Revision:TED (15)

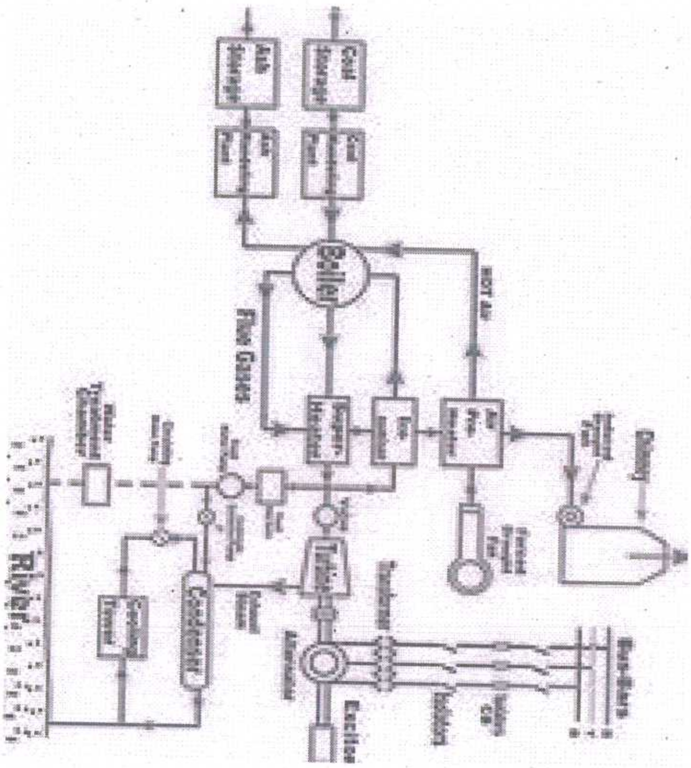
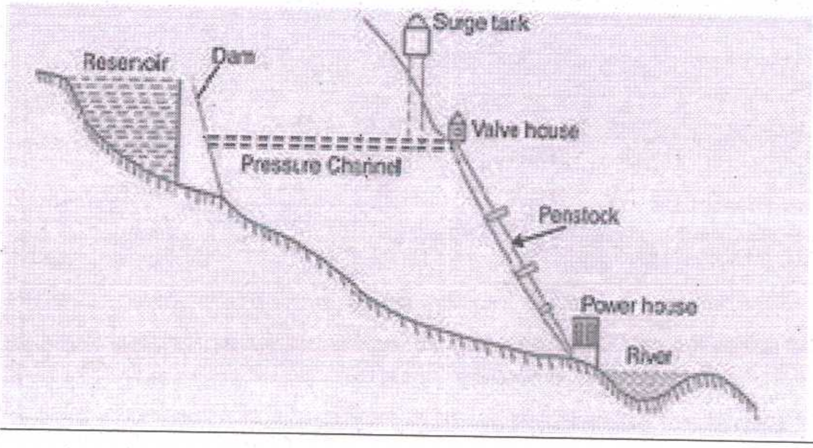
Course title: **ELECTRICAL POWER GENERATION ,TRANSMISSION AND DISTRIBUTION** Course code:4034

Qst .No	Scoring Indicators	Split up	Sub total	Total
	PART A			
I				
1.	Increases the temperature of the air supplied for coal burning by deriving heat from flue gases.		2	
2.	Conventional energy directly mean the energy source which is fixed in nature like oil, gas and coal.			
	Examples: Coal ,fire wood ,nuclear, petroleum and its products (any two)		2	
3	Maximum demand (Maximum load) is always more than average demand (average load).since L.F. =Avg. load / Max .demand		2	
4.	The difference in level between points of supports and the lowest point on the conductor is called sag		2	
5.	The ratio of voltage across the whole string to the product of no. of discs and the voltage across the disc nearest to the conductor is known as string efficiency		2	10
II	Overall efficiency = 0.33x .09 = 0.297			
1.	Coal used / annum =30x10^{5} / 300=10^{4}tons =10^{7}kg			
	Heat of combustion =Coal used / annum x calorific value	2		
	= 10^{7}x5000 = 5x 10^{10}kcal			
	Heat out put = Overall efficiency x Heat of combustion	2		
	=(0.297) x (5x 10^{10}).=1485 x 10^{7}kcal			
	Unit generated / annum = 1485 x10^{7}/ 860 kwh	1		
	= 17,267,441.86 kwh	1	6	

