Electrical Interview Questions

1) What is Electrical Engineering?

- ***Electrical Engineering is the field of Engineering that generally deals with the study and application of electricity, electronics, and electromagnetism.***

2) What is electricity ?

- ***Electricity is a general term used for all phenomena caused by electric charge whether static or in motion.***

3) What are the types of electricity ?

- ***There are two types,(1) Static Electricity and (2) Current Electricity.***

4) What is static electricity ?

- ***Static electricity means electricity at rest in contradistinction to dynamic or current electricity the effects of which are purely due to the electrostatic field produced by the charge. As it is obtained by rubbing two substance such as glass and silk it is also called frictional electricity.***

5) What is current electricity ?

- ***Current electricity means the electricity in motion the effects of which are due to the flow of electrons in a conductor.***

6) What are the types of current electricity ?

- ***There are two types :- (1) Direct current and (2) Alternating current.***

7) What are the different methods of producing electricity ? Give examples.

- ***The methods are –***

  i) By means of frictions- Static electricity is produced.

  ii) By means of chemical action in cells and batteries.

  iii) By means of mechanical driving- Generator produces electricity in two dissimilar methods.

  iv) By means of heat – Thermal electricity is produced.

  v) By means of lighting effect – Electricity is produced in photo electric cell.

8) Explain the difference between direct and alternating current?

- Direct current *(DC) is the flow of electric charge in only one direction. It is the steady state of a constant-voltage circuit.*
- Alternating current *(AC) is the flow of electric charge that periodically reverses direction. If the source varies periodically, particularly sinusoidal, the circuit is known as an alternating current circuit.*

9) Where is D.C. used ?

- *(1)Battery charging, (2)Electroplating, (3)Electrolysis, (4) Relays, (5) Traction motors, (6) Cinema projector.*

10) Where is A.C. used ?

- *(1)House hold appliances, (2) Fan, (3) Refrigerators, (4)Power driving motors. (5)Radio and T.V. Set etc.*

11) What is active, reactive, apparent & complex power?

- *I) Active power: It is the actual power that is delivered to the load such as transformer, induction motors, generators, etc and dissipated in the circuit. It is denoted by P & its unit is watts W.*

- *II) Reactive Power: The powers that continuously bounce back and forth between source and load is known as reactive power. It is denoted by Q & its unit is VAR voltage-ampere reactive.*

- *III) Apparent Power: It is the product of voltage & current without referencing the phase difference between them. It is a combination of active power & reactive power. It is denoted by S & its unit Volt-Ampere, VA.*

- *III) Complex power: it is the product of voltage & current with reference to the phase difference between them. it is the complex sum or vector sum of the active power & reactive power. It is denoted by S & measure in VAR.*

12) What is a leading & lagging power factor & how can you improve it? State the methods of power factor correction?

➢ ***The cosine of the angle between voltage & current is called the power factor. If the current leads the voltage, it causes a leading power factor. If the current lags voltage the power factor is lagging.***
Most loads are inductive that causes a lagging power factor. Thus these following methods are used for p.f correction (to nullify the lagging current):-

i) **Static Capacitor**
- *The capacitor helps in providing a leading current that eliminates the lagging component of current & improves the power factor*

ii) **Synchronous Condenser**
- *It is an over-excited synchronous motor with no load that also provides a leading power factor.*

iii) **Phase Advancer**
- *Phase advancer is a simple AC exciter which is connected on the main shaft of the motor and operates with the motor's rotor circuit for power factor improvement. Phase advancer is used to improve the power factor of induction motor in industries.*

13) Why do we improve the power factor?

➢ ***The reason for improving the power factors are stated below;***

- ***Large Line Losses (Copper Losses):*** *Line losses (I^2R) depend on current. The low power factor draws a large amount of current as compared to the high power factor.*
- ***Large kVA rating and Size of Electrical Equipment:*** *PF is inversely proportional to KVA. Low PF equipment with a high KVA rating is larger in size.*
- ***Large Conductor Size and Cost:*** *we need large conductors to transmit the heavy current required due to low power factor.*
- ***Poor Voltage Regulation and Large Voltage Drop:*** *The large current due to low PF causes a high voltage drop that needs to be regulated more often than usual.*
- ***Low Efficiency:*** *The losses due to the high current flow & voltage drop deteriorate the efficiency of the system. The efficiency is maximum at PF=1.*

14) What is a unilateral & bilateral circuit?

- *A unilateral is a type of circuit whose properties change with the direction of current flow or the voltage. The properties of a bilateral circuit do not change with changing the current direction or supply voltage.*

15) What is a linear & non-linear circuit?

- *In a linear circuit, the relation between the current & voltage is linear i.e. directly proportional. The circuit parameter such as frequency, resistance, inductance, capacitance, etc. remains constant with varying current & voltage.*
  While in the non-linear circuit, the current & voltage does not have a linear relationship. The electrical parameters of such circuits changes with varying voltage & current.

