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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Question No 1

Part (a)

Given Data:

$S = 10,000$

$N = 20$ years

$P = 200000$

Required:

Depreciation $= D = ?$

Solution:

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

$$= \frac{200000 - 10,000}{20}$$

D = Rs/- 9,500 annually

Part (b)

Given data:

Energy = E 10000 kWh

Voltage = V 230 Volts

Current = I 40 A

Sol:

Consumer power demand = $P = VI\cos\phi$

$= 230 \times 40 \times 1 = 9200\,W$

$= 9.2\,kW$

Electricity consumption for the first 500 hours = $500 \times 9.2 = 4600\,kWh$

cost of 500 hours = Rs 2

So, consumer has to pay = 4600×2

= Rs 9200

for remaining units (10,000 − 4600) = 5,400

Consumer has to pay = 5400×1 = Rs 5400

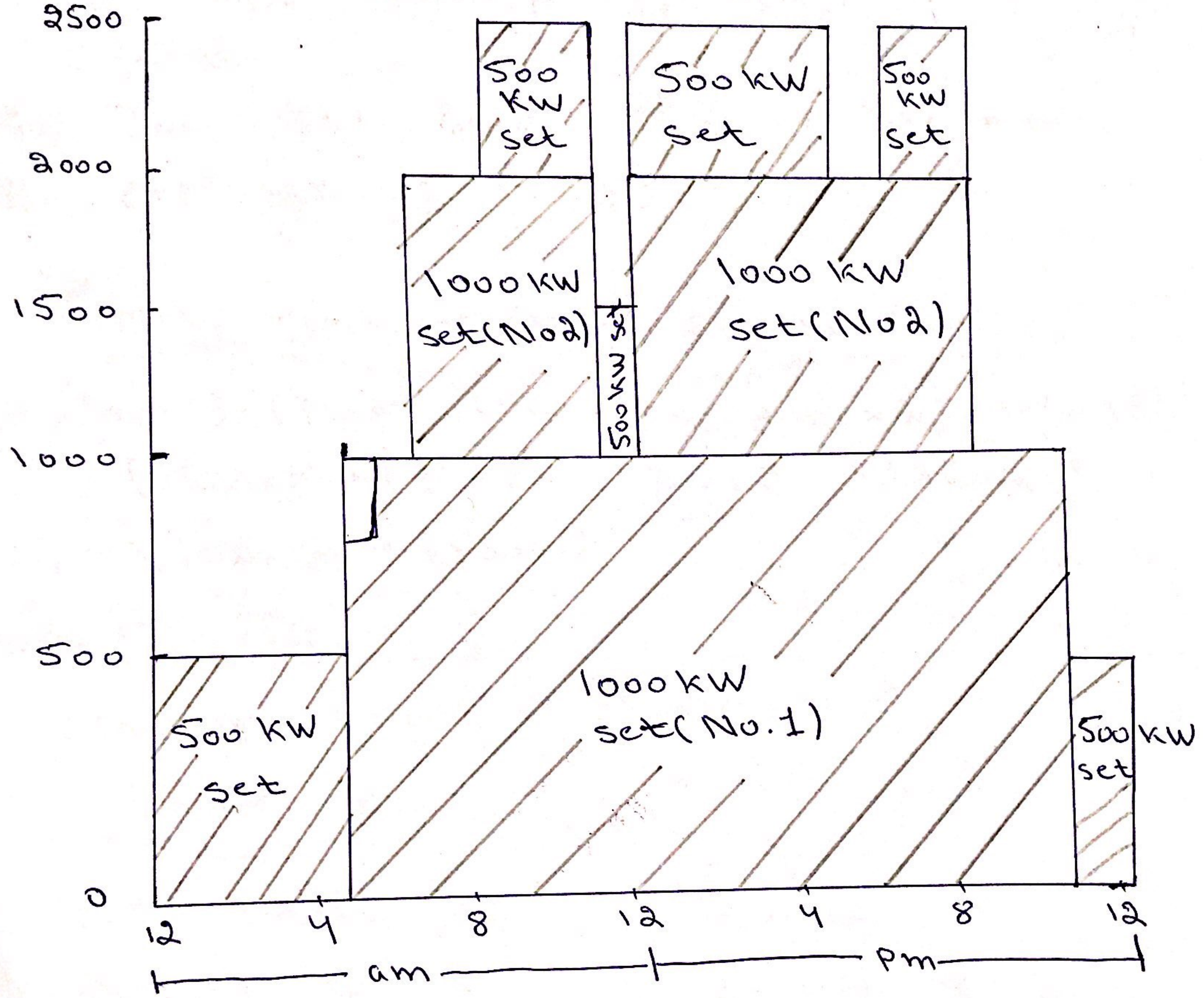
Annual bill = 9200 + 5400 = Rs 14,600

The flat rate equivalent is = $\frac{14600}{10,000}$

= Rs 1.46 per kWh

Question No 2

Load curve



The maximum demand is 2500 KW. If water resources were not available in the vicinity, the plant would normally be diseal - electric.

Number and size of generator:

from the load curve it will also be seen that three (3) generators will required.

(i): Two sets each of 1000 KW capacity

(ii): One set of 500 KW capacity.

Energy generated during 24 hours:

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

$= \boxed{38,750 \text{ KWh}}$

Maximum demand = 2500 KW

Reserve 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 capacity of station,

$1000 + 1000 + 500 + 1000 \text{ (reserve)} = \boxed{3500 \text{ KW}}$

Plant Capacity factor:

$$\text{Plant Capacity factor} = \frac{\text{Energy produced in 24 hours}}{\text{Installed capacity} \times 24 \text{ hours}}$$

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

Operating schedule:

With the operating schedule fixed, the energy that could have been generated by the capacity of plant actually running for the scheduled time.

$$(500\times6)+(1000\times2)+(2000\times2)+(2500\times3)$$
$$+(1500\times1)+(2500\times4)+(2000\times2)+(2500\times2)$$
$$+(1000\times2) = \boxed{39000 \text{ kWh}}$$

Energy actually produced = 38,750 kWh

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

$$= \frac{38,750}{39,000}$$

$$\boxed{= 0.994 \text{ or } 99.4\%}$$