Qst	Scoring Indicator	Split up	Sub total	Total
II 2.	**Site Selection of Nuclear Power Station** 1. **Availability of Water :** Although very large quantity of water is not regulated as hydro-electric power plant, but still sufficient supply of neutral water is obvious for cooling purposes in nuclear power station. That is why it is always preferable to locate this plant near a river or sea side. 2. **Disposal of ~~Water~~ Waste :** The by products or wastes of nuclear power station are radioactive and may cause severe health hazards. Because of this, special care to be taken during disposal of wastes of nuclear power plant. The wastes must be buried in sufficient deep from earth level or these must be disposed off in sea quite away from the sea share. Hence, during selecting the location of nuclear plant, these factors must be taken into consideration. 3. **Distance from Populated Area :** As there is always a probability of radioactivity, it is always preferable to locate a nuclear station sufficiently away from populated area. 4. **Transportation Facilities :** During commissioning period, heavy equipments to be erected, which to be transported from manufacturer site. So good railways and road ways availabilities are required. For availability of skilled manpower good public transport should also be present at the site. **(4 points)** **(Explanation)**	4 2	6	
3.	**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 (a x kW + b x kWh)	4		
	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.	2	6	

Qst	Scoring Indicator	Split up	Sub total	Total
II 4.	1. **Domestic load.** Domestic load consists of lights, fans, refrigerators, heaters, television, small motors for pumping water etc. 2. **Commercial load.** Commercial load consists of lighting for shops, fans and electric appliances used in restaurants etc. This class of load occurs for more hours during the day as compared to the domestic load. 3. **Industrial load.** Industrial load consists of load demand by industries. The magnitude of industrial load depends upon the type of industry. Thus small scale industry requires load upto 25 kW, medium scale industry between 25kW and 100 kW and large-scale industry requires load above 500 kW. Industrial loads are generally not weather dependent. 4. **Municipal load.** Municipal load consists of street lighting, power required for water supply and drainage purposes. Street lighting load is practically constant throughout the hours of the night. 5. **Irrigation load.** This type of load is the electric power needed for pumps driven by motors to supply water to fields. Generally this type of load is supplied for 12 hours during night. 6. **Traction load.** This type of load includes tram cars, trolley buses, railways etc. This class of load has wide variation.	6	6	
5.	Given datas : Tension T=1550 kg ,Length L =260 m ,Weight of conductor / mtr =680 / 1000= 0.68 kg / m	2		
	Sag = WL ²/ 8T S = 0.68 x(260) ²/ 8 x 1550 =3.7 m	2		
	Height of support = 10 + 3.7 =13.7 meter	2	6	
6.	**Skin effect is a tendency for alternating current (AC) to flow mostly near the outer surface of an electrical conductor, such as metal wire.** The **Skin effect** depends upon the factors	2		
	1. Diameter of conductor(As diameter increases more current flows through the surface) 2. Shape of wire. 3. Operational frequency 4. Nature of Material	2		
		4	6	