16) What could be the reason for the current to double in a linear circuit?***

- *There are two reasons for increasing the current:*

  1) Either the total resistance of the circuit is reduced by half

  2) Or the supply voltage to the circuit is doubled.

17) Why is Battery Rating in Ah (Ampere hour) and not in VA or Watts?

- *A battery converts chemical energy into electrical energy which is the charge stored inside the chemicals. The amount of current it can supply is for a said time thus Ampere-hour Ah is the unit for its rating. While the batteries supply direct current which has no phase or frequency thus there is no concept of P.F or reactive power, thus no need for expressing it in VA and its rated in Ah.*

18) What is a primary & secondary cell?

- *The primary cell is a non-rechargeable battery that cannot be recharged by any means. They are disposable & cannot be used once they are fully discharged. They are mostly used in toys, handheld devices & remote controllers, etc.*

- *The secondary cell is a rechargeable battery that can be recharged several hundreds of times (depends on its life cycle). Their initial cost is expensive compared to the primary cell. They are mostly used in cell phones, vehicles, generators, etc.*

19) What are the limitations of ohm's law?

- *Ohm law is not applicable to a unilateral circuit or a non-linear circuit. The criterion for ohm's law is that the resistance must be constant which also depends on the temperature. Whereas, the resistance of a non-linear or unilateral circuit varies with voltage & current. Thus it is not applicable in such a circuit. Also, the temperature must remain constant.*

20) Does current lead or lag the voltage in an inductive or capacitive circuit?

- *The current lags the voltage in an inductive circuit while the current leads the voltage in a capacitive circuit.*

21) Define the term Capacitance and Inductance

- *<u>Capacitance:</u> capacitance is the ability of a component to store charge between two plates when there is a potential difference applied. It is denoted by C & it is measured in Farads F.*
- *<u>Inductance:</u> inductance is the ability of a conductor to resist or oppose any change in the current. The current generates a magnetic field whose strength varies with the current. It is denoted by L & is measured in Henry H.*

22) Why the Capacitors works on AC only?

- *Generally capacitor gives infinite resistance to dc components (i.e., block the dc components). It allows the ac components to pass through.*

23) What is the maximum power transfer theorem?

- *It mentions the condition for maximum power transfer from source to load. It states that n a linear, bilateral network, the maximum power will be transferred from source to the load when the external load resistance equals the internal resistance of the source or Thevenin's resistance of the circuit.*

24) **Explain Thevenin's Theorem in a single sentence.**

- ***Thevenin's theorem states that any linear electrically complex circuit is reduced into a simple electric circuit with one voltage and resistance connected in series.***

25) **Explain Norton's Theorem in a single sentence.**

- ***Norton's Theorem states that it is possible to simplify any linear circuit, no matter how complex, to an equivalent circuit with just a single current source and parallel resistance connected to a load.***

26) ***Explain Network Theorem.***

- ***The current through, or voltage across, any element of a network is equal to the algebraic sum of the currents or voltages produced independently by each source. In other words, this theorem allows us to find a solution for a current or voltage using only one source at a time.***

27) **What are the different colors on wires indicates? Or Mention what are the different colors on wires indicates?**

- ***The different colors of the wires are used for phase indication purposes. They represent different phases, the neutral & earth cable. The color code may differ around the world but usually, the earth wire remains the same i.e green with yellow stripes.***

This is a must know question for any Electrical Engineer***

Black wire*: This wire is used for power supply in all circuits. Any circuits with this color are considered* ***hot or live****. It is never used for a neutral or ground wire.*

***Red wire**: This color wire is a secondary live wire in a 220 volt circuit and used in some types of interconnection. You can join the red wire to another red wire or to a black wire*

***Blue and Yellow wire**: These wires are also used to carry power but are not wiring the outlets for common plug-in electrical devices. They are used for the live wire pulled through the conduct. You will see yellow wire in the fan, structure lights, and switched outlets.*

***White and Gray**: This color wire is used as a neutral wire. It carries the current (unbalanced load) to the ground. You can join white and gray only to other white and gray wires*

***Green**: It is connected to the grounding terminal in an outlet box and run from the outlet box to the ground bus bar within an electric panel.*

28) Explain The Working Principal Of The Circuit Breaker?

- ***Circuit Breaker is one which makes or breaks the circuit. It has two contacts namely fixed contact & moving contact. Under normal condition the moving contact comes in contact with fixed contact thereby forming the closed contact for the flow of current. During abnormal & faulty conditions (when current exceeds the rated value) an arc is produced between the fixed & moving contacts & thereby it forms the open circuit. Arc is extinguished by the Arc Quenching media like air, oil, vacuum etc.***

29) What Is a Vacuum Circuit Breaker?

- ***A circuit breaker breaks the circuit by opening the contact terminals. During the opening, an arc is generated between the terminals that can be quenched using various mediums. In VCB, the medium for arc quenching is a vacuum. The vacuum has a high voltage arc quenching ability as compared to air & they are used for in high voltage circuits.***

30) What is the difference between MCB & MCCB?

