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

Name: ____________

REG.No: ____________

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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):

A 100KVA distribution transformer coasts 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.

Given data:

$P = 200,000$ Rs
$S = 10,000$ Rs
$N = 20$ years

Required:

Depreciation amount = D = ?

Formula:

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

Solution:

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

$$D = \frac{190,000}{20}$$

D = 9,500 Rs annully.

Question # 1
(B):

The average demand of a Consumer is 40A 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 500 hours use of the demand per annum plus Re 1 for each additional units. Calculate the annual bill of the Consumer and equivalent flat rate.

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Given data:

Total energy Consumption: $E = 10{,}000\ kWh$

Current: $I = 40A$

Voltage: $V = 230V$

Required:

Annual bill = ?
Flate rate = ?

Formula:

Annul Bill = Power + Consumer aomait

$$\text{flate rate} = \frac{\text{Annual Bill}}{\text{Energy}}$$

Solution:

First we have to find power demand of Consumer:

$P = VI\cos\theta$

$P = 230 \times 40 \times 1$ $\because \cos 0^\circ = 1$

$P = 9{,}200\ W$

Electricity Consumption for the first 500 hrs = 500 X 9200
= 4600,000 Wh
= 4600 KWh

given that ammount of Electricity is Rs 2 per KWh of for the first 500 hours therefore the Consumer has to pay:
4600 X 2 = Rs 9200

For the remaning units, that is:
(10,000 - 4600) = 5400, Consumer has to pay 5400 X 1
Rs = 5400

Annual Bill = 9200 + 5400
= 14,600 Rs

Flate Rate = $\frac{14600}{10,000}$

= Rs 1.46 per kWh

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Question # 2

A power station has to supply load as follows:

Timings	KW
11 pm to 5am	500
5am to 6am	750
6am to 7am	1000
7am to 9am	2000
9am to 12 noon	2500
12 noon to 1 pm	1500
1pm to 5pm	2500
5pm to 7 pm	2000
7pm to 9pm	2500
9pm to 11pm	1000

For the given data above draw the load curve. Select the number or 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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Solution:

Energy generated during 24 hours:

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

$= 38,750$ kW

Max demand = 2500 kW

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

$$= \frac{38750}{250 \times 24}$$

$= 64.7\%$

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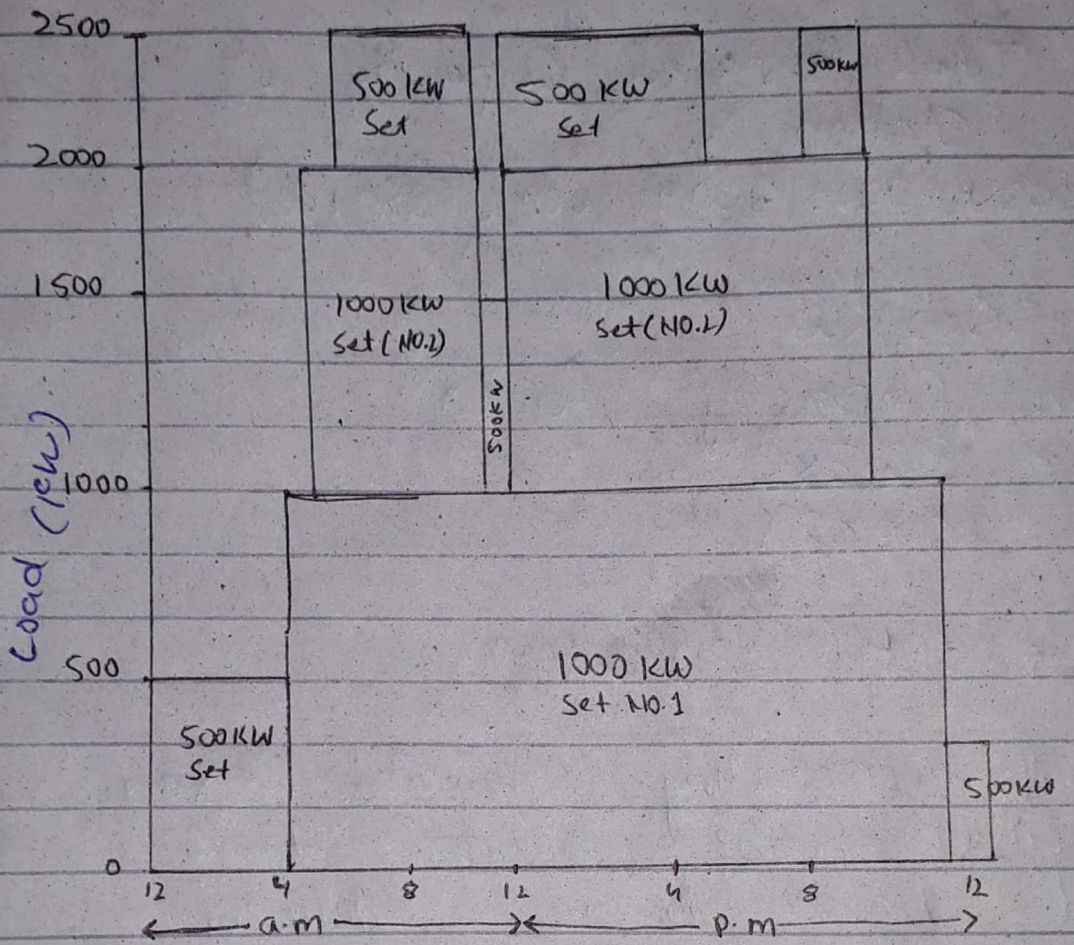

Load Curve of a power station.

plant Capacity factor =

$$= \frac{\text{Energy produced during 24 hrs (KWh)}}{\text{Installed Capacity (Kw)} \times 24 \text{ hrs}}$$

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 reseove.

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The Total installed Capacity of the Station is

$= 1000 + 1000 + 500 + 1000$ (reserve)

$= 3500$ KW

plant Capacity factor

$= \frac{38,750}{3500 \times 24}$

$= 0.46$ or 46%

With the operating sheduled fixed as above the energy that Could have been generated by the Capacity of plant actully running for the Scheduled time would be:

$= (500 \times 6) + (1000 \times 2) + (2000 \times 2) + (2500 \times 2) + (1500 \times 1) + (2500 \times 4) + (2000 \times 2) + (2500 \times 2) + (1000 \times 2)$

$=$ 39000 kWh

Energy actully produced = 38,750 kWh

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plant use factor:

$$= \frac{\text{Energy Produced (KWh)}}{\text{Capacity of Plant} \times \text{number of hrs plant has been in operation}}$$

$$= \frac{38750}{39000}$$

$= 0.994$

$= 99.4\%$

plant use factor = 99.4 %