Qst	Scoring Indicator	Split up	Sub total	Total
II 7.	**1.By using longer cross-arms.** The value of String Efficiency of Insulator depends upon the value of K i.e., ratio of shunt capacitance to mutual capacitance. The lesser the value of K, the greater is the String Efficiency of Insulator and more uniform is the voltage distribution. The value of K can be decreased by reducing the shunt capacitance. In order to reduce shunt capacitance, the distance of conductor from tower must be increased i.e., longer cross-arms should be used.	2		
	2.By grading the insulators. In this method, insulators of different dimensions are so chosen that each has a different capacitance. The insulators are capacitance graded i.e. they are assembled in the string in such a way that the top unit has the minimum capacitance, increasing progressively as the bottom unit (i.e., nearest to conductor) is reached.	2		
	3.By using a guard ring. The potential across each unit in a string can be equalized by using a guard ring which is metal ring electrically connected to the conductor and surrounding . The guard ring introduces capacitance between metal fittings and the line conductor.			
	PART C			
III (a)	**Conventional Sources I.**.The sources of energy which have been in use for a long time.	2	6	42
	II. They are exhaust able except water.			
	III. They cause pollution when used, as they emit smoke and ash.			
	IV. They are very expensive .			
	V.They primarily used for industrial and commercial purpose			
	Non-Conventional Sources of Energy			
	I. These refers to the sources that are identified few years ago. .			
	II. They are inexhaustible.			
	III. They are generally pollution free.			
	IV. Less expensive due to local use and easy to maintain.			
	V. They are mainly used for domestic purpose.	5		
	Conventional methods.:.Solid ,Liquid ,Gaseous fuels, Nuclear	1.5		
	Non conventional methods:Wind,solar,tidal,Biomass,wave,OTEC	1.5	8	

<table>
<tr><th>Qst</th><th>Scoring Indicator</th><th>Split up</th><th>Sub total</th><th>Total</th></tr>
<tr><td>III(b)</td><td>Steam power plant

</td><td>7</td><td>7</td><td>15</td></tr>
<tr><td>IV a</td><td>
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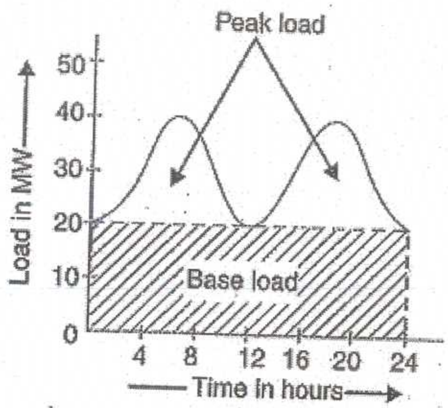
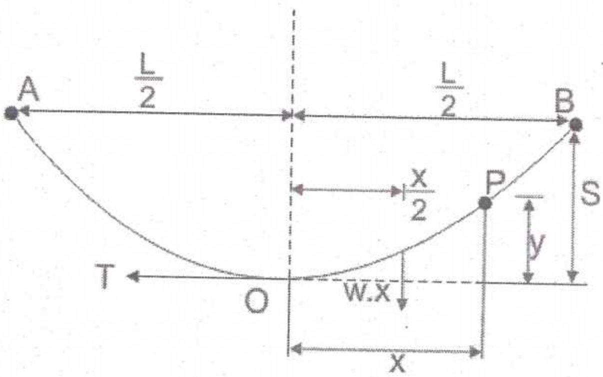
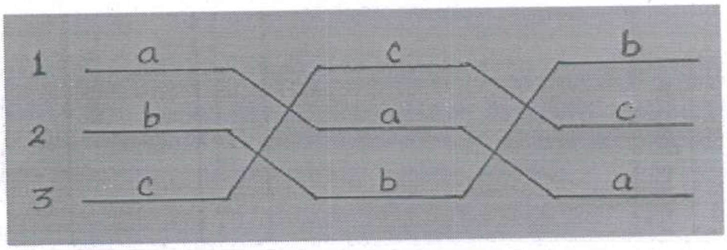
Q st	Scoring Indicator	Split up	Sub total	Total
	Working of Hydroelectric Power Plant: 1. Reservoir: water harvested from the catchment area is stored in the reservoir which is then used to generate the electricity. 2. Dam: it is made in the path of the river to make the reservoir to hold the rain water. 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. Surge tank: surge tank is build in between dam and the valve house. It is used to take care of the system load fluctuations. 5. Penstock: it is water pipeline carrying water from dam to turbine. 6. 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. 7. Powerhouse: it consists of turbine, alternator and electrical equipment. 8. Tail races: outlet water of the turbine is discharged to the river trough tail races.	3	8	
IV b.	**Thermal Power (Steam power plant)**1. Thermal Power is generated by heating fossil fuels such as coal, petroleum and natural gases. 2. It is a non-renewable source of energy. 3. Thermal power causes air pollution. 4. It is expensive. 5.Higher running cost than hydro electric power station 6.Overall efficiency is about 25 % 7.Maintenance cost is high as skilled operating staff is required 8.Requires a lot of time to starting **Hydro electric Power**1. Hydel Power is generated using the force of running or falling water. 2. It is a renewable source of energy. 3. Hydro Power is pollution-free. 4. It is economical. 5.Running cost is practically nil because no fuel is required (any 5 points)		7	15

