assume Cp of air and water as 1.005 and 4.2 kJ/kg K, respectively.	15	BT-6	Creating

UNIT-II DIESEL, 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 (2 Marks)			
Q.No.	**Questions**	**BT Level**	**Competence**
1.	What is a diesel engine?	BT-1	Remembering
2.	What are the applications of diesel engine power plant?	BT-3	Applying
3.	What are the different types of engines used in diesel power plant?	BT-2	Understanding
4.	Mention the major difference between otto cycle and diesel cycle.	BT-2	Understanding
5.	What is the duty of the air intake system in a diesel engine power plant?	BT-2	Understanding
6.	Define break thermal efficiency.	BT-1	Remembering
7.	What is cycle? What is the difference between an ideal and actual cycle?	BT-2	Understanding
8.	Draw a P-V and T-S diagram for Otto cycle.	BT-3	Applying
9.	Justify: Auxiliary power consumption of Brayton cycle is almost twice that of Rankine cycle despite the thermodynamic processes adopted are similar.	BT-3	Applying
10.	Show that the efficiency of the Otto cycle depends only on the compression ratio.	BT-2	Understanding
11.	State the four processes of the Dual cycle.	BT-1	Remembering
12.	Draw the P-V diagram and T-S diagram of dual cycle.	BT-3	Applying
13.	List down the various processes of the Brayton cycle.	BT-2	Understanding
14.	Define IGCC.	BT-1	Remembering
15.	Why, the maximum cycle temperature of gas turbine plant much lower than that of diesel power plant?	BT-5	Evaluating

16.	Classify the types of combined cycle plants.	BT-2	Understanding
17.	What are the advantages of combined cycles?	BT-1	Remembering
18.	What is reheating and regeneration of gas turbine?	BT-3	Applying
19.	Mention the methods of improving a simple gas turbine cycle efficiency?	BT-1	Remembering
20.	What are the advantages of closed cycle gas turbine over open cycle gas turbine ?	BT-1	Remembering
21.	What are the applications of gas turbine power plants?	BT-3	Applying
22.	Mention any two drawbacks of a stationary gas turbine power plant for generation of electricity.	BT-3	Applying
23.	What are the pollutants present in the gas turbine exhaust?	BT-1	Remembering
24.	What is integrated gasification combined cycle?	BT-2	Understanding
25.	Point out the term repowering.	BT-1	Remembering

PART - B (13 Marks)

Q.No.	Questions	Marks	BT Level	Competence
1.	Explain about the working process of Diesel power plant with a neat layout of all systems.	13	BT-6	Creating
2.	Write a detailed note on fuel injection system of diesel power plant with a neat sketch of CRDI.	13	BT-4	Analyzing
3. (i)	Explain: how do you select an engine for a diesel power plant and briefly explain its components with a neat sketch?	7	BT-4	Analyzing
(ii)	What are the factors to be considered for selecting the site of a diesel engine power plant?	6	BT-4	Analyzing
4.	A 2-cylinder CI engine with a compression ratio of 13:1 and cylinder dimensions of 200 mm x 250 mm works on two stroke cycle and consumes 14 kg/hr of fuel while running at 300 rpm. The relative and mechanical efficiencies of engine are 65% and 76% respectively. The fuel injection is effected	13	BT-5	Evaluating

	up to 5% of stroke. If the calorific value of the used is given as 41800 kJ/kg. Calculate the mean effective pressure developed.			
5.	An air standard diesel cycle has a compression ratio of 16. The temperature before compression is 27oC and the temperature after expansion is 627oC. Determine network output per unit mass of air, thermal efficiency and specific air consumption in kg/kWh.	13	BT-5	Evaluating
6.	Explain how reheating and regenerating improves the efficiency gas turbine plant P-V & T-S diagram and also its performance characteristics.	13	BT-4	Analyzing
7.	A four stroke diesel engine has a piston diameter of 16.5 cm and a stroke of 27 cm. The compression ratio is 14:3, the cut-off value is 4.23% of the stroke and the mean effective pressure is 4.12 bar. The engine speed is 264 rpm and the fuel consumption is 1.076 kg per hour, having a calorific value of 39150 kJ/kg. Calculate the relative efficiency of the engine.	13	BT-2	Understanding
8.	With an aid of a block diagram, explain the working of open cycle and closed cycle Gas turbine power plant and discuss its advantages and disadvantages.	13	BT-3	Applying
9.	What are the essential features of gas turbine blades? How are the blades are cooled?	13	BT-5	Evaluating
10. (i)	Explain the use of coal in a combined cycle plant.	8	BT-4	Analyzing
(ii)	What is the environmental impact of a combined cycle plant?	5	BT-1	Remembering
11.	How can a combined cycle plant to be used for Cogeneration? What is its thermodynamic advantage?	13	BT-4	Analyzing
12.	Explain in detail about the construction and working of Integrated Gasifier based Combined Cycle (IGCC) with a neat sketch.	13	BT-5	Evaluating
13.	A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 610oC. The isentropic efficiencies of the compressor and turbine are 0.80 and 0.82 respectively.	13	BT-3	Applying

