IQRA National University, Peshawar
Department of Electrical Engineering

Spring20

Power Generation

Assignment 1

Name:M.Saqib Khalil____

REG.No: 13343

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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Question #1

(a):-

Given data:

$P = 2,00,000$ Rs

$S = 10,000$ Rs

$n = 20$ Years

To find:

Depreciation (D) = ?

Solution:-

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

$$D = \frac{2,00,000 - 10,000}{25}$$

$$D = \frac{190,000}{25}$$

D = Rs 9,500 Answer.

Q#1 (b)
Given data:

current (I) 40 A
Energy (E) 10,000 KWh
Voltage (V) 230
P.f = Unity (1)

Solution:-

The power demand of consumer is:

$P = VI \cos\theta$

$= 230 \times 40 \times 1$ $\therefore \cos\theta = P.f$

$= 9200W$ OR $9.2KW$

Electricity for 1st 500 hours is 500×9.2

$= 4600 KWh$

Since the cost of electricity is Rs 2 per KWh for first 500 hours, therefore the consumer has to pay $4600 \times 2 =$ Rs 9200

For remaining units that is $= (10,000 - 4600)$

$= 5400 KWh$

So the consumer has to pay for remaining units is $5400 \times 1 =$ Rs 5400

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

The flat rate equivalent is: $14600/1,0000$

$= 1.46$ Per KWh

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Question# 2

Sol:-

Power station supply load as follows:

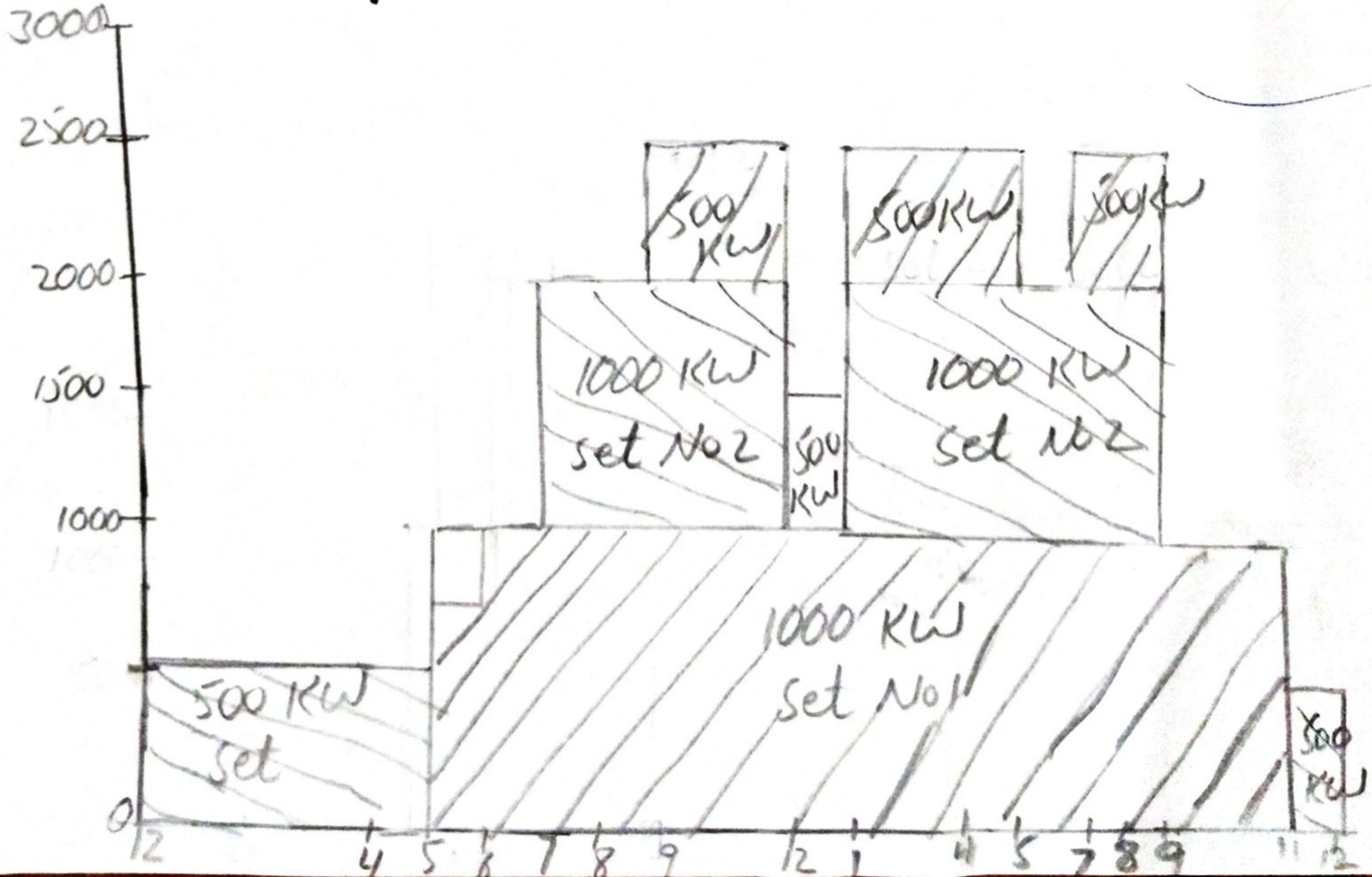
Time duration	KW	Time duration	KW
11 pm to 5am	500	12 moon to 1pm	1500
5 am to 6am	750	1 pm to 5pm	2500
6 am to 7am	1000	5 pm to 7pm	2000
7 am to 9am	2000	7pm to 9pm	2500
9 am to 12moon	2500	9pm to 11pm	1000