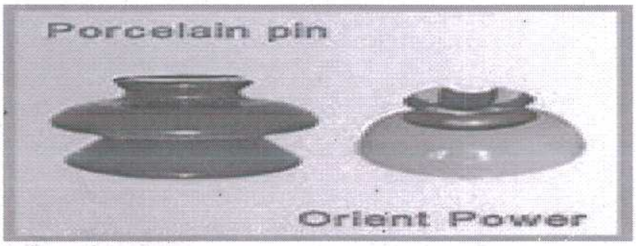
Qst	Scoring Indicator	Split up	Sub total	Total
	Module II			
V a	The tariff is the rate at which the electrical energy is supplied to the consumer. There are various types of tariffs followed in the market.	1		
	Tariff types: 1. Simple tariff 2. Flat rate tariff 3. Block rate tariff 4. Two part tariff 5. Maximum demand tariff 6. power factor tariff 7. Three part tariff	7	8	
V b	 **Fig. 3.13**	3		
	1.Base load. **The unvarying load which occurs almost the whole day on the station is known as base load.**	2		
	2.Peak load. **The various peak demands of load over and above the base load of the station is known as peak load..**	2	7	15

Qst. No	Scoring indicator	SPLIT UP	Sub total	Total
VI a	**1.Fixed Cost** It is independent of the maximum demand, the plant capacity and the energy generated. Fixed cost includes: ▪ Annual charges of the central organization management ▪ Salary of the employees (usually higher officials) ▪ Interest on the land costs	2		
	2.Semi Fixed Charges of Power Generation These charges mainly depend on the installed capacity of the plant and are independent of the electrical energy output of the plant. These charges include the following : 1. Interest and depreciation on the capital cost of the generating plant, transmission and distribution network, buildings and other civil engineering works etc. Capital cost of the plant also includes the interest paid during the construction of the plant, salaries of engineers and other employees, development and construction of the power station. It also includes cost incurred on account of transportation, labor etc. to bring the equipment on site and installing the same, all of which are involved for the overall economics of power generation. It is particularly note worthy, that in nuclear stations the capital cost of the station also includes the cost of initial charges of the nuclear fuel minus the salvage value paid at the end of its useful life. 2. It also includes all types of taxes, insurance premiums pain on policies to cover the risk of accidental breakdown. 3. Rent paid for the land being actually used for the construction purpose. 4. The cost due to starting and shutting down of plants are also included in this category, when the power plant operates on one or two shift basis	4		
	3.Running Or Operating Cost Running charges will depend mainly upon the energy (in units or kWh) generated by the plant. 1. Cost of fuel: 2.Cost of maintenance and repairs: 3.Salaries of the operating staff: 4.Other Costs:	2	8	

