UNIT V

Part-A

1. Define demand factor?

- Demand factor is defined as the ratio of maximum demand to connected load.
- Connected load is the sum of ratings in kW of equipment installed in the consumer's premises.
- Maximum demand is the maximum load, which a consumer uses at any time.

2. Define load curve? (Nov/Dec 2011)

Load curve is a graphical representation between load in kW and time in hours. It. shows variati6n of load at the power station. The area under the load curve -represents the energy generated in a particular period.

3. Define load factor? (May 2013)

Load factor is defined as the ratio of average load to the peak load (or) maximum demand.

4. What includes fixed cost? (May2012)

Fixed cost includes the following cost.

1. Cost of land
2. Cost of building
3. Cost of equipment
4. Cost of installati6n
5. Interest
6. Depreciation cost
7. Insurance
8. Management cost

5. What includes operating cost?

Operating cost includes the following cost.

1. Cost of fuel
2. Cost of operating labour,
3. Cost of maintenance labours and materials.
4. Cost of supplier like

   Water for feeding boilers, for condenser and for general use.

   Lubrication oil and, grease.

   Water treatment chemicals.

6. What is the need of depreciation cost?

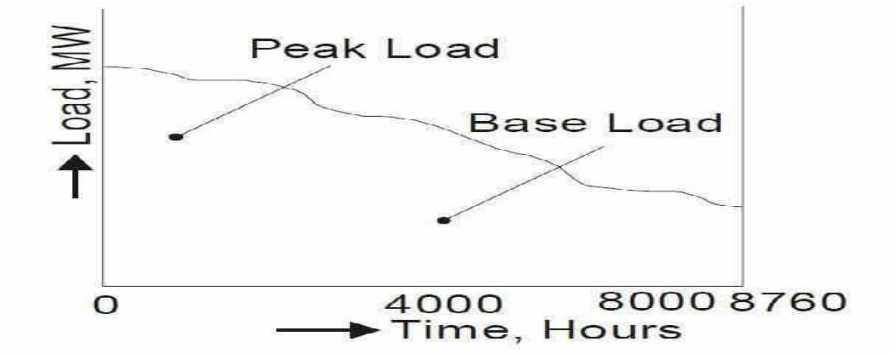
Depreciation cost is the amount to be set aside per year from the income of the plant to meet the depreciation caused by the age of service, wear and tear of the machinery and equipments. Depreciation amount collected every year helps in replacing and repairing the equipment.

Part-B

1. Explain the load duration curve (Nov/Dec 2012)

The load demand on a power system is governed by the consumers and for a system supplying industrial and domestic consumers, it varies within wide limits. This variation of load can be considered as daily, weekly, monthly or yearly. Such load curves are termed as "**Chronological load Curves**". If the ordinates of the chronological load curves are arranged in the descending order of magnitude with the highest ordinates on left, a new type of load curve known as **"load duration curve"** is obtained. If any point is taken on this curve then the abscissa of this point will show the number of hours per year during which the load exceeds the value denoted by its ordinate. The lower part of the curve consisting of the loads which are to be supplied for almost the whole number of hours in a year, represents the "Base Load", while the

upperpart, comprising loads which are required for relatively few hours per year, represents the "Peak Load".



2. TARIFFS:

In economic terms, electricity (both power and energy) is a commodity capable of being bought, sold and traded. An electricity market is a system for effecting purchases, through bids to buy; sales, through offers to sell; and short-term trades, generally in the form of financial or obligation swaps. Bids and offers use supply and demand principles to set the price. Long-term trades are contracts similar to power purchase agreements and generally considered private bi-lateral transactions between counterparties

3. ECONOMICS OF POWER PLANTS

Fixed cost includes the following cost.

1. Cost of land
2. Cost of building
3. Cost of equipment
4. Cost of installati6n
5. Interest
6. Depreciation cost
7. Insurance
8. Management cost

Operating cost includes the following cost.

1. Cost of fuel
2. Cost of operating labour,

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Water for feeding boilers, for condenser and for general use.

Lubrication oil and, grease.

Water treatment chemicals.

Depreciation cost

Depreciation cost is the amount to be set aside per year from the income of the plant to meet the depreciation caused by the age of service, wear and tear of the machinery and equipments. Depreciation amount collected every year helps in replacing and repairing the equipment.

