NAME: FAWAD REHMAN
ID: 5053
PAPER: POWER GENERATION
INST: ENGR. SANAULLAH AHMED
DATE: 20/08/2020

Question No 1.
Answer:

Electricity tariff:

→ The electricity generated is to be supplied to the consumers, the total cost of generation and profit as to be recovered from the consumers. the rate of energy sold to the consumers depend on the type of consumers as domestic, commerical and industrial.

→ Several different factors helps determine the electricity tariff that is applied in a given locality.

→ The rates depends upon the total energy consumed and the load factor of the consumer.

→ The tariff (energy rates) chosen should recover the fixed cost, operation cost and profit etc. incurred in generating the electrical energy.

→ In power system tariff is charged in a form of bill on monthly basis.

Classes/Types of Tariff:

- Tariff may be a plain, two or three part.
- Two and three part tariff consist of two components;
- Variable component, based on the actual unit being consumed.
- Fixed component, based on installed load capacity or maximum demand or both.
- In a plan tariff it is the cost of electricity units in terms of KWh (1 unit = 1 KWh) actually used by consumers are charged in the bill and therefore only consists of variable component.
- The units in terms of KWh are registered by the energy meter installed at consumer premises.
- 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. this is not very common in pakistan, but the tribal Electric supply company (TESCO) of Pakistan charges some groups of consumers on a flat rate in order to discourage theft and to payback to the government.

Two part tariff:

→ Cost of the electricity supplied to consumers may be divided into fixed cost and running cost.

→ Two part tariff consist of fixed and running cost for large power consumer two part tariff is imposed. fixed cost may vary from consumer to consumer and may based on appliances connected to supply.

→ 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.

THREE PART TARIFF:

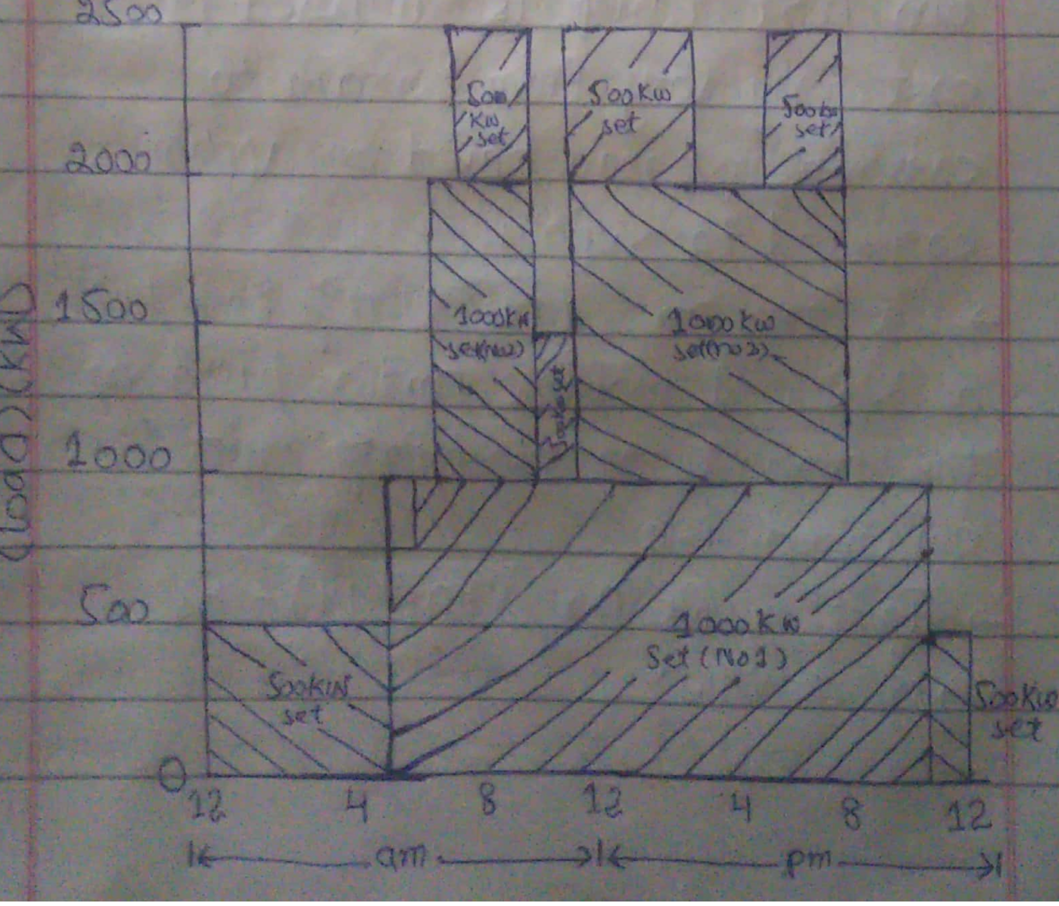
→ Three part tariff consists of fixed part based on KVA or KW, Variable portion based on KWH and maximum demand which varies depending on habit of use of appliances.

