

QUESTION BANK

1. Draw single line diagram for thermal, hydro and nuclear power stations. Discuss in brief various components in each case.
2. What is the meaning of electrical energy sources? Differentiate between conventional and non-conventional electrical energy sources.
3. Discuss about the organization of power sector in India with a block diagram and brief introduction of each section of organization.
4. Differentiate between (i) Maximum Demand and connected load (ii) Maximum demand and peak load (iii) Peak load and base load plant (iv) Mass curve and energy curve.
5. Write short note on: Effect of voltage and frequency on loads.
6. The load curve of an electrical system is given with the following values at different times:

Time	12	2	5	8	5	6	9	12
Load (MW)	20	10	10	50	50	100	100	20

- (i) Plot chronological load curve and load duration curve
 - (ii) Plot energy load curve and mass curve
 - (iii) Find load factor
 - (iv) Find capacity Factor and utilization factor if the station capacity is 125 MW.
7. What is the meaning of term 'load forecasting'? Differentiate between long term and short term forecasting. Discuss in detail different components to be considered while defining short term load forecasting.
 8. What is depreciation reserve? Why is it necessary to maintain it? Discuss the methods to calculate the depreciation charges.

9. Rearrange the following power plants in the descending order of the capital investment and fuel cost: steam stations, hydro stations, diesel stations and nuclear stations.
10. How can most economic power factor be calculated?
11. What is tariff? What are its objectives?
12. Find the power factor of an installation supplying the following loads: 300 kW at unity pf, 1000 kW at 0.9 lagging pf, at 1500 kW at 0.8 lagging pf. Also, find the maximum load at unity pf, which can be supplied by this substation.
13. Why do some power companies put a penalty for low power factor?
14. What considerations govern the selection of sites for steam plants?
15. Discuss the factors, which tend to limit the size of units in steam plants.
16. What is the effect of load factor on unit generation cost?
17. Write short note on, 'Electricity cost reduction'.
18. Discuss the importance of encouraging customers to use electricity during peak hours.
19. Compare the advantages and disadvantages of using a synchronous condenser and a capacitor for power factor improvement.
20. Two tariffs are offered (a) Rs 4000 per month + Rs. 1.0 per kWh (b) A flat rate of Rs. 4.00 per kWh. At what consumption is tariff (a) preferable?
21. Derive expressions for maximum savings when power factor is improved considering: kW demand is constant and kVA demand is constant
22. Compute the generation cost per kWh from the following data:
Installed capacity = 200 MW
Capital Cost = Rs. 45000 per kW
Interest and Depreciation = 12%
Fuel consumption = 0.6 kg per kWh.
Fuel cost = Rs. 1230 per 1000 kg

Other operating costs = 30 % of fuel costs

Peak Load = 170 MW

Load factor = 80 %

23. What is equal incremental cost criterion?

24. Define input-output characteristics, heat rate and incremental cost curves.

25. Discuss the equal incremental cost for deciding Power systems the load allocation between the units of a power plant.

26. Discuss why? Power systems always have some reserve capacity

27. The cost curves of two generating units can be approximated by second order polynomial as under:

$$C_1 = 0.08 P_1^2 + 16 P_1 + 400 \text{ Rs/hour}$$

$$C_2 = 0.04 P_2^2 + 20 P_2 + 600 \text{ Rs/hour}$$

(a) Find the economic generation of each generator for a total load of 150 MW.

The minimum and maximum loads of the units are 20 and 100 MW.

(b) Find the cost per hour if the generators are operated as per above schedule.

28. What is meant by flexibility of operation?

29. What is the significance of no spill rule curve?

30. Why is it necessary to operate run off river plant in combination with a steam plant? How are they operated in rainy season and dry season?

31. Discuss the methods used for computing the generation schedules in a combined hydro thermal system.

32. Write down definition, scope and benefits of cogeneration.

33. Define the term connected load, maximum demand, demand factor and load factor

34. A residence has following connected load:

6 lamps of 100 watt each

6 lamps of 40 watt each

5 fans of 60 watt each

2 power plug points 1000 watt each

4 light plug points 100 watt each

One geyser 3000 watt

The electricity use of on a typical summer day can be described as under:

Lamps: one 100 watt lamp from 5 am to 6 am, 3 lamps each of 100 watt and

3 lamps each of 40 watt from 7 pm to 11 pm.