	Calculate the power output in kilowatts of an electric generator geared to the turbine when the air enters the compressor at 15oC at the rate of 16 kg/s. Take Cp = 1.005 kJ / kg K and γ = 1.4 for the compression process and take Cp = 1.11 kJ / kg K and γ = 1.333 for the expansion process.			
14.	Discuss the materials which are used for gas turbines and compressors. What properties should the blade material possesses?	13	BT-5	Evaluating
15.	A 4.5 MW gas turbine generating set operates with two compressor stages. The overall pressure ratio is 9:1. The high pressure turbine drives the compressor while the low pressure turbine drives the generator. The temperature of gases at entry to the HP turbine is 625oC. The exhaust gases leaving the LP turbine are passed through a heat exchange to heat the air leaving the HP stage compressor. The compressors have equal pressure ratios and intercooling is complete between the stages. The air inlet temperature is 20oC. The isentropic efficiency of each compressor stage is 0.8 and that of each turbine stage is 0.85. The heat exchanger thermal ratio is 0.8. Assume a mechanical efficiency of 93% for both power shaft and compressor turbine shaft. Neglecting other losses, compute Thermal efficiency Work ratio of the plant Mass flow rate [Take Cp = 1.0 kJ/kg K, γ =1.4 for air Cp = 1.15 kJ/kg K, γ = 1.33 for exhaust gases]	13	BT-6	Creating
16.	With a neat diagram, explain the working principle of the combined MHD and steam open cycle power plant.	13	BT-5	Evaluating
17.	With a neat diagram, explain the working principle of the thermoelectric - steam power plant.	13	BT-5	Evaluating

18.	Discuss briefly the methods employed for improvement of thermal efficiency of open gas turbine power plant.	13	BT-4	Analyzing
PART - C (15 Marks)				
Q.No.	**Questions**	**Marks**	**BT Level**	**Competence**
1.	Compare Thermal, Diesel, and gas turbine power plants.	15	BT- 4	Analyzing
2. (i)	In a CI engine working on dual combustion cycle, the pressure and temperature at the start of compression 1 bar and 27oC respectively at the end of compression the pressure reaches value of 30 bar. 500 kJ of heat is supplied per kg of air during constant volume heating and pressure become 2.8 bar at the end of adiabatic expansion. Find the ideal thermal efficiency. Take Cp = 1.003 kJ/kg K, Cv = 0.713 kJ/kg K and γ =1.4.	12	BT-6	Creating
(ii)	What are the applications of diesel power plant?	3	BT-1	Remembering
3.	Air enters the compressor of a gas turbine plant operating on Brayton cycle at 101.325 kPa, 27oC. The pressure ratio in the cycle is 8. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume WT=2.5WC, where WT and WC are the turbine and the compressor work respectively. Take γ=1.4.	15	BT-5	Evaluating
4.	Explain the various methods to improve the gas turbine power plant efficiencies with a neat sketch.	15	BT- 4	Analyzing
5.	Discuss the wet sump lubrication system and dry sump lubrication system pertaining to reducing noise a diesel engine.	15	BT- 4	Analyzing

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 (2 Marks)			
Q. No.	**Questions**	**BT Level**	**Competence**
1.	Generalize the fuels used in nuclear power plants.	BT-3	Applying
2.	Define “electron volt” with reference to nuclear power plant.	BT-2	Understanding
3.	List out the important components of a nuclear reactor.	BT-1	Remembering
4.	Describe a chain reaction.	BT-2	Understanding
5.	Give typical examples of control rods.	BT-3	Applying
6.	Describe the functions of control rods in nuclear reactor.	BT-2	Understanding
7.	List out the desirable properties of a coolant.	BT-1	Remembering
8.	Justifying the function of cladding. What are the criteria for selecting cladding?	BT-4	Analyzing
9.	Generalise the factors those are to be considered for the design of a nuclear power reactor.	BT-3	Applying
10.	What do you understand by “Radioactive decay” and “half-life”?	BT-2	Understanding
11.	Define the term “Breeding”.	BT-1	Remembering
12.	What are breeder reactors?	BT-3	Applying
13.	Name the coolants commonly used for fast breeder reactors.	BT-3	Applying
14.	What is nuclear waste?	BT-1	Remembering
15.	Discuss the factors which control the selection of a particular type of reactor.	BT-2	Understanding
16.	Write the comparison between fission and fusion.	BT-6	Creating