- ***The MCB stands for "miniature circuit breaker" & it is used for current rating lower than 100 amps with interrupting ratings of below 18k Amps. Its tripping characteristics cannot be adjusted & they are used for domestic purposes.***
- ***The MCCB stands off "Molded case circuit breaker". It has a high current rating of around 2500 Amps, where its interrupting ratings are between 10K to 200k Amps. Also, its tripping characteristics can be adjusted. They are used in industries.***

31) What is the difference between a single pole and a double pole circuit breaker?

- ***Single-pole breakers are wired with one hot wire and one neutral wire. When there is an overload in a single-pole breaker's circuit, only that particular breaker trips.***
- ***Double-pole breakers have two hot wires that are connected by a single neutral wire. That means if there's a short circuit on either of the poles' hot wires, both trip.***

32) What Is the Difference Between Fuse And Breaker?

- ***The fuse is made of a metal wire called fuse link or element that melts when the current exceeds its limit. it works automatically & it is a one-time use device that needs to be replaced.***
- ***The circuit breaker is an electromechanical switch that opens the circuit during overcurrent or short-circuits. It works automatically as well as manually & it can be used again by resetting the lever.***

33) What is the difference between circuit breaker & Isolator?

- **Circuit Breaker:**
  A Circuit Breaker is a protective electromechanical device used to control the flow of current same like a fuse. It automatically breaks the circuit in case of fault conditions like short circuit and overload. It can also manually break the circuit. It is ON-load & OFF load device, it means it operates in both ON/OFF supply condition.
- **Isolator:**
  An isolator is a mechanical switch used for isolating or disconnecting power supply in substations. It is an off-load device i.e. it is operated when the power supply is off.

34) Why Motor rated in kW instead of kVA?

- ***As we know the transformer is rated in KVA because its PF (Power Factor) depends on the nature of the loads. However,*** *Motor* ***has a fixed*** *Power factor****, i.e. motor has defined power factor (P.F) and the rating has been mentioned in kW or HP on Motor. In more clear words, Motor only consumes active power and provides mechanical power in HP or kW at the motor shaft and that is the reason for motor rating in Watts.***

35) What is the definition of generator & motor?

- ***An electric motor is a machine that converts electrical energy to mechanical energy. The working principle of a motor is based on the current-carrying conductor that experiences a force when it is kept in the magnetic field. An electric generator is a machine that converts mechanical energy to electrical energy. The working principle of generator is based on electromagnetic induction.***

36) What is a motor starter?

- ***Motor Starter is a device that connects in series with the motor to decrease the starting current (that could damage the windings in normal conditions) and gradually increase current after starting the motor (in other words start or stop the motor) and provide overload protection.***

37) What are the different methods for starting an induction motor?

- ***The methods used for starting an induction motor are the following:***
  - ***DOL: direct online starter***
  - ***Star delta starter***
  - ***Autotransformer starter***
  - ***Resistance starter***
  - ***Series reactor starter***

38) What is the difference between a generator and an alternator?

➢ *The alternator and generator both work on the principle of Faraday's law of electromagnetic induction. An alternator is a device that converts mechanical energy into AC electrical energy. It always induces an alternating current. Alternators are very efficient. A generator is a mechanical device which converts mechanical energy to either AC or DC electrical energy. It can generate either alternating or direct current. Generators are considered less efficient. The major difference between the alternator and the generator is that in alternator, the armature is stationary and the field rotates whereas in the generator, armature rotates and field is stationary.*

39) What Are The Advantages Of Star¬ Delta Starter With Induction Motor?

➢ *The main advantages of star delta starter are:*

- *To decrease the starting current required for the induction motor because it is 6 to 7 times higher than full load current which can damage the windings of the motor.*
- *To eliminate the voltage drop problem because of the huge amount of starting current results in a voltage drop along the consumer line which may damage other electrical appliances.*
- *Its operation is very simple*
- *The cost of this starter is comparatively very cheap.*
- *It has a good torque to current performance.*

40) Why is the starting current high in dc motor?

➢ *The dc motor has no back emf. At the starting of the motor, the armature current is controlled by the resistance of the circuit. The resistance of the armature is low, and when the full voltage is applied at the standstill condition of the motor, the armature current becomes very high which damage the parts of the motor.*

41) What is the slip of an induction motor?

- *The percentage difference between the synchronous speed Ns & the rotor speed N of an induction motor is called slip. it is denoted by S. The rotor speed of the induction motor is always less than its synchronous speed.*

42) Why can't a series motor be started on no-load?

