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DIPLOMA EXAMINATION IN ENGINEERING/ TECHNOLOGY/ MANAGEMENT/ COMMERCIAL PRACTICE- APRIL 2018

ELECTRICAL POWER GENERATION, TRANSMISSION AND DISTRIBUTION

MAX MARKS: 100 **TIME: 3 Hours**

PART-A
(Maximum marks: 10)

I. Answer all questions. Each question carries 2 marks.

1. Write the function of moderator in atomic power plant
   A moderator is a material used in a nuclear reactor to slow down the neutrons produced from fission. By slowing the neutrons down the probability of a neutron interacting with Uranium-235 nuclei is greatly increased thereby maintaining the chain reaction.

2. Classify hydal power plant based on head

   According to availability of water head the hydroelectric power plants may be classified into:
   (a) Low Head
   (b) Medium Head and
   (c) High Head Power Plants.

3. Name any two performance characteristics of short transmission line
   Transfer impedance and current

4. Define voltage regulation
   Voltage Regulation of Transmission Line is defined as the rise in voltage at the receiving-end, expressed as percentage of full load voltage, when full load at a specified power factor is thrown off

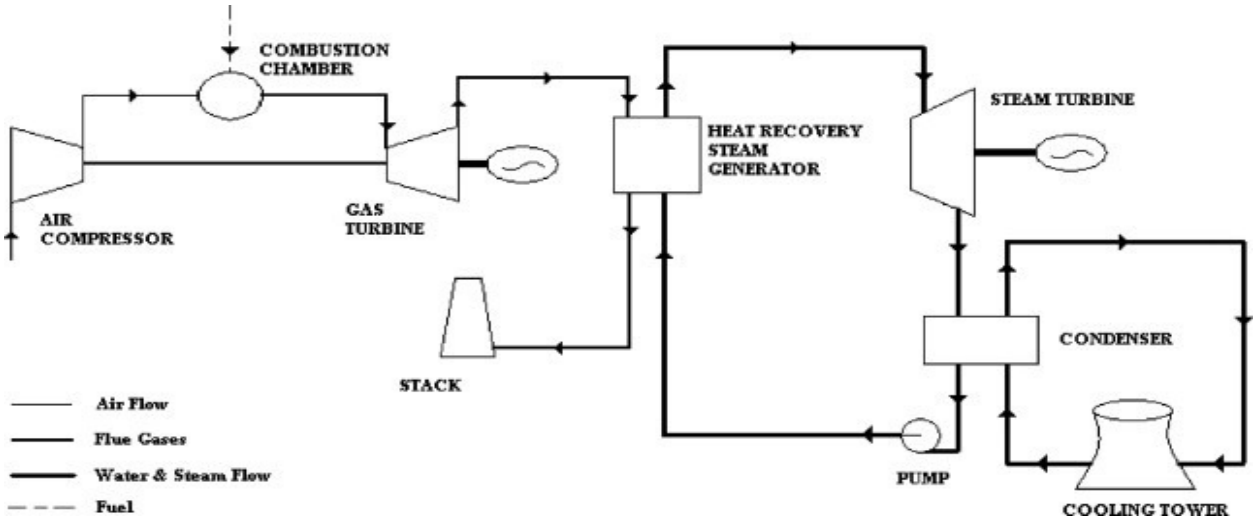
5. List the objectives of tariff
   Equal distribution of cost
   Recovery of capital investment

(5x2=10)

PART-B
(Maximum marks:30)

II Answer any *five* questions. Each question carries 6 marks.

1. Draw the layout of gas power plant and mark each part

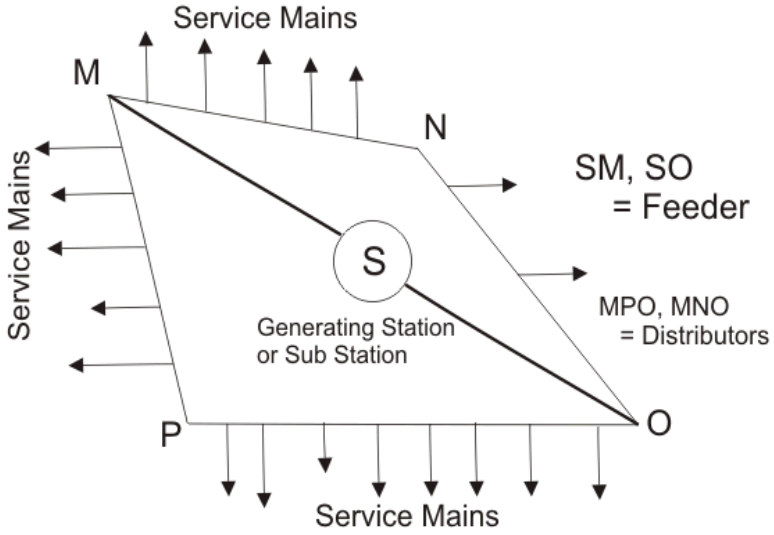


2. Discuss the function of super heater

A superheater is a device used to convert saturated steam or wet steam into superheated steam or dry steam. Superheated steam is used in steam turbines for electricity generation, steam engines, and in processes such as steam reforming

