IQRA National University, Peshawar
Department of Electrical Engineering
Spring20
Power Generation
Assignment 1

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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?

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Q 1:

(A): A 100kVA distibution Transformer Cost Rs, 2,00,000 and has an estimated useful life of 20 years, find The anual depricatien amount, assuming That The Scrap value of The Transformer to be Rs 10,000.

Given Data:
$P = 200000$

$S = 10,000$
$N = 20$ years

Deprication $D = (P-S)/n$

$$D = \frac{200000 - 10000}{20}$$

$$D = \frac{190,000}{20} = \boxed{9,500 \text{ annually}}$$

$$D = \boxed{9,500 \text{ annually}}$$

B) . The Average demond 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 demond per annum plus Re 1 for each additional units Calculate annual bill of The consumer and equivalent flat rate.

Given:

Energy: E 1000 KWh
Current: 40A
Voltage: v. 230 volts

The power demand of the consumer is: P = VI cosQ = 230 × 40 × 1 = 9200 W or 9.2 KW.

Electricity consumption for the first 500 hours is: 500 × 9.2 = 4600 Kwh

Since the cost of electricity is Rs 2 per kwh of for the first 500 hours, therefore the consumer has to pay:

4600 × 2 = R9200

For the remaining units, that is: (10,000 - 4600) = 5,400, consumer has to pay 5400 × 1 Rs5400

Annual bill is therefore: 9200 + 5400 = Rs 14,600.

The flat rate equivalent is: 14600/10,000 = Rs 1.46 per Kwh.

$$\boxed{1.46 \text{ Per kwh}}$$

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Q NO 2 A Power Station supply load as fellows

Timing	kw	Timing	kw
11 pm to 5 a.m.	500	5 pm to 7am ~~7pm~~	2000
5 am to 6 am	750	7 pm to 9 pm	2500
6 am to 7 am	1000	9 pm to 11 pm	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		

Solution: Figure R·1 is a load curve ploted from the above data. The maximum demand is 2500 Kw. If water resources were not availble in the vicinity, the plant would normally be diesel-electric, For a privately owned plant ic could be a stream station if local conditions were suitable. The method and considerations for the selections of size of generating units are, however, common to all types of stations so far as fitting in the load curve is concerned.

Energy generated during 24 hours

$= (500\times5) + (750\times1) + (1000\times1) + (2000\times2) + (2500\times3$
$+ (1500\times1) + (2500\times4) + (2000\times2) + (2500\times2) +$
$(1000+2) + (500\times1) = 38,750\text{ KWh}$

Maximum demand = 2500 KW

$$\text{Load factor} = \frac{\text{Energy generated during 24h}}{\text{maximum demand}\times24\text{ hours}}$$

$$= \frac{38,750}{2500\times24} = 64.7\%$$

From the nature 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 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 + 1000 + 500 + 1000 (reserve), i.e 3500 KW

$$\text{plant capacity factor} = \frac{\text{Energy produced during 24 hours (KWh}}{\text{Installed capacity (KW)} \times 24 \text{ hou}}$$

