IQRA National University, Peshawar
Department of Electrical Engineering

Spring20

Power Generation

Assignment 1

Name: ABDUL BASIT

REG.No: 13684

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?

Name:- Abdul-Basit

ID 13684

Question No 1 (A).

Given that:-

$P = 200000$

$S = 10,000$

$N = 20$ years.

Required

D = Depreciation = ?

Sol

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

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

$= 9500$ annually.

Name:- Abdul-Basit

ID :- 13684.

Question No 1(B).

Given

Energy = E = 10000 KWH

Current = I = 40A.

Voltage = V = 230 volts.

Solution:-

* Power demand of consumer = $P = VI\cos\theta$

$= 230 \times 40 \times 1 = 9200W$ or $9.2 KW$.

* Electricity Consumption = $500 \times 9.2 = 4600 kwh$.

* the cost of electricity is Rs 2 per kwh of for the first 500 hours = $4600 \times 2 = 9200$

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For the remaining unit that is (10,000 - 4600)
= 5,400 Consumer has to pay 5400×1/=
5400

Annual bill is there fore 9200 + 5400 = Rs 14600
The flat rate equivalent is = 14600/10,000
= Rs. 1.46 per Kwh.

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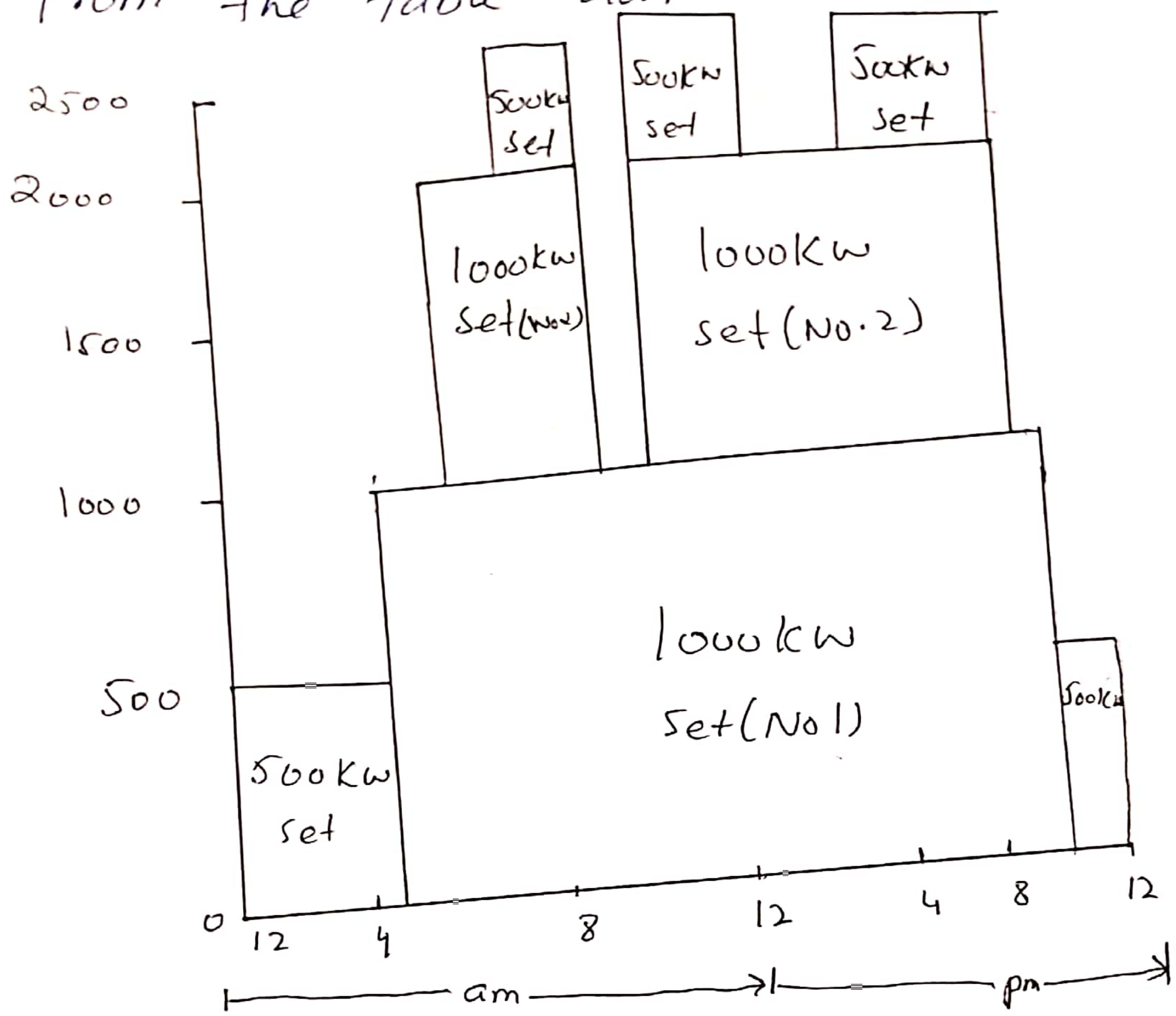
Question 2

In the table the load curve plotted from the table data.



The maximum demand is 2500kW. If water resource were not available in the vicinity the plant would normally be disel-electric.

* Energy generated during 24 hrs.

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

$= 38,750 \text{ kWh}$

Maximum demand = 2500kW

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

$$= \frac{38,250}{2500 \times 24}$$

$= 64.7\%$

From the nature of load curve, it will be seen that this the load of a small industrial town well distributed during day and night.

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Two set each of 1000 KW capacity
One set of 500KW Capacity.

The total installed capacity of the station will, therefore be 1000+1000+500+1000
35 KW.

Plant capacity factor = $\dfrac{\text{Energy Produced during 24 hours (KWh)}}{\text{Installed capacity (KW)} \times 24 \text{ hrs}}$

$= \dfrac{38,760}{3500 \times 24} = 0.46$ or 46%

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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

$(500\times 6) + (1000\times 2) + (2000\times 2) + (2500\times 3) + (1500\times 1) + (2500\times 4) + (2000\times 2) + (2500\times 2) + (1000\times 2) = 39000\,\text{kWh}$

Energy actually produced $= 38{,}750\,\text{kWh}$.

$$\text{Plant use factor} = \frac{\text{Energy Produced (kWh)}}{\text{Capacity of plant (kW)} \times \text{Number of hours}}$$

$$= \frac{38{,}750}{39000} = 0.994 \text{ or } 99.4\%$$