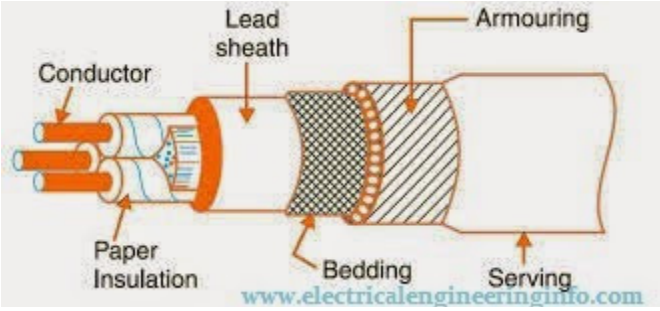
It is integral part of boiler and is placed in the path of hot flue gases from the furnace.The heat recovered from the flue gases is used in superheating the steam before entering into the turbine (i.e.,prime mover).Its main purpose is to increase the temperature of saturated steam without raising its pressure.

3. Draw the schematic diagram of distributer- feeder- service mains



4. Write the function of armouring in UG cables

Armouring : Over the bedding, armouring is provided which consists of one or two layers of galvanised steel wire or steel tape.Its purpose is to protect the cable from mechanical injury while laying it and during the course of handling. Armouring may not be done in the case of some underground cables



6. Define corona and factors affecting corona

Corona discharge from high voltage electric power transmission lines constitutes an economically significant waste of energy for utilities.

factors affecting corona

(I)ATMOSPHERE: As corona is formed due to ionization of air surrounding the conductors, therefore, it is affected by the physical state of atmosphere. In the stormy weather, the number of ions is more than normal and as such corona occurs at much less voltage as compared with fair weather.

(II) CONDUCTOR SIZE: The corona effect depends upon the shape and conditions of the conductors.

The rough and irregular surface will give rise to more corona because unevenness of the surface decreases the value of breakdown voltage. Thus a stranded conductor has irregular surface and hence gives rise to more corona that a solid conductor.

(III) SPACING BETWEEN CONDUCTORS: If the spacing between the conductors is made very large as compared to their diameters, there may not be any corona effect. It is because larger distance between conductors reduces the electro-static stresses at the conductor surface, thus avoiding corona formation.

(IV) LINE VOLTAGE: The line voltage greatly affects corona. If it is low, there is no change in the condition of air surrounding the conductors and hence no corona is formed. However, if the line voltage has such a value that electrostatic stresses developed at the conductor surface make the air around the conductor conducting, then corona is formed

6. Distinguish between base load and peak load power plant

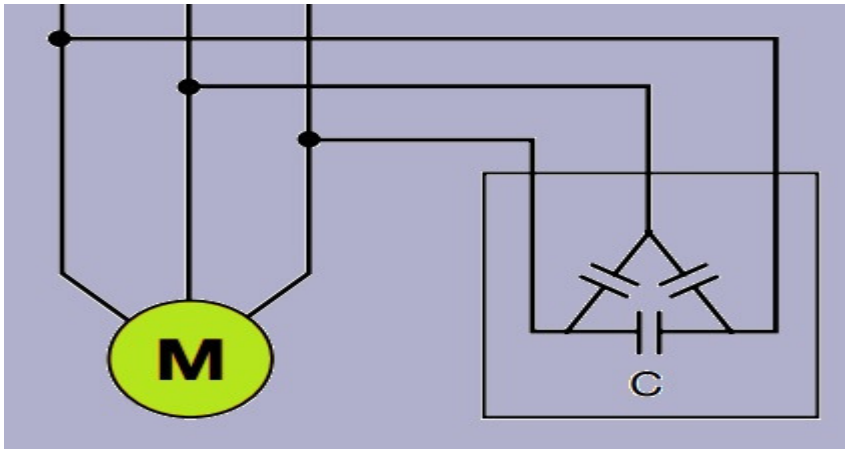
Base load is the minimum level of electricity demand required over a period of 24 hours. It is needed to provide power to components that keep running at all times (also referred as continuous load).

Peak load is the time of high demand. These peaking demands are often for only shorter durations. In mathematical terms, peak demand could be understood as the difference between the base demand and the highest demand

7. Explain different methods of power factor improvement

Power Factor improvement: By use of static capacitors

- This method is followed in factories widely.
- By connecting the capacitors in parallel with the equipment working at low power factor, the power factor can be improved.
- The capacitors draw a leading current. So it partly or completely neutralizes the lagging reactive component of the load current.
- Consequently the power factor of the load is increased.
- For three-phase loads, the capacitors are connected in star or delta manner.



Power factor improvement - By use of synchronous condensers

- The over excited synchronous motor running on no load is known as *synchronous condenser*.
- When over excited, a synchronous motor takes a leading current, thus it act as a capacitor.
- So when it is connected in parallel with the supply, it draws a leading current which eliminates the lagging reactive component of the load.
- So the power factor of the circuit is improved.
- This method is generally used at major bulk supply substations for power factor improvement

Power Factor improvement - By use of Phase advancers

- This method is used to improve the power factor of induction motors.