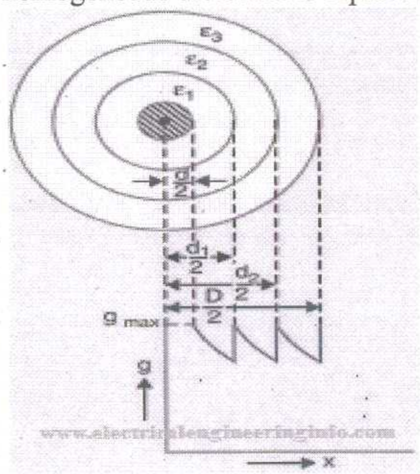
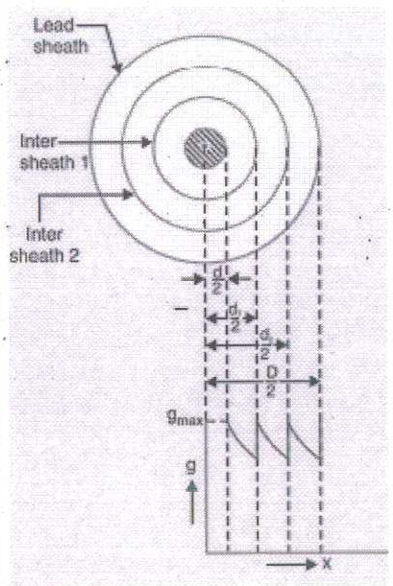
Qst	Scoring Indicator	Split up	Sub total	Total
VI(b)	Max.Demand :It is the greatest demand of load on the power station during a given period,	1		
	Demand factor :It is the ratio of maximum demand on the power station to its connected load .ie ..Demand Factor =Max. demand/Connected load. It will be usually less than one	3		
	Diversity Factor :The ratio of the sum of individual maximum demand to the maximum demand on the power station is known as diversity factor. It will be always greater than one	3	7	15
Vii a		2		
	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, $Ty = wx \times \frac{x}{2}$ $Now, y = \frac{wx^2}{2T}, \ when \ y = S \ and \ x = L/2$ $Then \ S = \frac{wL^2}{8T}$ **Factors causing sag**	4		
	1.Wt of conductor 2.Length of span 3.Tensile strength 4.Temperature5,Wind pressure 6.Ice weight	2	8	

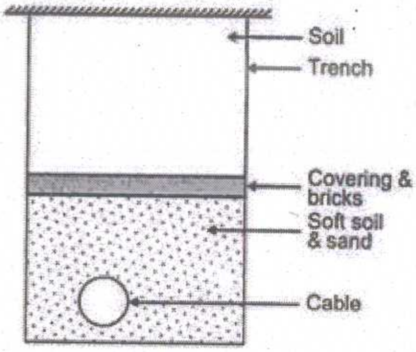
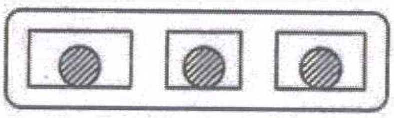
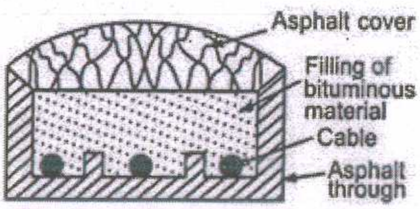
Qst	Scoring Indicator	Split up	Sub total	Total
VII(b)	Overhead transmission line are classified as, 1. Short transmission lines 2. Medium transmission lines 3. Long transmission lines			
	Short Transmission Lines	1		
	A short transmission line is one in which the line voltage is comparatively low (< **20kV**) and the length of an overhead transmission line is upto about **50km**. Due to smaller length and lower voltages the capacitance effects are small and hence can be neglected. Hence, whenever studying the performance of a short tranmssion line only resistance and inductance of the line are taken into consideration.	2		
	Medium Transmission Lines The transmission line having length of an overhead transmission line in the range **50-150 km** and the line voltage is moderately high (> **20 kV** < **100kV**) is considered as a medium transmission line. Since the line is having sufficient length and line voltage, the capacitance effects are taken into consideration. For the puropose of calcuklations, the distributed capacitance of the line is divided and lumped in the form of condensers shunted across the line at one or more points.	2		
	Long Transmission Line When the length of an overhead line is more than **150 km** and the line voltage is very high (>**100 kV**), it is considered as long transmission line. For the treatment of such line, the line constants are considered uniformly distributed over the whole length of the line and rigorous methods are employed for solution.	2	7	15