- *A series motor should never be started at no load. With no mechanical load on the series motor, the current is low, the counter-EMF produced by the field winding is weak, and so the armature must turn faster to produce sufficient counter-EMF to balance the supply voltage. The motor can be damaged by overspeed.*

43) Explain the principle of Induction Motor

- *We need to give double excitation to make a DC motor to rotate. In the DC motor, we give one supply to the stator and another to the rotor through brush arrangement. But in induction motor, we give only one supply, so it is interesting to know how an induction motor works.*

  It is simple, from the name itself we can understand that here, the induction process is involved. When we give the supply to the stator winding, a magnetic flux gets produced in the stator due to the flow of current in the coil. The rotor winding is so arranged that each coil becomes short-circuited.

  The flux from the stator cuts the short-circuited coil in the rotor. As the rotor coils are short-circuited, according to Faraday's law of electromagnetic induction, the current will start flowing through the coil of the rotor. When the current through the rotor coils flows, another flux gets generated in the rotor.

  Now there are two fluxes, one is stator flux, and another is rotor flux. The rotor flux will be lagging with respect to the stator flux. Because of that, the rotor will feel a torque which will make the rotor to rotate in the

direction of the rotating magnetic field. This is the working principle of both single and three-phase induction motors.

44) What is the difference between a Four Point Starter and a Three Point Starter?

- *The starter which consist three terminals is known as the three-point starter. The armature, field and line are the terminals of the three-point starter. In the three-point starter, the no-voltage coil (NVC) is connected in series with the field winding.*
  The starter that consist four terminals and hence called the four-point starter. In four-point starter along with the armature, field and line terminal one additional terminal is added which connected the no voltage coil parallel with the shunt field winding. In four-point starter the no-voltage winding is connected in parallel with the field winding.
  The three-point and four-point starter both are similar in construction. But in three-point starter when the speed of the motor varies then the current passes through the field coil and this current affects the no-voltage coil. The four-point starter is designed for reducing the problem.

45) What Is Meant By Regenerative Braking?

- *Regenerative braking takes place whenever the speed of the motor exceeds the synchronous speed. This baking method is called regenerative braking because here the motor works as generator and supply itself is given power from the load, i.e. motors. The main criteria for regenerative braking is that the rotor has to rotate at a speed higher than synchronous speed, only then the motor will act as a generator and the direction of current flow through the circuit and direction of the torque reverses and braking takes place. The only disadvantage of this type of braking is that the motor has to run at super synchronous speed which may damage the*

motor mechanically and electrically, but regenerative braking can be done at sub synchronous speed if the variable frequency source is available.

46) What is Plugging Breaking?

- *In this method the terminals of supply are reversed, as a result the generator torque also reverses which resists the normal rotation of the motor and as a result the speed decreases. During plugging external resistance is also introduced into the circuit to limit the flowing current. The main disadvantage of this method is that here power is wasted.*

47) What is dynamic breaking?

- *In this method of braking the motor which is at a running condition is disconnected from the source and connected across a resistance. When the motor is disconnected from the source, the rotor keeps rotating due to inertia and it works as a self-excited generator. When the motor works as a generator the flow of the current and torque reverses. During braking to maintain the steady torque sectional resistances are cut out one by one.*

48) What Is Meant By Armature Reaction?

- *The effect of armature flux on main flux is called armature reaction. The armature flux causes two effects on the main field flux:*
  - *The armature reaction distorts the main field flux.*
  - *It reduces the magnitude of the main field flux.*

49) Which Motor Has High Starting Torque And Staring Current Dc Motor, Induction Motor Or Synchronous Motor?

- *The DC series motor has the highest starting torque out of all motors & that is why they are used in electrical machinery requiring high starting torque like cranes, hoist, etc.*

50) What is a Universal Motor?

A universal motor works on either DC or single phase AC supply. When the universal motor is fed with a DC supply, it works as a DC series motor.

When current flows in the field winding, it produces an electromagnetic field. The same current also flows from the armature conductors. When a current carrying conductor is placed in an electromagnetic field, it experiences a mechanical force. Due to this mechanical force, or torque, the rotor starts to rotate. The direction of this force is given by Fleming's left hand rule.

When fed with AC supply, it still produces unidirectional torque.

Because, armature winding and field winding are connected in series, they are in same phase. Hence, as polarity of AC changes periodically, the direction of current in armature and field winding reverses at the same time.

Thus, direction of magnetic field and the direction of armature current reverse in such a way that the direction of force experienced by armature conductors remains same. Thus, regardless of AC or DC supply, universal motor works on the same principle that DC series motor works.

51) **What are some of the most common causes of transformer humming?**

- *Electric hum around transformers is caused by stray magnetic fields causing the enclosure and accessories to vibrate. Magnetostriction is a second source of vibration, in which the core iron changes shape minutely when exposed to magnetic fields. Transformer noise is produced by the core. The amount of noise is generally fixed by the design of the transformer.*

52) What is the voltage regulation of the transformer & why is it important?

- *The voltage regulation of a transformer is the percentage change in the secondary voltage from no load to full load condition. Ideally, the secondary voltage remains the same throughout the load, in which case the voltage regulation is zero. But practically it varies with the power factor of the load.*

  The voltage regulation value provides the efficiency of the transformer & it is best to prefer a transformer with low voltage regulation.