- In induction motor, the stator winding draws exciting current which lags behind the supply voltage by 90°. It leads to low power factor in induction motors.
- If the excitation is provided from some other source, then the stator winding will be relieved of exciting current.
- So the power factor of the induction motor can be increased.
- This additional excitation is done by phase advancers. It is simply known as ac exciter.
- It is mounted on the same shaft as the main motor and is connected in the rotor circuit of the motor.
- It provides the exciting ampere turns to the rotor circuit at slip frequency.
- By providing more ampere turns than required, the induction motor can be made to operate on leading power factor like an over-excited synchronous motor

(5x6=30)

PART-C

(Maximum marks: 60)

III. Answer any one full question from each unit. Each question carries 15 marks.

UNIT-I

III. a) Explain the working of Hydro electric power plant with neat sketch (10)

In hydropower plant potential and kinetic energy of the water is used to rotate the turbine and hence generator to generate electricity

main components of the hydroelectric power plant

1. Reservoir: water harvested from the catchment area is stored in the reservoir which is then used to generate the electricity.

2. Dam: it is made in the path of the river to make the reservoir to hold the rain water.

3. Spillways: Spillways are made to make the dam safe. When level of water is exceeds some defined point, it will discharge through these spillways.

4. Forebay: when there is sudden change in the turbine load, in such cases there is need of temporary storage of water. This temporary storage of water near turbine is called as forebay.

5. Surge tank: surge tank is build in between dam and the valve house. It is used to take care of the system load fluctuations.

6. Penstock: it is water pipeline carrying water from dam to turbine.

7. Prime mover or turbine: it is the main part of the power station. It is coupled with the generator. Turbine is rotated by the flow of water. As it is coupled with the generator, generator also rotates which produces electricity.

8. Powerhouse: it consists of turbine, alternator and electrical equipment.

9. Tail races: outlet water of the turbine is discharged to the river trough tail races.

Hydropower plants capture the energy of falling water to generate electricity. A turbine converts the kinetic energy of falling water into mechanical energy. Then a generator converts the mechanical energy from the turbine into electrical energy

b) Indicate the function of economiser (5)

1. It recovers more heat of flue gases which normal air pre-heater can not do.

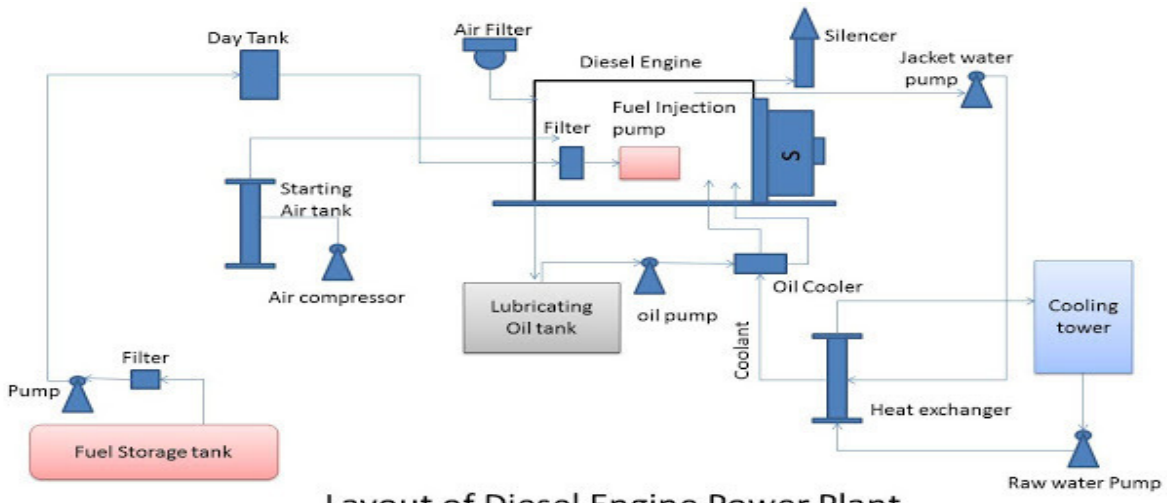
2. Due increase in fuel prices, all power plants are facing pressure for increasing boiler efficiency. So by using economizer, this pressure can be minimized.

3. Power plants where it is not used, large quantity of water is required to cool the flue gas before desulphurization which is minimized by using economizers.

4. The efficiency of power plant reduced when steam air pre-heater required steam

OR

IV a) Explain the working of diesel power plant with a neat sketch (7)



Layout of Diesel Engine Power Plant

Diesel engines or compression ignition engines as they are called are generally classified as two stroke engine and four stroke engines. In diesel engine, air admitted into the cylinder is compressed, the compression ratio being 12 to 20. At the end of compression stroke, fuel is

injected. It burns and the burning gases expand and do work on the position. The engine is directly coupled to the generator. The gases are then exhausted from the cylinder to atmosphere.

Engine strating system:

This includes air compressor and starting air tank. The function of this system is to start the engine from cold supplying compressed air.

Fuel system:

Pump draws diesel from storage tank and supplies it to the small day tank through the filter. Day tank supplies the daily fuel need of engine. The day tan is usually placed high so that diesel flows to engine under gravity.
Diesel is again filtered before being injected into the engine by the fuel injection pump. The fuel is supplied to the engine according to the load on the plant.

Air intake system:

Air filters are used to remove dust from the incoming air. Air filters may be dry type, which is made up of felt, wool or cloth. In oil bath type filters, the sir is swept over a bath of oil so that dust particles get coated.

