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REG.No:_13788_________

Power Generation

Assignment 1

Question No 1 *(CLO -1)* **_20_**

A. A 100kVA distribution transformer costs Rs 2,00,000 and has an estimated useful life of 20 years. Find the annual depreciation amount, assuming that the scrap value of the transformer to be Rs 10,000.

B. The average demand of a consumer is 40 A at 230 volts at unity power factor His total energy consumption annually is 10,000 KWh. If the unit rate is Rs 2 per kWh for the first 500hours use of the demand per annum plus Re 1 for each additional units, Calculate the annual bill of the consumer and equivalent flat rate.

Question No 2 *(CLO-2)* **_10_**

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?

Q1.- A 100 KVA distribution T/f Costs Rs 2,00,000 and has an estimated useful life of 20 year find the Annual depreciation amount, Assuming that the Scrap value of the T/f to be ~~RS~~ Rs, 10,000.

Given Data.

P= 2,00,000. initial Cost of Equipment.
S= 10,000. Scrap value After the useful
N= 20 Year. useful life of Equipment in Year.

find

Annual depreciation Amount, D.

given Formula

$$D = \frac{P-S}{n}$$

Solution:

$$\text{Depreciation } D = \frac{\text{initial cost of Equipment} - \text{Scrap value}}{\text{useful life of Equipment in Year.}}$$

$$D = \frac{2,00,000 - 10,000.}{20}$$

$$D = \frac{190,000}{20}$$

D = 9500 Annually.

Q3. The Average Demand of a Consumer is 40A at 230volts at unity power factor His total energy Consumption Annually is 10,000 Kwh.
if the unit rate is Rs 2 Per 1Kwh for the first 500hours use of the Demand per Annum plus Re 1 for each additional unit, Calculate the Annual bill of the ~~Ammount~~ Consumer and equivalent flat rate?

Given Data.

~~Energy~~ E=10000 Energy Consuption Annualy KWh.
I=40Amp Demand of Consumer Current.
~~Voltage~~ V=230volts. at unity power factor.

Solution

power Demand of the Consumer is P=VI CosQ
=230×40×1
=9200 W/Converting in Kw.

$$= \frac{9200}{1000} = 9.2\text{Kw.}$$

Electricity Consumption for the ~~8~~ first 500 hours is
500×9.2 = 4600 Kwh.

Since the Cost of Electricity is Rs 2 Per Kwh of For the first 500hours, ~~R~~.
There fore the Consumer has to pay: 4600×2=Rs 9200
for the remaining units that is (10,000−4600)
= 5400 Consumer has to pay. 5400×1Rs 5400.
⇒ Annual bill is There fore: 9200+5400=Rs 14,600
⇒ ~~The~~
⇒The flat rate ~~Equipment~~ equivalent is
14600/10,000
Rs=1.46 Per KWh.

Question No#2.

A. Apower station has to supply Load as Follows.

Timings	KW
11pm to 5am	500
5am to 6am	750
6am to 7am	1000
7am to 9 am	2000
9am to 12noon	2500
12noon to 1pm.	1500
1pm to 5pm	2500
5pm to 7pm	2000
7pm to 9pm	2500
9pm 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 reverse Capacity of the plant require.
Calculate the plant Capacity factor.
Determine the operating Schedule of the units in the station.
Calculate the plant factor?

Solution:

figure 2.1 is a Load Curve plotted from the Above Data.
The Maximum Demand is 2500 KW.
If water resources were not Available in the vicinity. The plant would normally be Diesel electric.
For a privately owned plant is Could be a steam station if Local Conditions where Suitable.

The Method and Considerations For the selection of Size of generating units are. however, Common to all Types of stations So far as fitting in the Load Curve is Connected.

Energy generated During 24 hours.

$= (500 \times 5) + (750 \times 1) + (1000 \times 1) + (2000 \times 2) + (2500 \times 3)$
$+ (1500 \times 1) + (2500 \times 4) + (2000 \times 2) + (2500 \times 2) + (1000 \times 2) + (500 \times 1)$
$= 38,750$ Kwh.

Maximum demand = 2500 Kw.

$$\text{Load factor} = \frac{\text{Energy generated during 24 hour}}{\text{Maximum Demand} \times 24 \text{ hours}}$$

$$= \frac{38,750}{2500 \times 24} = 64.7\%$$

from the nature of load Curve. it will be seen that this is the Load of a small industrial Town. 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 1000KW Capacity
one set of 500 KW Capacity.

The reverse Capacity required will Corresponed to the largest Size of the unit in the station.

in this Case a set of 1000kw. will have to be bought and kept as reverse. The Total installed Capacity of the station will There fore, be 1000+1000+500+1000 (reverse) i.e 3500 Kw

Plant Capacity Factor = $\frac{\text{Energy produced during 24 hours (Kwh)}}{\text{installed Capacity (Kw)} \times 24 \text{ hours}}$.