Qst	Scoring Indicator	Split up	Sub total	Total
VIII a		4		
	The interchange of conductor positions of a transmission line at regular intervals along the route is known as Transposition of Conductors.			
	Why transposition is needed? In the power transmission line when the line conductors are asymmetrically spaced i.e. not equally spaced, the inductance of each phase is different causing voltage drops of different magnitudes in the three phases even if the system is operating under balanced condition (load currents are balanced in the three phases). Also the magnetic field external to the conductors is not zero thereby inducing voltages in adjacent communication lines and causing what is known as "telecommunication interference". This can be overcome by the interchange of conductor positions at regular intervals along the route and this practice is known as "transposition of conductors".	4	8	
b	The phenomenon of ionisation of surrounding air around the conductor due to which luminous glow with hissing noise is rise is known as the corona effect. **The undesirable effects of the corona** areThe glow appear across the conductor which shows the power loss occur on it.The audio noise occurs because of the corona effect which causes the power loss on the conductor.The vibration of conductor occurs because of corona effect.The corona effect generates the ozone because of which the conductor becomes corrosive.The corona effect produces the non-sinusoidal signal thus the non-sinusoidal voltage drops occur in the line.The corona power loss reduces the efficency of the line.The radio and TV interference occurs on the line because of corona effect.	4		
	The **Ferranti effect** is, the voltage effect on the collecting end of the transmission line is higher than the transmitting end is called as "Ferranti Effect". Generally, this sort of effect happens due to an open circuit, light load at the collecting end or charging-current of the transmission line.	3	7	15

<table>
<tr><td></td><td colspan="4">Revision: TED(15) Electrical power Generation, Transmission and Distribution
Course code:4034</td></tr>
<tr><td>Qst. No</td><td>Scoring indicator</td><td>SPLIT UP</td><td>Sub total</td><td>Total</td></tr>
<tr><td>IX a</td><td>1.Pin insulator
2.Stay insulator
3.Shackle insulator</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>1.Pin insulator :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.

</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>2.Stay Insulators:
For low voltage lines, the stays are to be insulated from ground at a height. The insulator used in the stay wire is called as the stay insulator and is usually of porcelain and is so designed that in case of breakage of the insulator the wire will not fall to

</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>3.Shackle insulator: It is usually used in low voltage distribution network. It can be used both in horizontal and vertical position.
</td><td>2</td><td>8</td><td></td></tr>
</table>

Qst	Scoring Indicator	Split up	Sub total	Total
(IX)b	(i) Capacitance grading The process of achieving uniformity in the dielectric stress by using layers of different dielectrics is known as **capacitance grading**. In capacitance grading, the homogeneous dielectric is replaced by a composite dielectric.  	3.5		
	2.Intersheath grading : In this method of **Intersheath Grading**, a homogeneous dielectric is used, but it is divided into various layers by placing metallic intersheaths between the core and lead sheath.The intersheaths are held at suitable potentials which are in between the core potential and earth potential.  	3.5	7	15

Qst	Scoring Indicator	Split up	Sub total	Total
X(a)	i) Direct System, (ii) Draw in System and (iii) Solid System. . **1.Direct System Cable Laying Systems**	2		
	 The direct system of cable laying involves the cables laid in a cable trench and after that, the cable is filled with soil. The trench also cover with bricks or concrete slab then again fill with soil. The layout of this Cable Laying Systems can show in the figure. The system of cable laid with a serving and it's enough to protect the power cable from corrosion. 2.<u>Draw in System Underground Cable Laying</u>  <u>Draw in System Cable Layout</u> <u>Draw in system cable layout methods is widely used for heavily populated areas such as urban cities and towns.</u>	2		
	3.Solid System  The solid system of cable laying is mainly performed where the cable is laid in the wood, cast iron, or another nonsoil surface. Normally cable is laid in the manner which provides good mechanical strength to cables. •	2		
		2	8	

Qst. No:	Scoring Indicators		Split Up score	Sub Total	Total
X(b)	OH System	UG System			
	1.Not so safe 2.Cheap 3.Maintenance more 4.Future expansion is easy 5.Appearance is not good 6.Location of fault is easy 7.More current carrying capacity 8.More chances of fault 9.Less reliable 10.Shorter life	1.More safe 2.More expensive 3.Less expensive 4.Future expansion is difficulty 5.Good appearance 6.Location of fault is not easy 7.Less current carrying capacity 8.Less chances of fault due to max. protection 9.More reliable 10.Longer Life (Any seven points)	7	7	15