17.	Point out the functions of a pressurizer in PWR.	BT-1	Remembering
18.	What is a CANDU type reactor? Explain what is a calendria.	BT-1	Remembering
19.	Why the pressurised heavy water reactor is the preferred reactor in India ?	BT-2	Understanding
20.	What is meant by breeding ratio? Discuss.	BT-1	Remembering
21.	What are the conditions to be satisfied to sustain nuclear fission process?	BT-2	Understanding
22.	What is four factor formula and write the purpose of it.	BT-3	Applying
23.	What is shielding of a nuclear reactor necessary?	BT-2	Understanding
24.	List down the basic factors those are to be considered for the design of a nuclear power reactor.	BT-1	Remembering
25.	How can you cater for safety of nuclear power plant?	BT-3	Applying

PART - B (13 Marks)

Q.No.	Questions	Marks	BT Level	Competence
1.	Explain the following terms. i) Mass number, ii) Atomic number, iii) Mass defect, iv) Binding energy.	13	BT-5	Evaluating
2.	Explain fission and fusion reactions with an example chain reaction? Explain how it is maintained?	13	BT-4	Analyzing
3.	What do you understand by radioactive decay and half-life?	13	BT-5	Evaluating
4.	What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples	13	BT-4	Analyzing
5.	Explain inelastic and elastic scattering. What is logarithmic energy decrement?	13	BT-5	Evaluating
6.	Write short notes about heat transfer and fluid flow in nuclear reactors	13	BT-4	Analyzing
7.	Explain the construction and working of Nuclear power plant with a neat layout.	13	BT-1	Remembering

8.	Explain the working of a typical fast breeder nuclear reactor power plant, with neat diagram. List out the advantages and disadvantages	13	BT-4	Analyzing
9.	Explain the working process of PWR with a neat sketch and distinguish between PWR and BWR	13	BT-5	Evaluating
10.	With the help of a sketch, show all the important parts of nuclear reactor. Describe briefly the functions of each parts.	13	BT-6	Creating
11.	Explain the working principle of a BWR with a neat sketch	13	BT-3	Applying
12.	Generalize the Safety measures for nuclear power plants. And write a short notes on the hazardous effects of nuclear materials.	13	BT-6	Creating
13.	Describe the working principle of gas cooled reactor with a neat sketch and discuss the advantages of it.	13	BT-3	Applying
14.	Explain liquid metal cooled reactors with a neat sketch and discuss the advantages of it.	13	BT-5	Evaluating
15.	Explain the CANada Deuterium- Uranium reactor (CANDU). With a neat sketch and list out the advantages and disadvantages	13	BT-4	Analyzing
16.	Explain radioactive decay and half-life of nuclear fuels and moderating power and moderating ratio.	13	BT-5	Evaluating
17. (i)	Explain with a neat sketch of the vapour type pressurizer system.	7	BT-3	Applying
(ii)	Explain with a neat sketch of the indirect gas cooled reactor.	6	BT-4	Analyzing
18.	Discuss about the safety measures adopted in modern nuclear power plant.	13	BT-5	Evaluating
PART - C (15 Marks)				
Q.No.	**Questions**	**Marks**	**BT Level**	**Competence**
1.	Explain the safety regulation and norms followed in nuclear power plants.	15	BT-6	Creating
2.	Give a detailed note on Nuclear plant site selection and why Tamil Nadu is a safest region?.	15	BT-5	Evaluating
3.	Explain in detailed about the Nuclear power stations in India.	15	BT-4	Analyzing

4.	Give a detailed note on nuclear power plant waste management.	15	BT-4	Analyzing
5.	What is an LMFBR? Why is a liquid metal the preferred coolant in a fast reactor? What is its drawback?	15	BT-6	Creating

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 (2 Marks)