$= \frac{38,750}{3500 \times 24} = 0.46$ or 46%

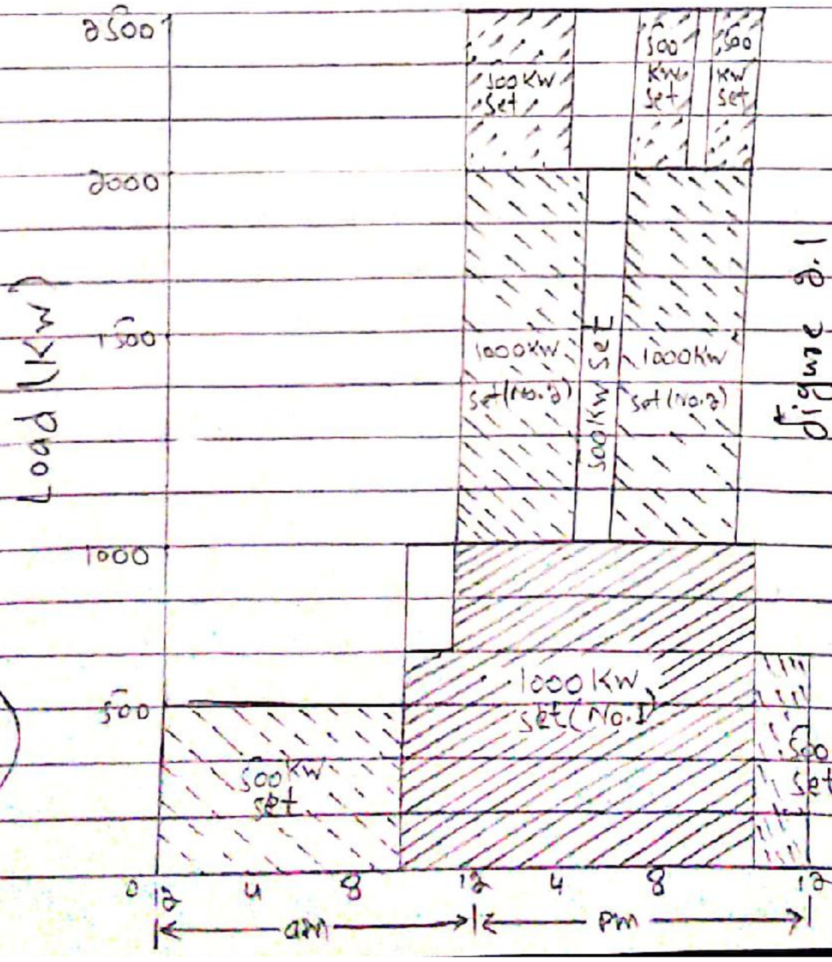

figure 2.1 Load Curve of a power station.

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The Capacity of the individual sets is chosen as far as possible to fit Approximately the Load Curve.

nent it should be decided now. when and in what Sequence the sets should be started and run.

The Arrangement is Known as the operating schedule of the station.

In arranging this a Schedule, Care is taken to see that the plant of the require Capacity is Kept ready for loading at the enpected time of the Load.

The Capacity of the plant started and Kept ready might be larger then necessary but should not be inadequate.

which the Type of Load Curve figure 9.1 and the Sizes of units selected as above the operating schedule can be Arranged as follows.

From 11 pm to 5am only the 500 Kw Set is run.

At 5am the Load is enpected to increase. The first 1000 Kw set is therefore started and parallel 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 1000 Kw is run from 5am to 7am Taking up the neccessary Load.

Just before 7am when an increase in Load is enpected, The second 1000 Kw set is started ~~and parallel~~

and paralled with the first one.

From 7am to 9am both the 1000 Kw sets are running together.

At 9am still more load is expected, The 500 Kw set is started and paralled with the other set on the busbars along with them.

Thus at the Time of supplying the Maximum Load, between 9am and 12 noon. all the three sets are running on full Load.

between 12 noon and 1 p.m the load decrease owing to recess-Lunch-Time-in inductrial plant.

one of the 1000 Kw sets is stopped After the has dropped to 1500Kw.

from 1pm to 5pm this set is run again along with the Two other.
At 5pm the load again drops, owing to the working shif inductries being over.

The Load on the 500Kw set is removed and then this set is Taken out of Commission.

From 5pm to 7pm. only both the 1000 Kw sets are running.
At 7pm the load increases owing to lighting and all the three sets are run until 9pm.

Timing

At 9pm Two sets are Taken out and ~~a~~ Only one 1000 Kw is run untill 11 Pm.

After 11pm. Only the 500Kw set need be run.

At each Time of change-over Care should be Taken to ensure Correct parallelling and Load Transfer.

~~with~~ with the operating Schedule Fixed as Above the energy that could have been genrated by the Capacity of plant actually running for the Scheduled Time would be.

$$(500\times6)+(1000\times2)+(2000\times2)+(2500\times3)+(1500\times1)$$
$$+(2500\times4)+(2000\times2)+(2500\times2)+(1000\times2)=$$
$$=39{,}000\ \text{Kwh}.$$

Energy Actually produced = 38750Kwh.

$$\text{Plant the Factor} = \frac{\text{Energy Produced(Kwh)}}{\text{Capacity of plant(Kw)} \times \text{Number of hours plant has been in operation}}$$

$$= \frac{38750}{39{,}000} = 0.994 \text{ or } 99.4\ \%$$