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

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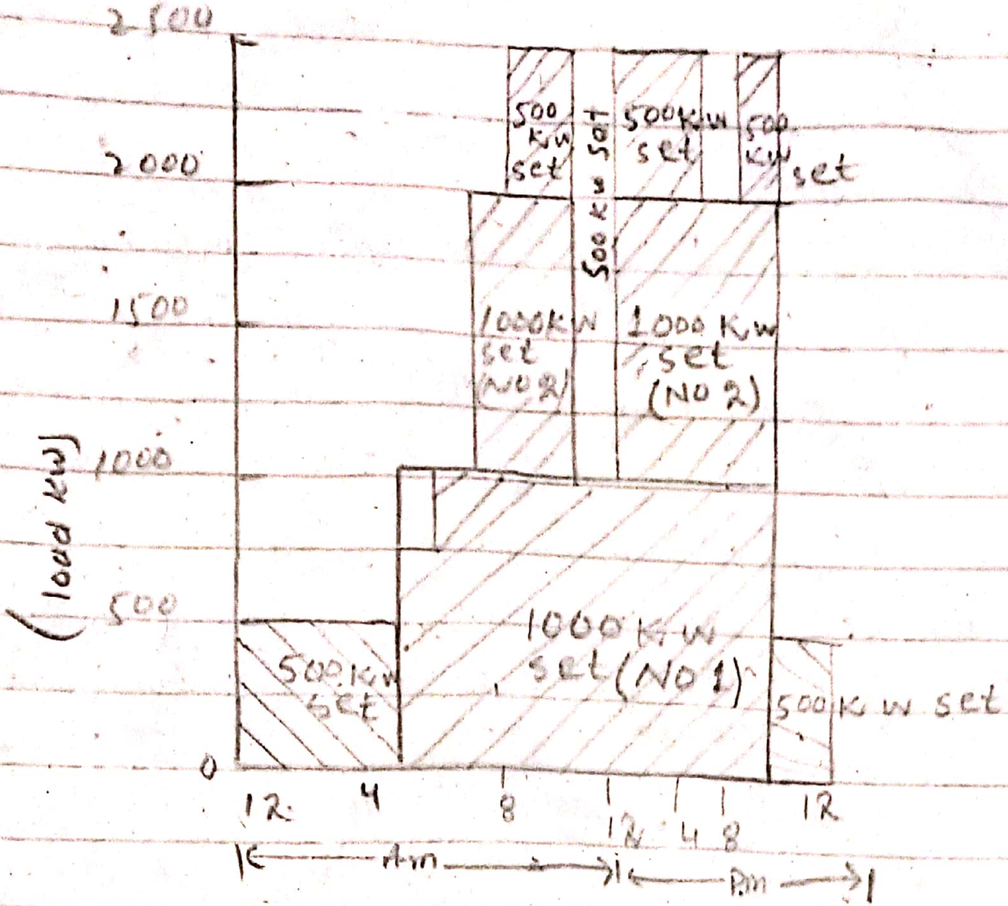
2500
2000
1500
1000
500
0
(1000 KW)
500 KW set
500 KW set
500 KW set
500 KW set
1000 KW set (NO 2)
1000 KW set (NO 2)
1000 KW set (NO 1)
500 KW set
500 KW set
12
4
8
12
4
8
12
Am
Pm

2.1 Figur

The capacity of the individual sets is chosen as far possible to fit apporimately the load curve. Next it should be decided how, when and in what sequence the sets 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 with the type of load curve shown in figure 2.1 and the sizes of units selected as above. The operating schedule can be arranged as follows from 11 pm to 5 am 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 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 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 paralleld with the

first one.
From 7a.m to 9.am both the 1000kw sets are running together. At 9.am still more load is expected, the 500kw set is started and paralleled with the other on the busbars and loaded along with them. Thus at the time of supplying the maximum load between 9a.m and 12 noon, all the three sets are running on full load. between 12 noon and 1p.m the load decrease owing 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 5p.m, this set is run again along with the two others.
At 5P.m. the load again drops owing to the working shift in industries being over. the load on the 500kw set is removed and then this set is taken out of commission.
From 5p.m to 7 P.m only both the ~~load~~ 1000 kw sets are running.
At 7p.m the load increases, owing to lighting and all the three sets are run until 9 p.m.
At 9 p.m two sets are taken out and only one 1000 kw is run until 11pm
After 11 p.m. only the 500 kw set needed be run.
At each time of change-over, care

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Care should be taken to ensure correct paralleling and load trasfer.
with the 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
(500×6)+(1000×2)+(2000×2)+(2500×3)+(1500×1)
+(2500×4)+(2000×2)+(2500×2)+(1000×2)
= 39,000 Kwh
Energy actually produced = 38,750 Kwh

$$\text{Plant use factor} = \frac{\text{Energy produced (Kwh)}}{\text{Capacity plant (Kw)} \times \text{number of hours plant has been in operation}}$$

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

The End