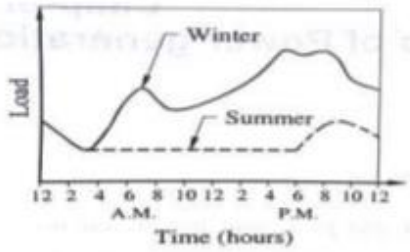
CHAPTER - 3

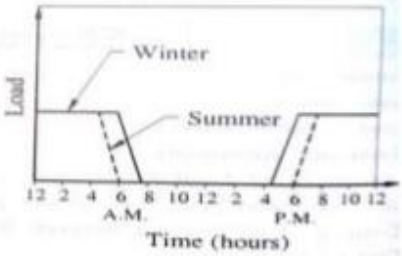
Loads and Load Curves

LOAD CURVES

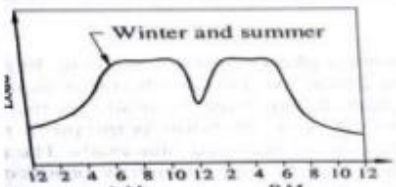
- The load on power plants will always be changing with time and will not be constant because consumer of electric power will use the power as and when required.
- Load curve is graphical representation between load in kW and time.
- It shows variation of load on the power station.
- If the time is in hours then the load curve is known as daily load curve.
- If the times is in days, the load curve is known as monthly load curve and if the time is in months, the load curve is known as yearly or annual load curve.
- The daily load curve will be different for different type of consumers and different localities. These load curves may show different pattern during summer, winter and rainy season.



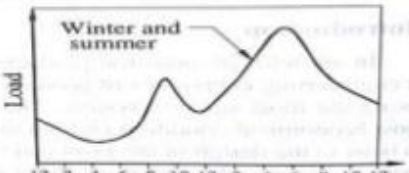
(a) Residential load curve



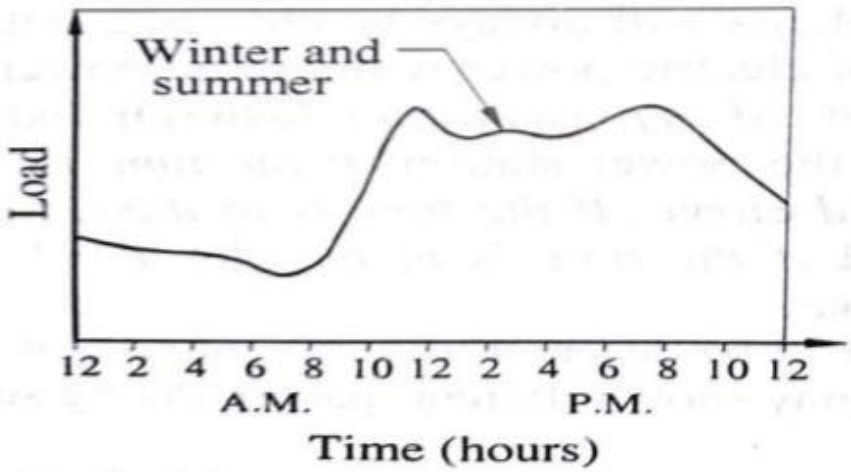
(b) Street lighting load curve



(c) Industrial load curve



(d) Urban traction load curve



- The combined daily load curve for all types of consumers is shown in figure (a) and the approximated curve for simplicity is shown in figure (b).