53) There is a Transformer and an Induction Machine. Those two have the same supply. For Which Device the load current will be maximum and why?

- ***For same rating and same loading, the losses occurred in both devices will be different because of its construction and application.***

1) ***The transformer has no moving parts unlike induction motor; therefore less magnetizing current will be required for its same load operation. Whereas, induction motors have the air gap between its primary (stator) and secondary (rotor) windings which will demand more magnetizing current due to high leakage reactance compared to the transformer.***
2) ***Induction motor will have to overcome the windage losses occurred due to rotation of the rotor to provide same output.***
   That's why induction motor will consume more load current compared to the transformer.

54) How many types of cooling system are there in Transformers?

- ***The types are***
  1. ***ONAN (oil natural,air natural).***
  2. ***ONAF (oil natural,air forced).***
  3. ***OFAF (oil forced,air forced).***
  4. ***ODWF (oil direct,water forced).***
  5. ***OFAN (oil forced,air forced).***

55) What is an Ideal Transformer?

- ***An ideal transformer is an imaginary transformer in which no losses occur at all. In other words, the transformer Input power is equal to the output power of the transformer i.e. they have 100% efficiency. It is just a theoretical transformer because there must be some losses in a real transformer. Transformer input Power = Transformer Output Power.PIN = POUT.***

56) What output power you will get from an ideal transformer and why?

- ***An ideal transformer does not have any losses like hysteresis loss, eddy current loss etc. So, the output power of an ideal transformer is exactly equal to the input power. Hence, 100% efficiency***.

57) What is transformer efficiency & all-day efficiency? What is the condition for maximum efficiency?

- **Transformer Efficiency:**

The efficiency of the transformer is given by the output power divided by the input power. Some of the input power is wasted in internal losses of the transformer.

$$\textit{Efficiency, } \eta = \textit{Output Power / Input Power}$$

- **All Day Efficiency:**

*The ratio of energy delivered in Kilo Watt-Hour (kWh) to the energy input in kWh of the transformer for **24 hours** is called all-day efficiency*.

$$\eta_{all\_day} = \text{Output in kWh / Input in kWh}$$

- **Condition for Maximum Efficiency:**

The copper loss must be equal to the iron loss; which is the combination of hysteresis loss & eddy current loss.

$$\text{Cu Loss} = \text{Iron Loss}$$

$$W_{cu} = W_i$$

58) Why the current transformer's secondary should not be open when there is current flowing in its primary?

- ***The current transformer is essentially a step-up transformer that increases the voltage & decreases the current on the secondary side. Under the open secondary condition, the primary current becomes the magnetizing current that generates a very high secondary voltage that can damage the insulation as well as can pose danger to personnel.***

59) Why are transformers rated in KVA?

- ***Note:- KVA= KV(killo Volt) * A(ampere)***

  KW= KV(killo Volt) * A(ampere) * Power factor

We already know that Power factor only depends on the type of Loads like,

- ***Inductive Load - Lagging Power factor***
- ***Capacitive Load - Leading Power Factor***
- ***Resistive Load - Unity Power Factor***

i) ***The Transformer is not a Load, it is a device which can transfer power not consume power. If you think that a Transformer is a Load that's wrong. So as the transformer does not consume power it can only transfer power with increasing and decreasing voltage and current that is why the Transformer always rated in KVA.***

ii) ***When the transformer is designed the manufacturer does not know which type of load will be connected in future. And the power factor depends upon the load. If an Inductive Load is connected then the current will be lag which flows through the secondary winding of the transformer as well as the primary winding of the transformer. We also know that pure inductive and pure capacitive load does not practically exist. Every load has some resistance even it inductive or capacitive. For example, a motor is connected to the transformer which is inductive + resistive. So the motor draws both reactive(KVAR) and active power(KW). So the power supplied by the transformer is the vector sum of reactive(KVAR) power and active power(KW) that is KVA.***

iii) ***The Copper loss(I2R) occurs due to the flow of the current in the transformer winding and the Iron or core loss occurs due to the voltage. These losses do not depend on the power factor so that is why the transformer rating in KVA not KW.***

OR

- ***When manufacturers design a transformer, they have no idea which kind of load will be connected to the transformer. The load may be resistive (R), inductive (L), capacitive (C) or mixed load (R, L, and C). Its mean, there would be different power factor (p.f) at the secondary (load) side. The output of real power may vary depending on the power factor. Thus the manufacturer denotes it as "this transformer can provide x number of amperes***

at y amount of voltage". This way, they go for VA as in (voltage x Amperes) instead of W in case of rating of a Transformer.

60) What will happen if DC supply is given to the primary of the Transformer?

- *Mainly transformer has high inductance and low resistance. In case of DC supply there is no inductance, only resistance will act in the electrical circuit. So high electrical current will flow through primary side of the transformer. So for this reason coil and insulation will burn out.*

61) What do you mean by 1Ton of AC?