→ Maximum demand can be obtained from maximum demand indicator installed on distribution transformer.

→ Tariff = Rs per KVA(KW) + Rs per KWH + Rs per KW maximum demand.

Question No 2.

Solution: Load Curve:



→ Here the maximum demand is 2500KW. If water resourses were not avaible in the vicinty, the plant would normally be diesel-electric. for a privately owned plant it could be a steam station of local conditions were suitable. the method and considerations for the selection of size of generating are, however common to all types of station so far as fitting in the load curve is concerned.

Energy generated during 24-hrs.

$= (500\times5)+(750\times1)+(1000\times1)+(2000\times2)$
$+(2500\times3)+(1500\times1)+(2500\times4)$
$+(2000\times2)+(2500\times2)+(1000\times2)+(500\times1)$

$= 38,750$ KWh.

Maximum demand $= 2500$ KW

Note:

$$\text{Load Factor} = \frac{\text{Energy Generated during 24hrs}}{\text{Maximum demand} \times 24\text{hrs}}$$

$$= \frac{38,750}{2500\times24}$$

$\Rightarrow 64.7\%$

→ From the nature of load curve, It will be seen that this is the load of a small industrial twon. well distributed during day and night. From the load curve it will also be seen that three generator sets will suffice with the following ratings.

Two sets each of 1000 KW capacity
one set of 500 KW capacity

→ The 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+500+1000 (reserve). i.e 3500 KW

→ Plant capacity Factor = $\frac{\text{Energy produced during 24hrs}}{\text{Installed capacity (KW)} \times 24\text{hrs}}$

$$= \frac{38,750}{3500 \times 24}$$

$\Rightarrow$ 0.46 or 46 %

→ The capacity of the individual set is chosen as far as possible to fit approximately the load curve. Next it should be decided how, when and in what sequence the set should be started and run. this arrangement is known as the operating schedule of the station. In arranging this schedule, care is taken to see that the plant of the required capacity is kept ready for loading at the expected time of the load. the capacity of the plant started and kept ready might be larger than necessary but should not be inadequate.

→ The operating schedule can be arranged as follows;

- From 11 p.m to 5 a.m only the 500 KW set is run.
- At 5 a.m the load is expected to increase. the first 1000 KW set is, therefore started and paralleled with the 500 KW set, all the load is transferred to the 1000 KW set, and then the 500 KW set is stopped.

- Thus one set of 1000KW is run from 5 am to 7 a.m taking up the necessary load.
- Just before 7 a.m when an increase in load is expected, the second 1000 KW set is started and parallel with the first one.
- From 7 a.m to 9 a.m both the 1000 KW sets are running together.
- At 9 am still more load is expected 500 KW set is started and parallel with the other sets on the busbars and loaded along with them, thus at the time of supplying the maximum load, b/w 9 a.m and 12 noon, all the three sets are running on full load.
- Between 12 noon and 1 p.m the load decreases, owning to recess-lunch time - in industrial plants. One of the 1000 KW sets is stopped after the load has dropped to 1500 KW.
- From 1 p.m to 5 p.m this set is run again along with the two others.
- At 5 p.m to 7 p.m only both the 1000 KW sets are running.

- At 7 p.m the load increases, owning to lighting and all the three sets are run till 9 p.m.
- At 9 p.m two set are taken out and only one 1000 KW is run until 11 p.m.
- After 11 p.m only 500 KW set need be run.
- At each time of change-over, care should be taken to ensure correct paralleling and load transfer.

→ With operating schedule fixed as above, the energy that could have been generated by the capacity of plant actually running for the scheduled time would be

$= (500 \times 6) + (1000 \times 2) + (2000 \times 2) + (2500 \times 3) + (2500 \times 1) + (2500 \times 4) + (2000 \times 2) + (2500 \times 2) + (2000 \times 2) = 39{,}000$ KWh

Energy actually produced = 38,750 KWh

$$\text{Plant use factor} = \frac{\text{Energy produce (KWh)}}{\text{capacity of plant (KW)} \times \text{No of hrs Plant has been in operation}}$$

$$= \frac{38{,}750}{39{,}000} \Rightarrow 0.994 \text{ or } 99.4\%$$

Question No 3.

Solution:

* Industrial:

Maximum demand = 2400

Load factor = $\frac{1420}{2400}$ = 0.59 or 59.1%

Diversity Factor = $\frac{210}{2400}$ = 0.08 or 8.75%

Class contribution factor = $\frac{100}{2400}$ = 0.04 or 4.1%

---

* Residential:

Maxim demand = 2400

Load factor = $\frac{1470}{2400}$ = 0.61 or 61.2%

Diversity Factor = $\frac{255}{2400}$ = 0.10 or 10.6%

CCF = $\frac{100}{2400}$ = 0.04 or 4.1%

---

* Commercial:

M.D = 3600

L.F = $\frac{2255}{3600}$ = 0.62 or 62.6%

D.F = $\frac{275}{3600}$ = 0.076 or 7.63%

CCF = $\frac{150}{3600}$ = 0.04 or 4.16%

"The End"