Fans: Two fans used simultaneously from 8 am to 11 pm

Power plug load: NIL

Light plug load: one point used from 6 am to 8 am 12 noon to 2 pm and 7 pm to 10 pm

Gyser: 9 am to 10 am

Find (i) maximum demand (ii) demand factor (iii) Average load on a typical winter day (iv) monthly consumption of electricity.

35. The use of electricity in the house of problem (mentioned above) on a typical winter day is as under:

Lamps: Two lamps 100 watt each from 5 am to 7 am, three lamps each of 100 watt and two lamps each of 40 watt from 5 pm to 11 pm.

Power Plug: one point used from 5 am to 7 am and 8 pm to 10 pm

Light Plug point: one point from 6 am to 8 am, 12 noon to 2 pm and 7 pm to 9 pm.

Geyser: from 8 am to 10 am

Draw winter chronological load curve for this residence. Find (i) maximum demand (ii) demand factor (iii) Average load (iv) monthly consumption.

36. A large industrial undertaking has a maximum demand of 50 MW at a load factor of 0.5. It has the option of getting supply from utility or of installing its own steam plant.

The costs are as under:

Public Supply tariff: Rs 600 per kW of maximum demand per year + Rs 2.50 per kWh

Private steam plant

Reserve Capacity 20 MW

Capital investment Rs 30,000 per kW

Interest and depreciation 15 %

Fuel Consumption 0.6 kg/kWh

Fuel cost Rs 1400 per 1000 kg

Wages, repair and other operating expenses: Rs 0.80 per kWh

Find out the cheaper alternative.

37. A steam plant is installed at a cost of Rs 2×10^8 . Assuming a salvage value of 15 %, a useful life of 25 years and interest rate 8 %. Find (i) the annual depreciation reserve by straight line method (ii) by sinking fund method (iii) find rate depreciation by fixed percentage method (iv) also find accumulated depreciation at the end of 10th year.

38. Define the following terms with formula (if required):

- (i) Capital cost
- (ii) Annual fixed cost
- (iii) Production cost
- (iv) Annual operating cost
- (v) Annual plant cost
- (vi) Generation cost
- (vii) Straight line depreciation reserve
- (viii) Sinking fund method
- (ix) Fixed percentage method

39. Draw and explain chronological load curves for domestic, Industrial, Commercial, traction, street light and irrigation loads.
40. The annual load duration curve of a small hydro plant shows 438×10^4 kWh of energy during this year. It is a peak load plant with 20 % annual load factor. Find station capacity if plant capacity factor is 15 %. Find reserve capacity of the plant.
41. Discuss why?
- Maximum demand of a group of consumers is always less than the sum of their individual maximum demands.
42. A domestic consumer's monthly consumption of electricity can be approximated as under:
- 5 lamps 100 watt each for 4 hours a day
 - Geyser 2.5 kW for one hour daily
 - Room heater 1 kW for 2 hours daily
- Find his bill for a month of 30 days at the following tariff
- Rs 4.00 per kWh for first 15 units
 - Rs 3.00 per kWh for next 20 units
 - Rs 2.00 per kWh for remaining units
 - 5% discount for prompt payments
43. An industrial consumer has a load of 250 kW at power factor of 0.8 for 8 hours a day and 300 days per year. Calculate his annual payment under each of the following tariffs. (a) Rs 2000 per kVA of maximum demand per year + Rs 2.0 per kWh (b) a flat rate of Rs 3.0 per kWh.
44. Discuss the importance of encouraging customers to use electricity during off peak hours.
45. What is 'spot Pricing'? What is its importance?

46. The annual electricity requirements of an industry are 20000 MWh with a maximum demand of 50 MW. The requirements can be met from a utility charging Rs 800 per kW of maximum demand plus 150 paise per kWh. Alternatively the industry can set up a private steam plant which will have a capacity of 60 MW. The following different plans for setting up the steam plant are available.

	Plan A	Plan B	Plan C
Total capital cost of plant	Rs 19,500 per kW	Rs 20,000 per kW	Rs 20,000 per kW
Station heat rate Kcal/kWh	3500	3000	2600

Taxes 4 %, insurance 0.5%, interest rate 8%. Depreciation rate may be calculated by sinking fund method taking plant life as 20 years. Heat value of coal 5000 kcal/kg, Fuel cost Rs 1400 per 1000 kg, annual salaries, supplies and maintenance are Rs 620000 per year. Compare the different plans by (i) Annual cost method (ii) Present Worth method (iii) Capitalized cost method. Select the optimum plan using each of the three methods.