Q. No.	Questions	BT Level	Competence
1.	Define hydrology.	BT-1	Remembering
2.	What are the main components of a Hydel power plant?	BT-1	Remembering
3.	What is spillway?	BT-2	Understanding
4.	Name the methods by which water heads are measured for a layout of Hydel power plants.	BT-1	Remembering
5.	Describe salt gulp method.	BT-1	Remembering
6.	Name some typical components of a wind mill.	BT-1	Remembering
7.	What do you understand by tip-speed ratio?	BT-2	Understanding
8.	List out the advantages of tidal power plants over Hydel power plant?	BT-1	Remembering
9.	What are the limitations of tidal power plant?	BT-3	Applying
10.	Define tidal range (R).	BT-2	Understanding
11.	How are winds formed?	BT-2	Understanding
12.	Mention the various advantages of wind power.	BT-3	Applying
13.	What is a solar cell?	BT-1	Remembering

14.	List the methods of solar energy utilization.	BT-3	Applying
15.	Point out the applications of SPV.	BT-2	Understanding
16.	Give the significance of solar thermal energy.	BT-2	Understanding
17.	What is geothermal energy? Mention its applications.	BT-3	Applying
18.	Classify the different types of geothermal fluids.	BT-3	Applying
19.	What are the forms of geothermal energy stored deeply inside the earth?	BT-3	Applying
20.	Point out the concept of biogas technology.	BT-2	Understanding
21.	List out the methods of solar energy utilization.	BT-1	Remembering
22.	What if fuel cell?	BT-1	Remembering
23.	Explain how a fuel cell works?	BT-2	Understanding
24.	Name the different types of fuel cells.	BT-2	Understanding
25.	What is a FCEV?	BT-1	Remembering

PART - B (13 Marks)

Q.No.	Questions	Marks	BT Level	Competence
1.	A pelton wheel has to be designed for the following specifications. Power to be developed = 6000kW. Net head available = 300 m. Speed=550 rpm. Ratio of jet diameter to wheel diameter = 1/10. Hydraulic efficiency = 0.9. Assuming the velocity coefficient Cv = 0.98 and speed ratio f = 0.46, find (a) the number of jets (b) diameter of each jet (c) diameter of the wheel and (d) the quantity of water required.	13	BT-6	Create
2.	Sketch the layout of hydroelectric power plant and explain the functions of each component in it. List out the advantages and limitations of this plant	13	BT-3	Applying

3.	What are the factors to be considered while selecting a site for hydroelectric power plant and the selection factors of a hydraulic turbine.	13	BT-3	Applying
4.	Sketch and explain the two pool tidal power plant and What are the different types of tidal power plants?	13	BT-2	Understanding
5.	What are the factors to be considered while governing the selection of a suitable type of turbine?	13	BT-5	Evaluating
6.	How are dams classified? What are the factors to be considered in selecting a type of dams?	13	BT-6	Create
7.	Briefly explain the low temperature system with flat plate collector in solar power plant.	13	BT-5	Evaluating
8.	Explain with a neat diagram of wind electric generating power plant and the various types of wind energy system.	13	BT-5	Evaluating
9.	Write down the factors to be considered for selecting site to install wind mills.	13	BT-3	Applying
10.	Explain the construction and working of geo thermal power plant.	13	BT-5	Evaluating
11. (i)	The wind velocity is 10 m/s at 22oC. The turbine diameter is 10 m. The wind machine operates at 35 rpm at a peak efficiency of 40%. Compute the following (i) Total power density of wind stream (ii) Actual power density (iii) Turbine power output.	6	BT-3	Applying
(ii)	Describe the energy generation cycle of 'Single basin single effect' and single basin double effect' systems.	7	BT-4	Analyzing
12.	Enumerate and explain the various types of prime movers used in geothermal energy conversion systems.	13	BT-4	Analyzing
13.	What is a SPV power plant and Explain in detail how power is produced in a SPV power plant and List out the advantages and disadvantages	13	BT-4	Analyzing
14.	Explain the method of power generation using biogas with a neat sketch	13	BT-5	Evaluating
15.	What is a fuel cell? Explain its working using a block diagram and generalised concept of a fuel cell as a power plant.	13	BT-3	Applying

16.	Explain the principle, construction and working of a tidal power plant and List out the advantages and disadvantages.	13	BT-5	Evaluating
17.	Explain the principle, construction and working of a wind power plant and List out the advantages and disadvantages.	13	BT-4	Analyzing
18.	What is meant by pumped storage plant? Discuss its advantage and disadvantages.	13	BT-5	Evaluating
PART - C (15 Marks)				
Q.No.	**Questions**	**Marks**	**BT Level**	**Competence**
1.	List out the future scope for renewable energy power plants in India.	15	BT-6	Create
2.	Explain various renewable energy power plants in Tamil Nadu.	15	BT-4	Analyzing
3.	Write a short note on various geothermal energy systems in India and abroad.	15	BT-4	Analyzing
4.	List out the various government subsidy and schemes for renewable energy plants in India.	15	BT-5	Evaluating
5.	“Solar thermal power cycles can be broadly classified into low, medium and high temperature cycles”. Elaborate this statement with suitable examples and relevant sketches.	15	BT-5	Evaluating