4. Cost of Electrical energy

Cost of Electrical Ener Cost of Electrical Energy The total cost of electrical energy generated can be divided into three parts, namely ; (i) Fixed cost ; (ii) Semi-fixed cost ; (iii) Running or operating cost. (i) Fixed cost. It is the cost which is independent of maximum demand and units generated. The fixed cost is due to the annual cost of central organisation, interest on capital cost of land and salaries of high officials. The annual expenditure on the central organisation and salaries of high officials is fixed since it has to be met whether the plant has high or low maximum demand or it generates less or more units. Further, the capital investment on the land is fixed and hence the amount of interest is also fixed.

(ii) Semi-fixed cost. It is the cost which depends upon maximum demand but is independent of units generated. The semi-fixed cost is directly proportional to the maximum demand on power station and is on account of annual interest and depreciation on capital investment of building and equipment, taxes, salaries of management and clerical staff. The maximum demand on the power station determines its size and cost of installation. The greater

the maximum demand on a power station, the greater is its size and cost of installation. Further, the taxes and clerical staff depend upon the size of the plant and hence upon maximum demand.

(iii) Running cost. It is the cost which depends only upon the number of units generated. The running cost is on account of annual cost of fuel, lubricating oil, maintenance, repairs and salaries of operating staff. Since these charges depend upon the energy output, the running cost is directly proportional to the number of units generated by the station. In other words, if the power station generates more units, it will have higher running cost and vice-versa.

5.Methods of Deter Methods of Determining Depreciation

There is reduction in the value of the equipment and other property of the plant every year due to depreciation. Therefore, a suitable amount (known as depreciation charge) must be set aside annually so that by the time the life span of the plant is over, the collected amount equals the cost of replacement of the plant. The following are the commonly used methods for determining the annual depreciation charge : (i) Straight line method ;

(ii) Diminishing value method ;

(iii) Sinking fund method.

(i) Straight line method.

In this method, a constant depreciation charge is made every year on the basis of total depreciation and the useful life of the property. Obviously, annual depreciation charge will be equal to the total depreciation divided by the useful life of the property. Thus, if the initial cost of equipment is Rs 1,00,000 and its scrap value is Rs 10,000 after a useful life of 20 years, then,

Annual depreciation charge = Total depreciation / Useful life = 100 000 - 10 000 / 20 = Rs 4,500

In general, the annual depreciation charge on the straight line method may be expressed as :

Annual depreciation charge = P – S/ n

where P = Initial cost of equipment n = Useful life of equipment in years S = Scrap or salvage value after the useful life of the plant.

The straight line method is extremely simple and is easy to apply as the annual depreciation charge can be readily calculated from the total depreciation and useful life of the equipment. Fig. 4.1 shows the graphical representation of the method. It is clear that initial value P of the equipment reduces uniformly, through depreciation, to the scrap value S in the useful life of the equipment. The depreciation curve (PA) follows a straight line path, indicating constant annual depreciation charge. However, this method suffers from two defects. Firstly, the assumption of constant depreciation charge every year is not correct. Secondly, it does not account for the interest which may be drawn during accumulation.

(ii) Diminishing value method.

In this method, depreciation charge is made every year at a fixed rate on the diminished value of the equipment. In other words, depreciation charge is first applied to the initial cost of equipment and then to its diminished value. As an example, suppose the initial cost of equipment is Rs 10,000 and its scrap value after the useful life is zero. If the annual rate of depreciation is 10%, then depreciation charge for the first year will be $0{\cdot}1 \times 10{,}000$ = Rs 1,000. The value of the equipment is diminished by Rs 1,000 and becomes Rs 9,000. For the second year, the depreciation charge will be made on the diminished value (i.e. Rs 9,000) and becomes $0{\cdot}1 \times 9{,}000$ = Rs 900. The value of the equipment now becomes $9000 - 900$ = Rs 8100. For the third year, the depreciation charge will be $0{\cdot}1 \times 8100$ = Rs 810 and so on.

Mathematical treatment

Let

P = Capital cost of equipment

n = Useful life of equipment in years

S = Scrap value after useful life

Suppose the annual unit* depreciation is x. It is desired to find the value of x in terms of P, n and S.

(iii) Sinking fund method.

In this method, a fixed depreciation charge is made every year and interest compounded on it annually. The constant depreciation charge is such that total of annual installments plus the interest accumulations equal to the cost of replacement of equipment after its useful life.

Let P = Initial value of equipment

n = Useful life of equipment in years

S = Scrap value after useful life

r = Annual rate of interest expressed as a decimal

Cost of replacement = P − S

Let us suppose that an amount of q is set aside as depreciation charge every year and interest compounded on it so that an amount of P− S is available after n years. An amount q at annual interest rate of r will become *q(1 + r) n at the end of n years.