Exhaust system:

In the exhaust system, silencer (muffler) is provide to reduce the noise.

Engine cooling system:

The temperature of burning gases in the engine cylinder is the order of 1500 to 2000'C. to keep the temperature at the reasonable level, water is circulated inside the engine in water jackets which are passage around the cylinder, piston, combustion chamber etc. hot water leaving the jacket is sent to heat exchanger. Raw water is made to flow through the heat exchanger, where it takes up the heat of jacket water. It is then cooled in the cooling tower and recirculates again.

Engine lubrication system:

It includes lubricating oil tank, oil pump and cooler. Lubrication is essential to reduce friction and wear of engine parts such as cylinder walls and piston.
Lubricating oil which gets heated due to friction of moving parts is cooled before recirculation. The cooling water used in the engine is used for cooling the lubricant also.

Advantages of diesel power plant:

1. Plant layout is simple. Hence it can be quickly installed and commissioned, while the erection and starting of a steam power plant or hydro-plant takes a fairly long time.

2. Quick starting and easy pick-up of loads are possible in a very short time.

3. Location of the plant is near the load center.
4. The load operation is easy and requires minimum labors.
5. Efficiency at part loads does not fall so much as that of a steam plant.
6. Fuel handling is easier and no problem of ash disposal exists.
7. The plant is smaller in size than steam power plant for same capacity.
8. Diesel plants operate at high overall efficiency than steam.

b) Write the functions of surge tank **(8)**

The important functions of surge tank are as follows

- It should Protects the conduit system from high internal pressures.
- It should help the hydraulic turbine regarding its regulation characteristics.
- It should store the water to raise the pressure in pressure drop conditions

UNIT-II

V. a) A thermal power station supplies the following loads to various consumers. Industrial consumer = 1500KW, commercial establishment =750 KW , domesric light= 100 KW, domestic power= 450KW. If the maximum demand per year is 2500KW and the number of kWh generated per year is 450000 , determine (i) diversity factor, (ii) annual load factor (9)

$$(i) \quad \text{Diversity factor} = \frac{1500+750+100+450}{2500} = 1{\cdot}12$$

$$(ii) \quad \text{Average demand} = \frac{\text{kWh generated / annum}}{\text{Hours in a year}} = 45 \times 10^5/8760 = 513{\cdot}7 \text{ kW}$$

$$\therefore \quad \text{Load factor} = \frac{\text{Average load}}{\text{Max. demand}} = \frac{513{\cdot}7}{2500} = 0{\cdot}205 = 20{\cdot}5\%$$

b) Discuss different type of cost in generation of energy (6)

Fixed Cost of Electricity

In every manufacturing unit there is some hidden expenditure which fixed. This is same for manufacturing one unit or thousand units of the items. In electric generating station like manufacturing unit, there are some hidden costs which independent of the quantity of electricity produced. These fixed expenditures are mainly due to an annual cost to run the organization, interest on capital cost and tax or rent of the land on which the organization established, salaries of high officials and interests of loans (if any) on the capital cost of the organization.

Semi-fixed Cost of Electricity

There is another type costing for any manufacturing or production or any similar type of industries. These costs are not strictly fixed and also not fully dependent on the number of items manufactured or produced. These costs depend on the size of the plant. These actually depend on the assumption of a maximum number of items which can be produced from the plant at a time during peak demand period. That means the forecasted production demand of the plant determines how big will be the manufacturing or production plant. Likewise, the size of an electrical generating plant depends on the maximum demand of the connected load of the system. If the maximum demand of the load is quite higher than the average demand of the load, then the power generating plant should be constructed and well equipped to fulfill that maximum demand of the system even the peak demand lasts for less than an hour. This type of costs is referred as semi-fixed cost. It is directly proportional to the maximum demand on the power station.

Running Cost of Electricity

The concept of running cost is quite simple. It solely depends on the number of units produced or generated. In power generating plant the main running cost is the cost of fuel burnt per unit of electrical energy generation. The cost of lubricating oil, maintenance, repairs and salaries of operating staff are also accounted under running cost of the plant. Since these charges are directly proportional to the number of units generated

OR

VI a) Explain different type of tariff , write the advantage and disadvantage (9)

A tariff is a tax imposed by a government on goods and services imported from other countries that serves to increase the price and make imports less desirable, or at least less competitive, versus domestic goods and services.

Simple Tariff:

Definition: When there is a fixed rate per unit of energy consumed, it is known as simple tariff (Uniform Rate Tariff).

- This is the most simplest of all tariff.
- In this type, the price charged per unit is constant.
- It means, the price will not vary with increase or decrease in number of units used.

Disadvantages:

- The cost per unit delivered is high.
- There is no discrimination among various types of consumers.

Flat Rate Tariff:

Definition: When different types of consumers are charged at different uniform per unit rates, it is said to be Flat rate Tariff.

- In this type, the consumers are grouped into different classes.
- Each class is charged at different uniform rate.
- the different classes of consumers may be taken into account of their diversity and load factors.
- Since this type of tariff varies according to the way of supply used, separate meters are required for lighting load, power load etc.

Block rate tariff:

When a given block of energy is charged at a specified rate and the succeeding blocks of energy are charged at progressively reduced rates is called as block rate tariff.