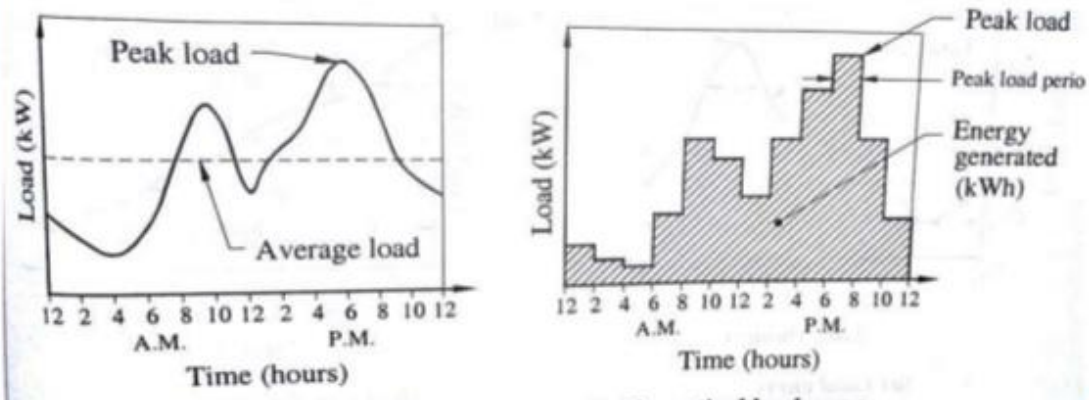
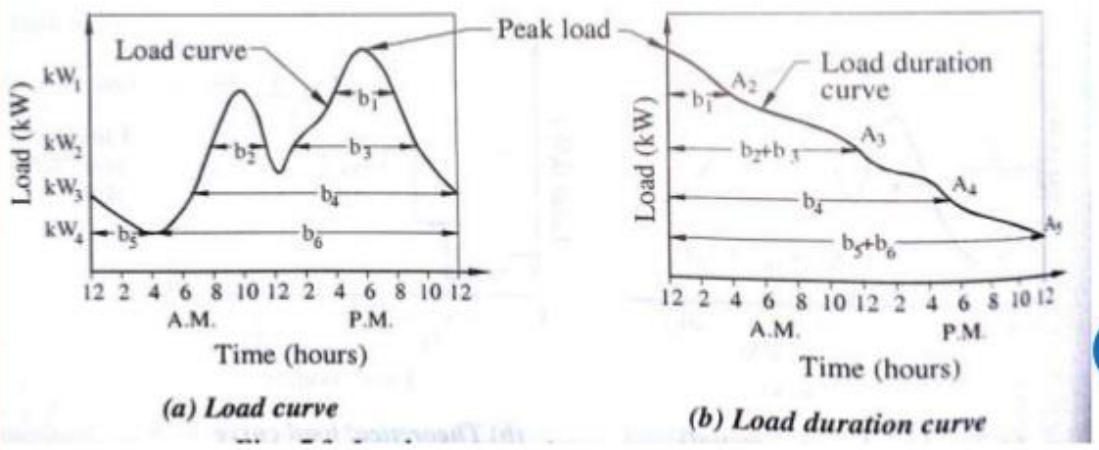


Fig. 7.2 Daily load curve for all types of consumers.

LOAD DURATION CURVES

- Load duration curve is simply a re-arrangement of daily load curve with loads set up in descending order of magnitude.
- The load duration curve indicates for how many hours a certain load is required in a day.



Energy Load Curve:

It plots the cumulative integration of area under the load curve.

Mass Curve

It gives the total energy used by the load up to each hour of the day.