UNIT V - ENERGY, 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 (2 Marks)			
Q.No.	**Questions**	**BT Level**	**Competence**
1.	Define utility factors.	BT-1	Remembering
2.	Define load factor.	BT-1	Remembering
3.	What are chronological load curves?	BT-2	Understanding
4.	Define load curve.	BT-1	Remembering
5.	Draw the load duration curve.	BT-3	Applying
6.	What do you understand by tariff? Mention its types.	BT-3	Applying
7.	How can we calculate the cost of electricity?	BT-3	Applying
8.	How will you describe two part tariff?	BT-2	Understanding
9.	Discuss how power factor can be improved.	BT-2	Understanding
10.	Describe the capital cost of power plant.	BT-1	Remembering
11.	What is financing cost?	BT-1	Remembering
12.	What is operating cost?	BT-1	Remembering
13.	Discuss about flat demand rate.	BT-2	Understanding
14.	Mention the various operating cost of coal fired steam power plant.	BT-3	Applying
15.	Name any two advanced emissions control technologies for coal-fired power plants.	BT-1	Remembering
16.	What is acid rain?	BT-1	Remembering
17.	How ‘smog’ is defined?	BT-1	Remembering

18.	What are the methods used for reduction of SO2 pollutants?	BT-1	Remembering
19.	Define flat rate tariff.	BT-1	Remembering
20.	List the components of fixed cost.	BT-1	Remembering
21.	How the tariff for electrical energy is arrived?	BT-2	Understanding
22.	Compare the significance of two part tariff and three part tariff.	BT-4	Analyzing
23.	What are the equipment used to control the particulates?	BT-1	Remembering
24.	Define "Green House Effect".	BT-1	Remembering
25.	Point out the waste disposal options for nuclear power plant.	BT-4	Analyzing

PART - B (13 Marks)

Q.No.	Questions	Marks	BT Level	Competence
1. (i)	What do you understand by power plant economics? Discuss.	7	BT-2	Understanding
(ii)	Explain the fixed costs and operating costs of a power station.	6	BT-4	Analyzing
2.	Show the elements which contribute to the cost of the electricity and Describe how are they accounted for fixing cost of electricity.	13	BT-6	Creating
3.	A generating stations as a maximum demand (MD) of 14 MW and the daily load curve on the station is as follows, 10pm to 05 am 2500 KW 01pm to 04pm 10000KW 05am to 07 am 3000KW 04pm to 06pm 12000KW ,07pm to 11am 9000KW 06 pm to 08pm 15000KW 11am to 01pm 6000KW 08pm to 10pm 5000KW. Determine the size and the number of generator units, plant load factor, plant capacity factor, use factor and reserve capacity of plant.	13	BT-5	Evaluating
4.	A power station supplies the following loads to the customers. <table><tr><td>Time in hours</td><td>0 to 6</td><td>6 to 10</td><td>10 to 12</td><td>12 to 16</td><td>16 to 20</td><td>20 to 22</td><td>22 to 24</td></tr><tr><td>Load in MW</td><td>30</td><td>70</td><td>90</td><td>60</td><td>100</td><td>80</td><td>60</td></tr></table>	13	BT-5	Evaluating

		Draw the load curve and estimate the load factor of the plant. What is the load factor of a standby equipment of 30 MW capacity if it takes up all loads above 70 MW? What is its use factor?			
5.		A generating station supplies four feeders with maximum demands in (MW) 16, 10, 12, and 7. The overall maximum demand of the stations is 22MW and the annual load factor is 45%. Calculate the diversity factor and number of units generated annually.	13	BT-6	Creating
6.		Calculate the cost of generation per kWh for a power station having the following data: Installed capacity of the plant = 200 MW Capital cost = Rs 400 crores Rate of interest and depreciation = 12% Annual cost of fuel, salaries and taxation = Rs 5 crores Load factor = 50% Also estimate the saving in cost per kWh if the annual load factor is raised to 60%.	13	BT-6	Creating
7.	(i)	Explain the various methods used to calculate the depreciation cost.	7	BT-4	Analyzing
	(ii)	Elucidate the objectives and requirements to tariff and general for of tariff.	6	BT-1	Remembering
8.	(i)	Explain the terms peak load, demand factor, load factor and plant use factor.	7	BT-1	Remembering
	(ii)	What are load curves and load duration curves? Discuss their utility in the economics of generation.	6	BT-2	Understanding
9.		A peak load on the thermal power plant is 75 MW. The loads having maximum demands of 35 MW, 20MW, 15 MW and 18MW are connected to the power plant. The capacity of the plant is 90 MW and annual load factor is 0.55. Calculate the average load on power plant, energy supplied per year, demand factor and diversity factor.	13	BT-6	Creating
10.		A central power plant 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.	13	BT-6	Creating