- In this type, the energy consumption is divided into many blocks and price per unit is fixed in each block.

Two Part tariff:

When the rate of electrical energy is charged on the basis of maximum demand of the consumer and the units consumed it is called two-part tariff.

- In this type, the total charge to be made from the consumer is split into two components.
- ie, fixed charges and running charges.
- The fixed charges depend upon the number of units consumed by the customer. Thus the consumer is charged at a certain amount per kW of maximum demand + a certain amount per kWh of energy consumed.
- Total charges = Rs (X x kW + Y x kWh)
- It is easily understood by the consumer.
- It recovers fixed charges which depend upon the maximum demand of the consumer independent of the units consumed.

Disadvantages

- Consumer has to pay the fixed charges irrespective of the fact whether he has consumed or not the electrical energy.
- There is always error in assessing the maximum demand of the consumer.

Maximum demand tariff:

It is similar to two-part tariff. The only difference is the maximum demand of the consumer is calculated by installing a maximum demand meter at his premises. This type of tariff is mostly applied to the bulk consumers.

Power factor tariff:

The tariff in which the power factor of the consumers is taken into account is known as power factor tariff.

Three part Tariff:

When the total charges to be made from the consumer is split into three parts, fixed charge, semifixed charge and running charge, it is known as three-part tariff. This type of tariff is applied to big consumers. The principle objection of this type of tariff is the charges are split into three components (fixed charge, charge per kW of maximum demand, charge per kWh of energy consumed)

b) The tariff in force is Rs.75 per KVA of maximum demand and 4 paisa per unit consumed. If the load factor is 25 %, find the overall cost per unit at (i) unity pf (ii)0.7pf (6)

Solution. *(a)* **At 25% load factor and unity power factor**

Maximum demand charge *per unit* = $\frac{75 \times 100}{8760 \times 0.25}$ = 3.43 paise

Energy charge per unit = 4 paisa ; Cost *per unit* = 4 + 3.43 = **7.43 paise**

(b) **At 25% load factor and 0.7 power factor**

Maximum demand charge *per unit* = $\frac{75 \times 100}{0.7 \times 0.25 \times 8760}$ =**4.9 paise**

Energy charge per unit = 4 paise ; Cost per unit = 4 + 4.9 = **8.9 paise**

UNIT-III

VII. a) A transmission line has a span of 214 m between level supports. The conductors have a sross sectional area of 3.225cm^2. Calculate the factors of safety under the following condition: vertical sag = 2.35m, wind pressure= 1.5kg/m run, breaking stress= 2540kg/cm^2, weight of conductor = 1.123kg/m run (9)

Here, l=214 m; w=1.125 kg; w_w=1.5 kg

Overall weight of one metre length of conductor is

$$w_t = \sqrt{w^2 + w_w^2} = \sqrt{(1.125)^2 + 1.5^2} = 1.875\ kg$$

If f is the safety factor, then,

Working tension, $T = \frac{Breaking\ stress \times conductor\ area}{safety\ factor} = \frac{2540 \times 3.225}{f} = \frac{8191}{f}\ kg$

Slant Sag, $S = \frac{Vertical\ sag}{\cos\theta} = \frac{2.35 \times 1.875}{1.125} = 3.92\ m$

Now $S = \frac{w_t l^2}{8T}$

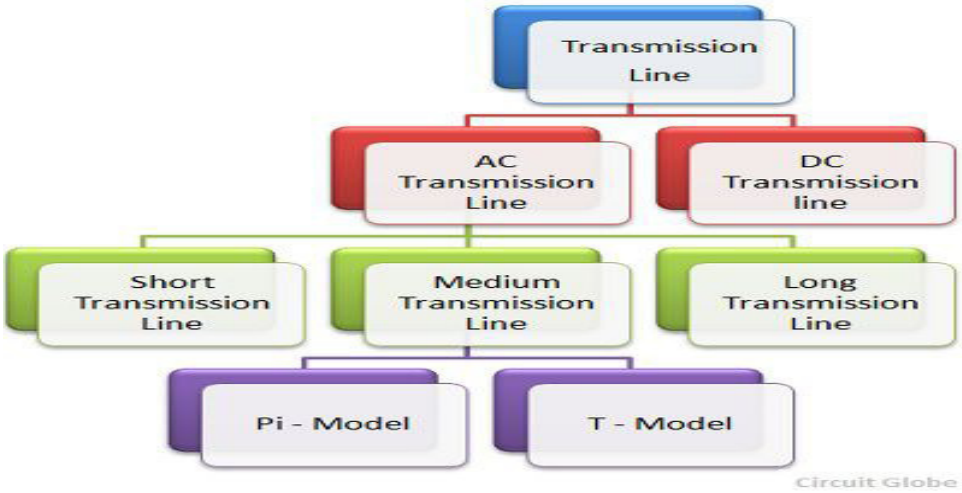
Or

$$T = \frac{w_t l^2}{8S}$$

$$\frac{8191}{f} = \frac{1.875 \times 214^2}{8 \times 3.92}$$

Or safety factor $f = \frac{8191 \times 8 \times 3.92}{1.875 \times 214^2} = 3$

b) Classify transmission line based on length and operating voltage (6)



1. AC Transmission Line

The transmission line has resistance R, inductance L, capacitance C and the shunt or leakage conductance G. These parameters along with the load and the transmission line determine the performance of the line. The term performance means the sending end voltage, sending end currents, sending end power factor, power loss in the line, efficiency of the transmission line, regulate and limit of power flow during efficiency and transmission, regulation and limits of power during steady state and transient condition.