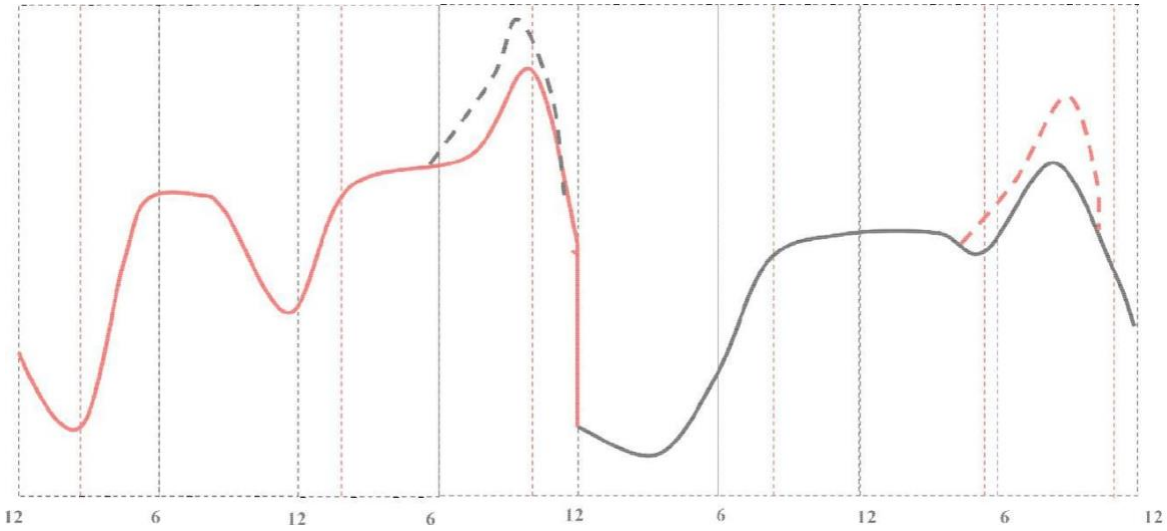


Figure 1: Load Curve

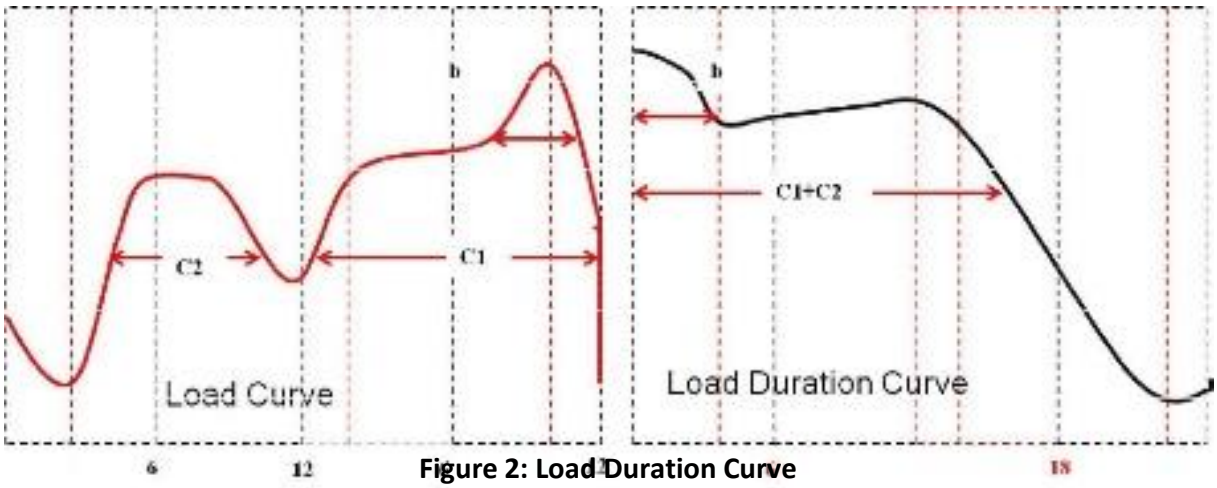


Figure 2: Load Duration Curve

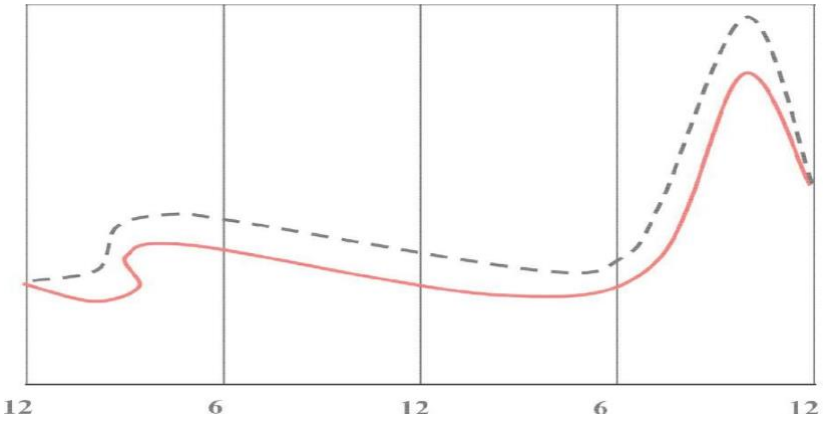


Figure 3: Domestic Load
(DF=0.5)

