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Subject = Power Generation & Utilization

Question No 1 : What is meant by electricity tariff, Explain different classes of tariff with example?

Answer 1 :

Electricity Tariff : A tariff is the schedule of rates structured by the supplier for supplying electrical energy to various types of consumers. Tariff consists of two components "variable component" based on the actual unit being consumed "fixed component" based on installed load capacity or maximum demand or both.

Classes of Tariff :

1. Plain Tariff
2. Flat rate Tariff
3. Two part Tariff
4. Three part Tariff

Plain Tariff : In plain tariff it is the cost of electricity units in terms of kWh (1 unit = 1 kWh) actually used by a consumers are charged in the bill and therefore only consists of variable component.

Example : our routine bills i.e fixed price per each unit , it may be for domestic, commercial or for industrial

Flat rate Tariff : Sometimes a supply company may offer a flat rate tariff in certain areas in which case the consumers are charged a fixed amount irrespective of the amount of electricity units they consume.

Example : In Tribal Electric Supply Company (TESCO) of Pakistan charges some groups of consumers on a flat rate in order to discourage theft and to pay back to the government.

Two Part Tariff : when rate of electrical energy is charged on the basis of maximum demand of the consumer and the units consumed, is called two part tariff. Thus two part tariff usually have KVA or KW and variable portion based on the amount of electricity units consumed i.e Tariff = Rs per KVA(KW) + Rs per KWH

Example : This type of tariff is used for large power consumer, let say a consumer have maximu demand of 10 KW which the company gave them on Rs 1000/KW and he consumed more than his maximum demand so for that extra consumption he will be charged extra on per unit price basis.

Three Part Tariff : Three part tariff consists of Fixed part based on KVA or KW , Variable portion based on KWH and maximum demand which varies depending on habit of use of appliances. Maximum demand can be obtained from maximum demand indicator installed on distribution transformer.

Eample : This type of tariff is the charges are split into three components (fixed charge, charge per kW of maximum demand, charge per kWh of energy consumed). Applied to big consumers include interest, depreciation on the cost of secondary distribution and labor cost of collecting revenues.

Question No 2 : Define Load Factor, Diversity Factor, Pant Capacity Factor and Plant Use Factor?

Answer 2 :

Load Factor : The ratio of Average load to maximum or peak load.

It play an important part on the cost of generation per unit. The higher the load factor the lesser will be the cost of generation for the same maximum demand.

Load Factor = Average Load / Maximum Load

Diversity Factor : The ratio of the sum of maximum demands of the individual consumers and simultaneous maximum demand of the whole group during a particular time.

Diversity Factor = Sum of individual maximum demand/simultaneous maximum demand at given time

Plant Cpacity Factor : The ratio of actual energy produced in kilowatt hours (kwh) to the maximum possible energy that could have been produced during the same period.

Plant Capacity Factor = Average Load x 24 / Plant Capacity x 24 = Average Load / Plant Capacity

Plant Use Factor : The ratio of energy produced in a given time to the maximum possible energy that could have been produced during the actual number of hours the plant was in operation. It shows the extent to which the plant capacity is used to meet the peak demand.

Plant Use Factor =

Annual energy produced / Capacity of plant x No. of hours plant in operation during year.

Question No. 3 :