Short Transmission Line

If the line is not more than 80 KV or if the voltage is not over than 66 KV then the line is known as the short transmission line. The capacitance of the line is governed by their length. The effect of capacitance on the short transmission line is negligible, but for cable where the distance between the conductor is small, the effect of capacitance cannot be ignored.

Medium Transmission Line

The line which is ranging from 80 to 240 km is termed as a medium transmission line. The capacitance of the medium transmission line cannot be ignored. The capacitance of the medium transmission line is considered to be lumped at one or more point of the lines.

Long Transmission Line

The line having a length more than 240 km is considered a long transmission line. All the four parameters (resistance, inductance, capacitance, and leakage conductance) are found to be equally distributed along the entire length of the line.

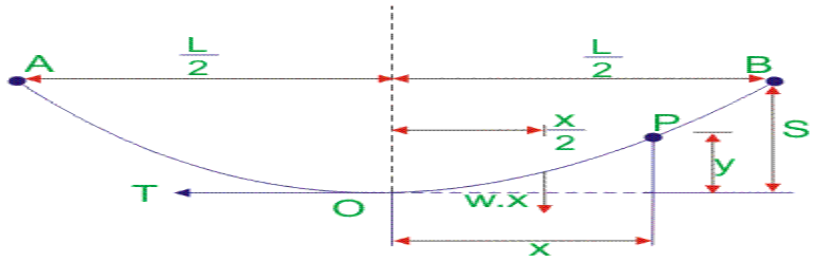
2. DC Transmission Line

The DC transmission is mainly used for the bulk power transmission. For long distance transmission, the DC is less expensive and have low electrical losses. The cost of the DC transmission systems is higher for short distance transmission line because it requires more convertible equipment as compared to an AC system.

OR

VIII a) Express the calculation of sag in equal and unequal levels (10)

Sag calculation for supports are at equal levels



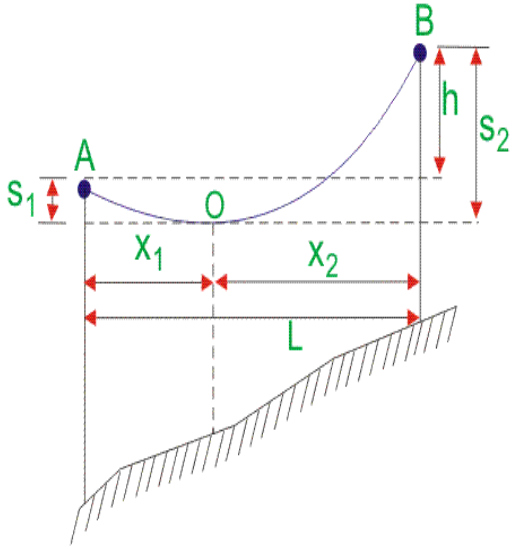
Suppose, AOB is the conductor. A and B are points of supports. Point O is the lowest point and the midpoint. Let, L = length of the span, i.e. AB w is the weight per unit length of the conductor T is the tension in the conductor. We have chosen any point on conductor, say point P. The distance of point P from Lowest point O is x. y is the height from point O to point P.

Equating two moments of two forces about point O as per the figure above we get,

$$Ty = wx \times \frac{x}{2}$$

$$Now, y = \frac{wx^2}{2T},\ when\ y = S\ and\ x = L/2\ \ Then\ S = \frac{wL^2}{8T}$$

Sag calculation for supports are at unequal levels



Suppose AOB is the conductor that has point O as the lowest point. L is the Span of the conductor. h is the difference in height level between two supports. x_1 is the distance of support at the lower level point A from O. $x_2$is the distance of support at the upper level point B from O. T is the tension of the conductor. w is the weight per unit length of the conductor. Now,

$$Sag\ S_1 = \frac{wx_1^2}{2T}\ And\ Sag\ S_2 = \frac{wx_2^2}{2T}$$

$$Also,\ x_1 + x_2 = L.....equation(1)$$

$$Now,\ S_2 - S_1 = \frac{w}{2T}(x_2^2 - x_1^2) = \frac{w}{2T}(x_2 - x_1)(x_2 + x_1)$$

$$So,\ S_2 - S_1 = \frac{wL}{2T}(x_2 - x_1)$$

$$Again, S_2 - S_1 = h$$

$$So, h = \frac{wL}{2T}(x_2 - x_1)$$

$$Or,\ (x_2 - x_1) = \frac{2Th}{wL} \ldots\ldots\ldots equation(2)$$

$$Solving\ equation\ (1)\ and\ (2),\ we\ get$$

$$x_1 = \frac{L}{2} - \frac{Th}{wL}\ and\ x_2 = \frac{L}{2} + \frac{Th}{wL}$$

b) Discuss transmission line parameters (5)

Parameters of transmission line

The performance of transmission line depends on the parameters of the line. The transmission line has mainly four parameters, resistance, inductance, capacitance and shunt conductance. These parameters are uniformly distributed along the line. Hence, it is also called the distributed parameter of the transmission line.

