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 1(a)

Given that:

$P = 200,000$

$S = 10,000$

$N = 20$ years

Required:

Depreciation $D = ?$

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

$$D = \frac{200,000 - 10,000}{20}$$

$D = 9500$ annually

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Q1 (b)

Solution:

energy $E = 10{,}000$ kwh
Current $I = 40A$
Voltage $V = 230V$

The power demand of consumers is

$P = VI\cos\theta = 230 \times 40 \times 1$
$= 9200W$ or $9.2kW$

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

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

$5400 \times 1 =$ Rs 5400

Annual Bill $= 9200 + 5400$
$= 14{,}600$

The plate rate equivalent $= 14600/10{,}000$
$= 1.46$

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Q No 2

Sol:

Energy generated during 24 hrs

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

Maximum demand = 2500 kW

Load factor

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

$$= \frac{38750}{2500 \times 24}$$

$= 64.7\%$

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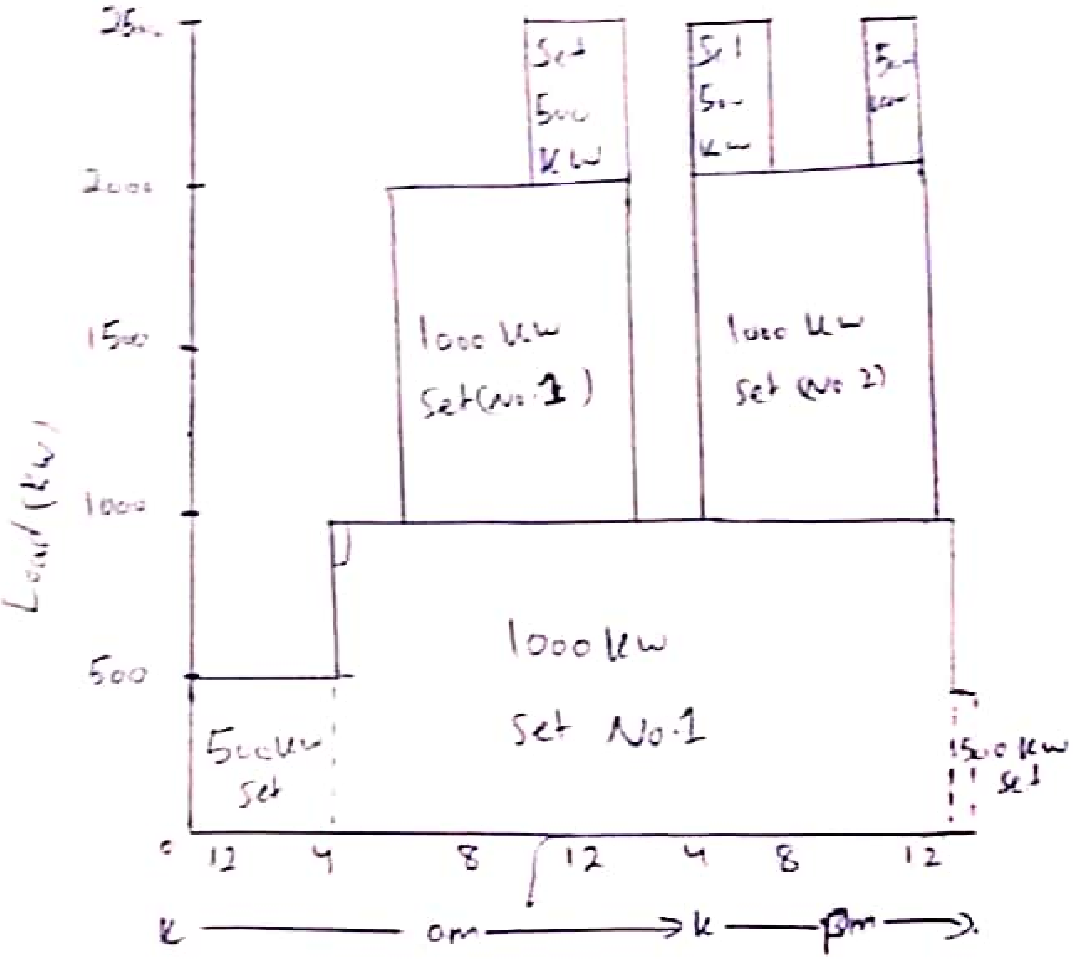

Plant capacity factor.

$$= \frac{\text{Energy produced during 24 hrs}}{\text{Installed capacity (kW)} \times 24 \text{ hrs}}$$

Two sets each of 1000 kW

One set of 500 kW

In this case a set of 1000 kW will have to be bought and kept as reserve.

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The total installed capacity of the solution is

= 1000+1000+500+1000 (reserve)
= 3500 kw

Plant capacity factor

$= \frac{36,750}{3500 \times 24}$

= 0.46 or 46%

with the operating scheduled 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)= 3900kwh

actually produced = 38,750 kwh

Plant use factor

$= \frac{\text{Energy Produced}}{\text{Capacity of plant} \times \text{no of hours plant has been in operation}}$

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

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