11.	A power plant has to supply load as follows: <table><tr><td>Time (hrs)</td><td>0-6</td><td>6-12</td><td>12-14</td><td>14-18</td><td>18-24</td></tr><tr><td>Load (MW)</td><td>45</td><td>135</td><td>90</td><td>150</td><td>75</td></tr></table>Draw the load curve, load duration curve and Choose suitable generation units and its operation schedule to supply the load.	13	BT-5	Evaluating
12. (i)	Explain about economics of load sharing between power plants and generators.	6	BT-2	Understanding
(ii)	Compare the operating and capital cost of Thermal and Nuclear power plants.	7	BT-4	Analyzing
13. (i)	Explain the pollution control technologies including waste disposal options for coal power plant.	7	BT-2	Understanding
(ii)	Explain in detail Capital & Operating Cost of different power plants.	6	BT-2	Understanding
14.	Explain the pollution control technologies including waste disposal options for nuclear power plant.	7	BT-2	Understanding
15.	Give short notes on site selection criteria and Explain the merits and demerits.	13	BT-5	Evaluating
16.	Elucidate the objectives and requirements to tariff and general form of tariff.	13	BT-5	Evaluating
17.	A power plant of 210 MW installed capacity has the following particulars.: Capital cost = Rs. 18,000 / kW installed Interest and depreciation = 12% Annual load factor = 60% Annual capacity factor = 54% Annual running charges = Rs. 200 x 106 Energy consumed by power plant auxiliaries = 6% Calculate. (a) the cost of power generation per kWh, and (b) the reserve capacity.	13	BT-5	Evaluating
18.	Write short notes about the effect of load factor on cost per kWh.	13	BT-5	Evaluating

PART - C (15 Marks)				
Q.No.	Questions	Marks	BT Level	Competence
1.	A hydro power plant is to be used as peak load plant at an annual load factor of 30%. The average electrical energy obtained during the year is 750 x 105 kWh. Determine the maximum demand. If the plant capacity factor is 24% find reserve of the plant.	15	BT-6	Creating
2.	Write down the procedure for calculating the power tariff for your home and give a specimen calculation.	15	BT-5	Evaluating
3.	What are the factors to be considered while calculating the operating cost and the running cost? Explain each separately in detail.	15	BT-4	Analyzing

<table>
<tr>
<td>4.</td>
<td>It is proposed to supply a load with a maximum demand of 500 MW and load factor of 70%. Choice is to be made from a nuclear power plant, a hydraulic power plant and a steam power plant. Calculate the overall cost per kWh in case of each scheme as given below:
<table>
<tr><th>S.No</th><th>Cost</th><th>Steam power plant</th><th>Hydro-electric power plant</th><th>Nuclear power plant</th></tr>
<tr><td>1</td><td>Capital cost per MW installed</td><td>Rs. 3 crore</td><td>Rs. 4 crore</td><td>Rs. 5 crore</td></tr>
<tr><td>2</td><td>Interest</td><td>6%</td><td>5%</td><td>5%</td></tr>
<tr><td>3</td><td>Depreciation</td><td>6%</td><td>4%</td><td>5%</td></tr>
<tr><td>4</td><td>Operating cost (including fuel) per kWh</td><td>30 paise</td><td>5 paise</td><td>15 paise</td></tr>
<tr><td>5</td><td>Transmission and distribution cost per kWh</td><td>2 paise</td><td>3 paise</td><td>2 paise</td></tr>
</table>
</td>
<td>15</td>
<td>BT-6</td>
<td>Creating</td>
</tr>
<tr>
<td>5.</td>
<td>Compare the cost analysis of various power plants.</td>
<td>15</td>
<td>BT-5</td>
<td>Evaluating</td>
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