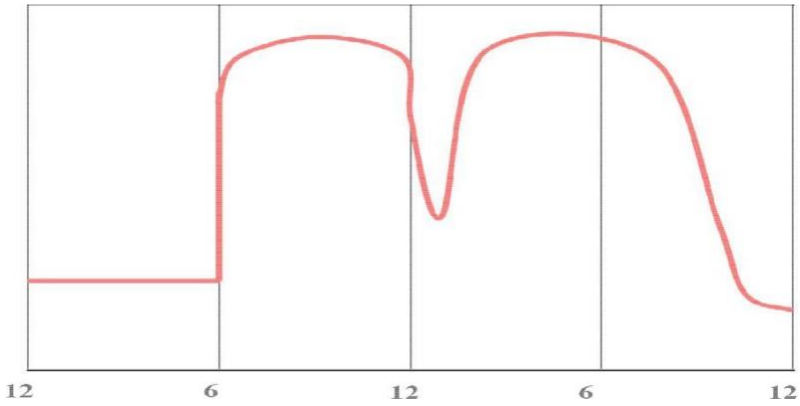


Figure 4: Industrial Load
(DF=0.8)

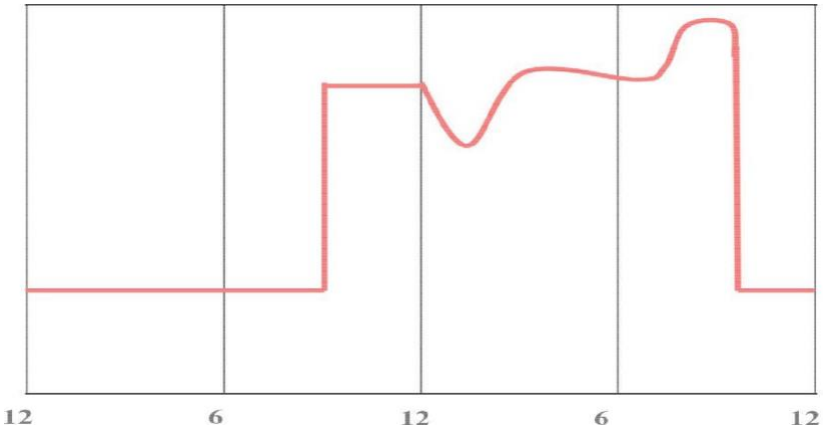


Figure 5: Commercial Load

TERMS AND DEFINITIONS

1. Connected load:

connected load is the sum of ratings in kilowatts (kW) of equipment installed in the consumer's premises.

The connected loads in the premises of a consumer are shown in figure.

Total load connected in the consumer's premises:

= 40 + 1000 + 60 + 40 + 20 + 500 + 25 + 60 = 1745 W

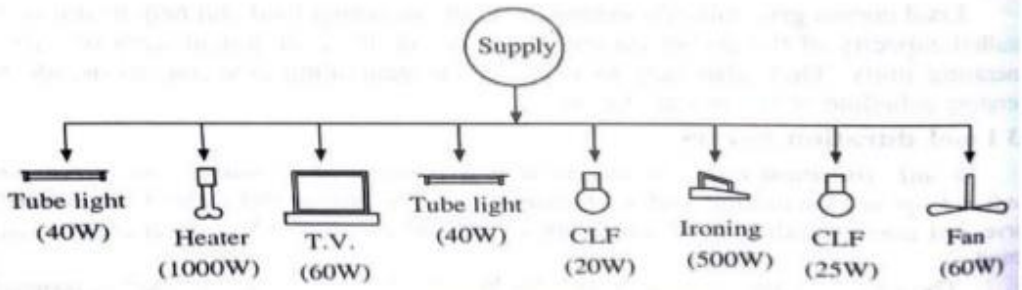


Fig. 7.4 Load in a consumer's premises

2. Demand:

The demand of an installation or system is the load that drawn from the source of supply at the receiving terminals averaged over a suitable and specified interval of time. Demand is expressed in killowatts (kW) or other suitable units.

3. Maximum demand or Peak load

It is the maximum load which a consumer uses at any time. It can be less than or equal to connected load.

If all the equipment fitted in consumer's premises run to their fullest extent simultaneously then the maximum demand will be equal to connected load. But generally the actual maximum demand is less than the connected load because all the devices never run at full load at the same time.

(4) Demand factor:

It is defined as the ratio of maximum demand to connected load.