Energ generated during 24 hours

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

$= 38750$ KW

* Load curve of power station with generator Unit.



***Number & size of Generators:-** (4) ID: 13342

For this load shedule we use three generator set of following rating

1. 500KW capacity
2. 1000KW capacity
3. 1000KW capacity

*** Reserve capacity of plant Required:-**

The reserve capacity required will correspond to largest size of the unit in the station. In this case a set of 1000 KW will kept as reserve.

So, the total installed capacity of station is:

$= 1000 + 1000 + 500 + 1000 (\text{Reserve})$

$= 3500 KW$

*** Plant capacity factor:-**

$$\text{Plant capacity factor} = \frac{\text{Energy produce during 24 hours}}{\text{installed capacity (KW)} \times 24 \text{ hours}}$$

$$= \frac{38750}{3500 \times 24}$$

$$= 0.46 \text{ OR } 46\%$$

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*Operating shedule of Generator Units :-

* From 11pm to 5am only 500 KW generator set is run

* From 5am to 7am only one 1000 KW generator set is run. & from 6am to 7am the 250KW is spining reserve in 1000 KW generator

* From 7am to 9am two 1000 KW Generator sets are run

* From 9am to 12 noon two 1000 KW generator sets & one 500 KW generator are run

* From 12 noon to 1pm one 1000 KW & one 500 KW generator sets are run

* From 1pm to 5pm two 1000 KW generator sets & one 500 KW generator set is run

* From 5pm to 7pm two 1000 KW generator sets are run

* From 7pm to 9pm two 1000 KW generator sets & one 500 KW set are run

* From 9pm to 11pm two 1000 KW generator sets are run.

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Plant use factor:-

For this operating shedule, the energy that could have been generated by the capacity of plant actually running for shedule time would be

$$(500\times6)+(1000\times2)+(1000\times2)+(2500\times3)$$
$$+(1500\times1)+(2500\times4)+(2000\times2)+(2500\times2)$$
$$+(1000\times2) = 39000\,KWh$$

So,

capacity of plant (KW) x Number of hours plant has been in operation is 39000 KWh

So,

$$\text{Plant use factor} = \frac{\text{Energy produced (KWh)}}{\text{capacity of plant (KW)} \times \text{Number of hours plant has been in operation}}$$

$$= \frac{38750}{3900}$$

$$= 0.994 \text{ OR } 99.4\%$$