Line inductance – The current flow in the transmission line induces the magnetic flux.When the current in the transmission line changes, the magnetic flux also varies due to which emf induces in the circuit. The magnitude of inducing emf depends on the rate of change of flux. Emf produces in the transmission line resist the flow of current in the conductor, and this parameter is known as the inductance of the line.

Line capacitance – In the transmission lines, air acts as a dielectric medium. This dielectric medium constitutes the capacitor between the conductors, which store the electrical energy, or increase the capacitance of the line. The capacitance of the conductor is defined as the present of charge per unit of potential difference.

Capacitance is negligible in short transmission lines whereas in long transmission; it is the most important parameter. It affects the efficiency, voltage regulation, power factor and stability of the system.

Shunt conductance – Air act as a dielectric medium between the conductors. When the alternating voltage applies in a conductor, some current flow in the dielectric medium because of dielectric imperfections. Such current is called leakage current. Leakage current depends on the atmospheric condition and pollution like moisture and surface deposits.

UNIT IV

IX a) What are the different methods of voltage regulation (10)

The methods used for controlling the voltage are explained below in details.

1. **Off – Load Tap Changing Transformer** – In this method, the voltage is controlled by changing the turn ratio of the transformer. The transformer is disconnected from the supply before changing the tap. The tap changing of the transformer mostly done manually.

2. **On – Load Tap Changing Transformer** – This arrangement is used for changing the turn ratio of the transformer for regulating the system voltage when the transformer delivers the load. Most of the power transformer is provided with on-load tap changer.

3**. Shunt Reactor** – The shunt reactor is the inductive current element which is connected between the line and neutral. The shunt reactor compensates the inductive current from the transmission line or underground cables. It is mainly used in the long distance EHV and UHV transmission lines for reactive power control.

The shunt reactors are used in the sending end substation, receiving end substation and in the intermediate substation of long EHV and UHV line. In the long transmission line, the shunt reactor is connected at the distance of 300 Km to limit the voltage at an intermediate point.

4. **Shunt Capacitors** – The shunt capacitors are the capacitors connected in parallel with the line. It is installed at the receiving end substation, distribution substations and in the switching substations. The shunt capacitor injected the reactive volt-ampere to the line. It is placed in the three phase bank.

5. **Synchronous Phase Modifier** – The synchronous phase modifier is the synchronous motor running without a mechanical load. It is connected with the load at receiving the end of the line. The synchronous phase modifier absorbs or generates the reactive power by varying the excitation of the field winding. It keeps the voltage constant at any condition of the load and also improves the power factor.

6. **Series Var Systems (SVS)** – The static VAR compensator inject or absorb the inductive VAR to the system when the voltage becomes higher or lower than the reference value. In static VAR compensator, the thyristor is used as switching device in place of circuit breakers. Nowadays, the thyristor switching is used in the system in place of mechanical switching because thyristor switching is faster and provides transient free operation by controlling the switching.

b) Comparison between OH and UG distribution systems (5)

1 .Overhead Transmission lines are cheaper as the insulation cost is lesser and the conductor material cost is lesser too. They also have better heat dissipation. However, they have significant disadvantages. Overhead lines are vulnerable to lightning strikes which can cause interruption. Overhead lines use bare conductors and can cause damage if they break. They are considered to be unsightly as they mar the scenery of the landscape. The maintenance cost of overhead lines is more and the voltage drop in overhead lines is more.

2. Underground transmission due to cables is expensive than overhead transmission as the ground needs to be excavated. This can be difficult when passing though geographic obstructions such as hills, marshes and rivers. Special trenches need to be constructed when passing through loose soil. Besides, heat dissipation in underground cables is an issue. Hence, the conductors have to be thicker. The insulation required for the cables is expensive. Hence, it is difficult to use underground cables for voltages at HV levels (> 33 kV).

3. Underground cables may have to be rerouted to accommodate other underground structures such as pipelines, sewage lines, etc. It is necessary that the routes of underground lines are clearly marked with signboards to prevent accidents when excavations are carried out for other reasons at a later date.

4. Underground cables has less chances of faults. Because all cables are under the ground and usually better Insulation is provided on the other hand overhead transmission lines have more chances of faults due to effects Of weather

5. Usually it is difficult to find faults and other problems in underground transmission lines than overhead transmission lines.

6. Underground transmission lines have more useful life than Overhead transmission lines. if Overhead tranmission have age of 25 years. Then the age of Underground transmission will be 50 years.

7. For public safety, Underground transmission lines are better than Overhead transmission lines.

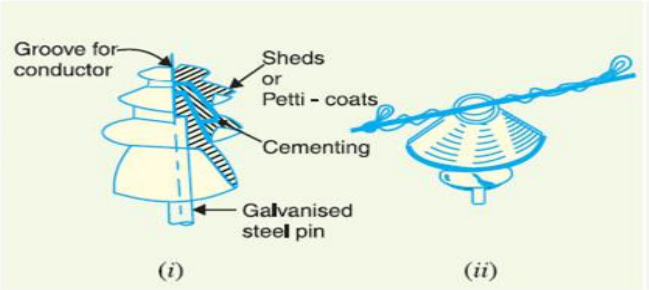
8. Maintenance cost of Overhead transmission lines are more than Underground transmission. Because there is no lighting problems in Underground transmission lines.