The cooling produced by melting of 1 ton of ice in a day is taken as unit of refrigeration (in tons). Now unit of refrigeration used in S.I. System is KW.
1 ton of refrigeration
= mass of ice x latent heat of ice / 24 hrs

= 900 kg x 335 KJ/Kg (one short ton = 900 kgs)
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24 x 3600 secs
= 3.4895 KJ/Sec
say 3.5 KJ / Sec = 3.5 KW

That is 1 ton of refrigeration = 3.5 KW

62) What is "pu" in electrical engineering?

- *Pu stands for per unit and this will be used in single line diagram of power distribution and it is like a huge electrical circuit with no of components (generators, transformers, loads) with different ratings (in MVA and KV). To bring all the ratings into common platform we use pu concept in which, in general largest MVA and KV ratings of the component is considered as base values, then all other component ratings will get back into this basis.Those values are called as pu values. (p.u=actual value/base value).*

63) Why are most of the parameters measured in pu?

- ***Circuits are simplified. Voltages have same range in per unit in all parts of the system from EHV system to distribution and utilization. When expressed in the per unit system, apparatus parameters usually fall in narrow range regardless of apparatus size.***

64) ***What are the various kinds of cables used for transmission?***

- *The types of cables based on the transmission voltage ratings are given below :*

- ***Low tension*** *or LT cable t is used for transmission of voltage below 1000v*
- ***High tension*** *or HT cable used for transmission of up to 11kv.*
- ***Super tension*** *cable is used for handling voltage up to 33kv*
- ***Extra high tension*** *cable can handle voltage up to 66 kV.*
- ***Extra super tension*** *cable is used for transmission of voltage up to 132kV.*

65) What is meant by reverse polarity and how it can be fixed?***

- ***An electrical outlet has two wires i.e. neutral & hot or live wire. The Reverse Polarity means that the neutral wire is connected to the terminal where the hot wire is supposed to be. It can create shock hazards because the ON/OFF switches will cutoff only the neutral wire from the appliance connected to such outlets.***

66) What is the difference between surge arrestor and lightning arrestor?

- ***Both of them are used as protection devices for grounding the high voltage transients or surges. The surge arrestor is used inside the circuit to protect the components from high voltage spikes. The lightning arrestors are used outside the circuit such as on transmission tower to protect them from high voltage strikes of lightning.***

67) What Is Critical Disruptive Voltage?

➢ ***It is the minimum voltage required for the breakdown of the insulation (air) between a phase & neutral to discharge the current. It is the voltage at which the corona discharge starts.***

68) How Many Types of Faults Occur in a 3 phase Power System?

➢ ***The faults in the three-phase system are named below:-***

Open circuit fault:

- *Single-phase open fault*
- *Double phase open fault*
- *Three-phase open fault*

Short circuit fault:

- *Single line to ground fault (LG)*
- *Double line to ground fault (LLG)*
- *Line to line fault (LL)*
- *Three phase short circuit fault (LLL)*

69) What Is Skin Effect?

➢ ***The current density of the AC passing through a conductor tends to be very high near the surface & very low near the middle of its cross-section area. This phenomenon is called skin effect & directly proportional to the frequency. That is why; stranded conductors are used for power transmission.***

70) How to reduce Skin Effect?

➢ ***The methods of reducing skin effects are:***

- ***ACSR bundled conductor is used to reduce the skin effect. ...***
- ***Using cable material with less magnetic permeability. ...***
- ***Reducing the size of the conductor.***
- ***Increasing the voltage by reducing the current which decreases the skin effect in the same conductor.***

71) What is Ferranti Effect?

➢ ***The effect in which the voltage at the receiving end of the transmission line is more than the sending voltage is known as the Ferranti effect. Such type of effect mainly occurs because of light load or open circuit at the receiving end. Capacitance and***

inductance are the main parameters of the lines having a length 240km or above. On such transmission lines, the capacitance is not concentrated at some definite points. It is distributed uniformly along the whole length of the line.

When the voltage is applied at the sending end, the current drawn by the capacitance of the line is more than current associated with the load. Thus, at no load or light load, the voltage at the receiving end is quite large as compared to the constant voltage at the sending end.

72) How can we reduce Ferranti Effect?

- *Ferranti effect can be reduced:*

- *By installing shunt compensation devices at receiving end. The compensation device is a shunt reactor which is connected in parallel with the transmission line. It reduces the voltage level by absorbing the reactive power.*
- *Running the transmission line with higher load. I.e if you have two line both carries 5 % load in each side means, we can switch of the one transmission line and the remaining load can be diverted in to another one.*

73) What is Proximity Effect?

- *When the conductors carry the high alternating voltage then the currents are non-uniformly distributed on the cross-section area of the conductor. This effect is called proximity effect. The proximity effect results in the increment of the apparent resistance of the conductor due to the presence of the other conductors carrying current in its vicinity.*

74) How can we reduce Proximity Effect?