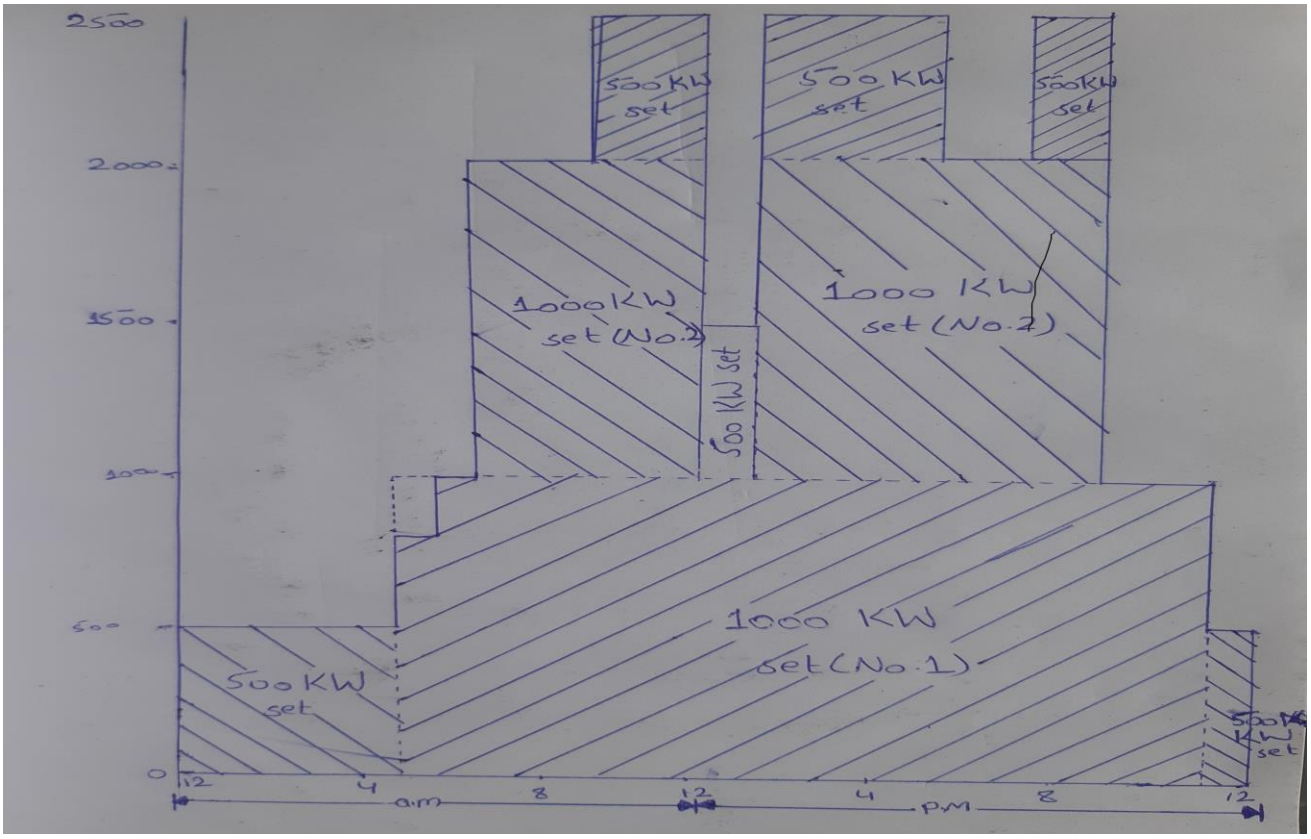
A. A power station has to supply load as follows:

Timings	KW
11 pm to 5 am	500
5 am to 6 am	750
6 am to 7 am	1000
7 am to 9 am	2000
9 am to 12 noon	2500
12 Noon to 1 pm	1500
1 pm to 5 pm	2500
5 pm to 7 pm	2000
7 pm to 9 pm	2500
9 pm to 11 pm	1000

For the given data above draw the load curve. Select the number and size of generator units to supply this load. Find the reserve capacity of the plant required. Calculate the plant capacity factor. Determine the operating schedule of the units in the station. Calculate the plant factor?

Answer 3 :

Load Curve



From the load curve we can see that three generator sets will suffice with the following ratings

Two sets each of 1000 KW capacity

One set of 500 KW capacity

Reserve capacity required will correspond to the largest size of the unit in the station. In this case a set of 1000 KW will have to be bought and kept as reserve. The total installed capacity of the station will therefore be, 1000 + 1000 + 500 + 1000 (reserve) = 3500 KW

Plant Capacity Factor?

Plant capacity factor = Energy produced during 24 hours (KWH) / Installed capacity (KW) x 24 hours

Energy generated during 24 hours =

(500 x 5) + (750 x 1) + (1000 x 1) + (2000 x 2) + (2500 x 3) + (1500 x 1) + (2500 x 4) +(2000 x 2) + (2500 x 2) + (1000 x 2) + (500 x 1) = 38,750 KWh

Plant capacity factor = 38750 / 3500 x 24 = 0.46 or 46%

Operating schedule of units in the station :

From the load curve the energy that could have been generated by the capacity of plant actually running for the scheduled time would be

(500 x 6) + (1000 x 2) + (2000 x 2) + (2500 x 3) + (1500 x 1) + (2500 x4) + (2000 x 2) + (2500 x 2) + (1000 x 2) = 39,000 kWh

Energy actually produced = 38750 KWh

Plant Use Factor?

Plant Use Factor = Energy Produced (KWh) / Capacity of plant (KW) x No. of hours plant in operation

Plant Use Factor = 38750 / 39000 = 0.994 or 99.4%