9. Overhead transmission lines interfere with the communication system. As as result the electric potential of Communication paths increases to a distortion level

OR

X a) Explain given list of insulators with figure (i)pin type (ii)strain type (iii)suspension type (iv) shackle type (9)

1 Pin type Insulators



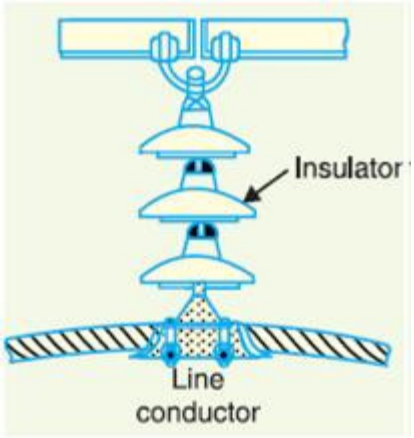
As the name suggests, the pin type insulator is secured to the cross-arm on the pole. There is a

groove on the upper end of the insulator for housing the conductor. The conductor passes through this groove and is bound by the annealed wire of the same material as the conductor.

Pin type insulators are used for transmission and distribution of electric power at voltages upto 33 kV. Beyond operating voltage of 33 kV, the pin type insulators become too bulky and hence uneconomical.

Pin Type Image

2 Suspension Type



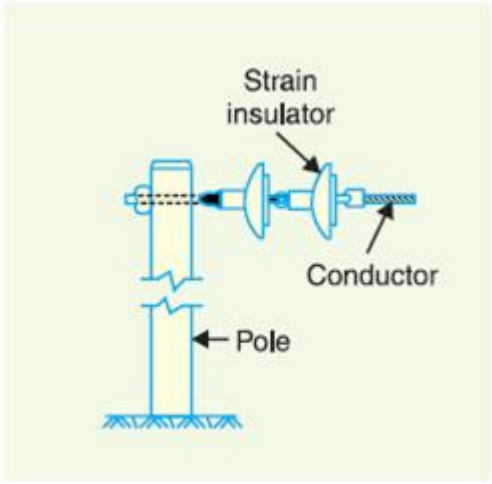
Suspension Type

For high voltages (>33 kV), it is a usual practice to use suspension type insulators shown in Figure. consist of a number of porcelain discs connected in series by metal links in the form of a string. The conductor is suspended at the bottom end of this string while the other end of the string is secured to the cross-arm of the tower. Each unit or disc is designed for low voltage, say

11 kV. The number of discs in series would obviously depend upon the working voltage. For instance, if the working voltage is 66 kV, then six discs in series will be provided on the string.

Suspension Type Image

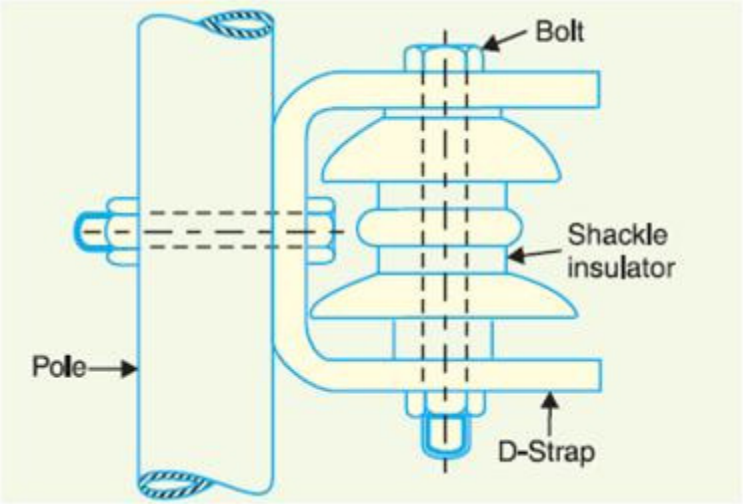
3 Strain Insulators



Strain Type Insulator

When there is a dead end of the line or there is corner or sharp curve, the line is subjected to greater tension. In order to relieve the line of excessive tension, strain insulators are used. For low voltage lines (< 11 kV), shackle insulators are used as strain insulators. However, for high voltage transmission lines, strain insulator consists of an assembly of suspension insulators as shown in Figure. The discs of strain insulators are used in the vertical plane. When the tension in lines is exceedingly high, at long river spans, two or more strings are used in parallel.

4 Shackle Insulators



Shackle Type Insulator

In early days, the shackle insulators were used as strain insulators. But now a days, they are frequently used for low voltage distribution lines. Such insulators can be used either in a horizontal position or in a vertical position. They can be directly fixed to the pole with a bolt or to the cross arm.

b) Distinguish between feeder and transmission line **(6)**

A feeder is line which starts from grid to whom which we want to transmit power to the consumers. Feeder is an electrical distribution network. They carry power from substation to consumers

A transmission is a line starts from generating station and ends at the power grid . it can be either short ,medium, or long transmission line. Transmission lines are current carrying lines that carry power from generating stations to the substations.