- *We can reduce proximity effect by:*
  - *Reducing the size of the conductor*
  - *Increasing the distance between the two conductor. I.e in cable manufacturing to reduce increase the distance between the conductor, we use dummies.*

- *Reducing the frequency and increasing the voltage we can reduce the proximity effect. It is practically not possible. However, AC frequency cannot be changed. But we can step up the voltage further steps.*

75) What is ACSR cable and where we use it?

- *ACSR stands for "Aluminum Conductor Steel Reinforced". Its outer strands are made of highly pure aluminum to have better conductivity while the center strands from steel to increase the tensile strength of the cable. It is used for overhead transmission lines. It has better conductivity & low weight as well as cost.*

76) Why a bird doesn't get shocked while sitting on a power line?

- *Birds can sit on power lines and not get electric shocks because the electricity is always looking for a way to get to the ground. The birds are not touching the ground or anything in contact with the ground, so the electricity will stay in the power line. If the birds touch 2 lines then the circuit will be closed and they will get electrical shock.*

77) Why human bodies feel electric shock? In an electric train during which is running, we do not feel any shock? Why?

- *Unfortunately our body is a pretty good conductor of electricity. The golden rule is that current takes the lowest resistant path. If we have insulation to our feet the circuit is not complete (wearing covered rubber footwear while doing some repairs or when in lab is advisable as our footwear is a high resistance path and not much current flows through our body).The electric train is well insulated from its electrical system.*

78) What does RYB in a circuit indicates?

- *RYB simply stands for Red, yellow and Blue respectively in a three phase electrical system. In a three phase electrical system, the three phases are separated by an angle of 120 degrees and*

each phase is given a specific colour, i.e. R, Y and B for the phases to be identified.

79) Which bulb glows brighter when connected in series, 80Watt or 100 Watt & why?

- *1) When connected in series: In a series connection, current flowing across each element is same. So when 80W bulb and 100W bulb are connected in series, same current will flow through them. To find which bulb will glow brighter we need to find the power dissipation across each of them. From the relation*

*P=(I*I) R*

since current is same we can say that power dissipation will be higher for the bulb with higher resistance i.e. 80W bulb.

Hence 80W bulb will glow brighter in series connection.

- *2) When connected in parallel: In a parallel connection, voltage across each element is same. So when 80W bulb and 100W bulb are connected in parallel, voltage across them will be same. To find which bulb will glow brighter we need to find the power dissipation across each of them. From the relation*

*P=(V*V)/R*

since voltage is same we can say that power dissipation will be higher for the bulb with lower resistance i.e. 100W bulb.

Hence 100W bulb will glow brighter in parallel connection.

80) Explain the working principle of a tube light.

- *The tube light does not work directly on power supply. It needs some auxiliary components to work. They are-*

1) Ballast: It may be electromagnetic ballast or electronic ballast.
2) Starter: The starter is a small neon glow up lamp that contains a fixed contact, a bimetallic strip and a small capacitor.

auxiliary electrical components along with tube light

Working Principle of Tube Light

When the switch is ON, full voltage will come across the tube light through ballast and fluorescent lamp starter. No discharge happens initially i.e. no lumen output from the lamp.

At that full voltage first the glow discharge is established in the starter. This is because the electrodes gap in the neon bulb of starter is much lesser than that of inside the fluorescent lamp.

Then gas inside the starter gets ionized due to this full voltage and heats the bimetallic strip that is caused to be bent to connect to the fixed contact. Current starts flowing through the starter. Although the ionization potential of the neon is little bit more than that of the argon still due to small electrode gap high voltage gradient appears in the neon bulb and hence glow discharge is started first in starter.

As voltage gets reduced due to the current causing a voltage drop across the inductor, the strip cools and breaks away from the fixed contact. At that moment a large L di/dt voltage surge comes across the inductor at the time of breaking.

This high valued surge comes across the tube light electrodes and strike penning mixture (mixture argon gas and mercury vapor).

Gas discharge process continues and current gets path to flow through the tube light gas only due to low resistance as compared to resistance of starter.

The discharge of mercury atoms produces ultra violet radiation which in turn excites the phosphor powder coating to radiate visible light.

Starter gets inactive during operation of tube light.

81) What is measurement?

- ***Measurement is essentially the act, or the result, of a quantitative comparison between a given quantity and a quantity of the same kind chosen as a standard or a unit.***

82) What are the measuring instruments in electrical engineering?