(5) Average load:

The average load is calculated dividing the area under the load curve (energy in kWh) by the time period (24 hours) considered to draw the load curve.

$$\therefore \text{Average load} = \frac{\text{Area under load curve}}{24} = \frac{\text{Energy consumed 24 hrs}}{24}$$

(6) Load factor:

It is defined as the ratio of average load to maximum or peak load. Load factors and demand factors are always less than unit.

Load factor play an important part on the cost of generation per unit. The higher the load factor the lesser will be the cost of generation per unit for the same maximum demand.

$$\therefore \text{Load factor} = \frac{\text{Average load}}{\text{Maximum load}}$$

7. Diversity factor:

The diversity factor is the ratio of the sum of the maximum demands of the individual consumers and simultaneous maximum demand of the whole group during a particular time.

∴ Diversity factor

$$= \frac{\text{Sum of individual maximum demands}}{\text{Simultaneous maximum demand at a given time}}$$

Diversity factor is always greater than unity.

8. Plant Capacity factor:

It is defined as the ratio of actual energy produced in kilowatt hours (kWh) to the maximum possible energy that could have been produced during the same period.

$$\therefore \text{Plant capacity factor} = \frac{\text{Average load x 24}}{\text{Plant capacity x 24}} = \frac{\text{Average load}}{\text{Plant capacity}}$$

The difference between load and plant capacity factors is an indication of reserve capacity.

The capacity factor shows how near the plant runs to its full ratings.

The high values of demand factor, load factor, diversity factor and capacity factor are always desirable for economic operation of the plant and to produce energy at a cheaper rate.

9. Plant use factor:

It is defined as the ratio of energy produced in a given time to the maximum possible energy that could have been produced during the actual number of hours the plant was in operation.

It shows the extent to which the plant capacity is used to meet the peak demand.

Plant use factor =

$$\frac{\text{Annual energy produced}}{\text{capacity of plant x No. of hours plant is in operation during year}}$$

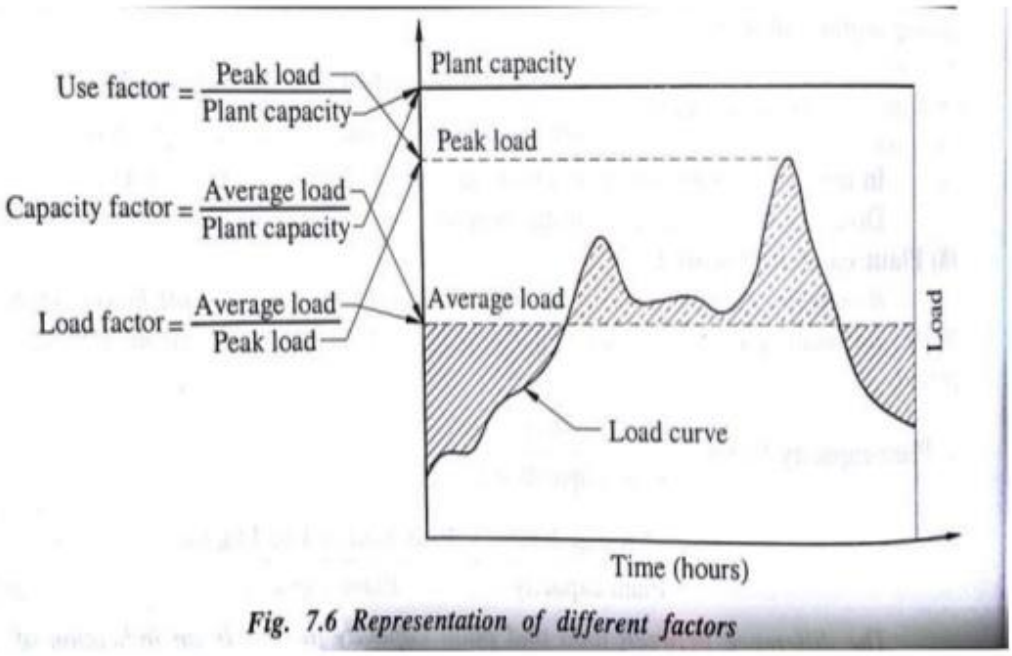


Fig. 7.6 Representation of different factors