Name	Purpose
Ammeter (Ampermeter)	Measures current
Capacitance meter	Measures the capacitance of a component
Current clamp	Measures current without physical connection
Curve tracer	Applies swept signals to a device and allows display of the response
Cos Phi Meter	Measures the power factor
Distortionmeter	Measures the distortion added to a circuit
Electricity meter	Measures the amount of energy dissipated
ESR meter	Measures the equivalent series resistance of capacitors
Frequency counter	Measures the frequency of the current
Leakage tester	Measures leakage across the plates of a capacitor
LCR meter	Measures the inductance, capacitance and resistance of a component
Megger tester	Measures Resistance of an Winding of Motor or Generator And Measures Earthing's Resistance
Microwave power meter	Measures power at microwave frequencies
Multimeter	General purpose instrument measures voltage, current and resistance (and sometimes other quantities as well)
Network analyzer	Measures network parameters
Ohmmeter	Measures the resistance of a component

Name	Purpose
Oscilloscope	Displays waveform of a signal, allows measurement of frequency, timing, peak excursion, offset, ...
Psophometer	Measures AF signal level and noise
Q meter	Measures Q factor of the RF circuits
Tachometer	Measures speed of motors
Signal analyzer	Measures both the amplitude and the modulation of a RF signal
Signal generator	Generates signals for testing purposes
Spectrum analyser	Displays frequency spectrum
Sweep generator	Creates constant-amplitude variable frequency sine waves to test frequency response
Transistor tester	Tests transistors
Tube tester	Tests vacuum tubes (triode, tetrode etc.)
Wattmeter	Measures power in a circuit
Vectorscope	Displays the phase of the colors in color TV
Video signal generator	Generates video signal for testing purposes
Voltmeter	Measures the potential difference between two points in a circuit. (Includes: DVM and VTVM)
VU meter	Measures the level of AF signals in Volume units

Name	Purpose
CRO(Cathode Ray Oscilloscope)	Check transistor

83) **What is the difference between an ammeter and a voltmeter?**

- ***Ammeter is a low resistance indicating instrument while the voltmeter is high resistance one.***

84) **Why should an ammeter be of very low resistance?**

- ***Ammeter, which is connected in series with the circuit carrying the current under measurement, must be of very low resistance so that the voltage drop across the ammeter and power absorbed from the circuit are as low as possible.***

85) **Why should a voltmeter be of very high resistance?**

- ***Voltmeter, which is connected in parallel with the circuit across which the voltage is to be measured, must be of very high resistance so that the current flowing through the voltmeter and the power absorbed from the circuit are minimum possible.***

86) **How can an ammeter be changed in to a voltmeter?**

- ***An ammeter of low range can be converted into a voltmeter by connecting a high resistance in series with it provided the current through the series combination is within the range of the ammeter when connected across the voltage under measurement.***

87) **What do you understand by the term 'burden' of a CT?**

- ***The product of voltage and current on the secondary side, when the CT is supplying the instrument with its maximum rated value***

of current, is known as rated burden and is expressed in volt-amperes.

88) What is Meggar?

- *An instrument that is used to measure insulation resistance is a Meggar. It is also known as meg-ohm-meter. It is used in several areas like multi-meters, transformers, electrical wiring, Etc. Megger device is used since the 1920s for testing various electrical devices which can measure greater than 1000meg-ohms. The principle of Megger is based on moving coil in the instrument. When current is flowing in a conductor, which is placed in a magnetic field, it experiences a torque. Meggar here is used to measure*

  - *Insulation resistance*
  - *Machine windings*

89) Difference between Analog and Digital Circuit

- *Analog circuit can process an analog input signal that has continuously varying voltage. An analog circuit can convert an analog signal into a digital signal.*
- *Digital circuit can only process a digital signal i.e. a signal that has only two levels (1 or 0 / High or low). They are used in logic-based circuit designing to process complicated functions like in computer & cell phones etc.*

90) What are the types of semiconductors?

- *The main two types of semiconductors are;*

- *Intrinsic semiconductor: the semiconductor that has same number of electrons & holes. They exist in their natural form.*
- *Extrinsic semiconductor: these semiconductors have foreign impurity (electrons or holes) inserted artificially through the process called doping. The impurities are intentionally added to change its electrical properties.*
  - *N-Type: The dopant in this type of semiconductor increases the number of free electrons. So the majority carriers are electrons in N-type.*

- ***P-Type**: the dopant of such semiconductors adds in the excess number of holes. The majority carriers in P-type semiconductors in holes.*

91) Explain what rectifiers are and what are the types of rectifiers?

- ***A rectifier is an electronic circuit that converts the alternating current into a direct current. The types of rectifiers are as follows;***

- ***Uncontrolled rectifier**: these rectifiers are made from diodes & their output only depends on the input supply. They are not controlled by any external means.*
- ***Half wave rectifier;** that converts half i.e. positive half or negative half-wave of the AC cycle into DC.*
- ***Full-wave rectifier**: it converts both positive & negative half of AC into DC.*
  - *i) Bridge rectifier; It is made of 4 diodes to converts full AC wave into DC*
  - *ii) Center tap rectifier; it utilizes a center tap transformer with only 2 diodes to convert full AC into DC.*
- ***Controlled Rectifier**: these rectifiers are made from SCR (thyristors) & their output voltage can be controlled by varying the firing angle.*
  - *i) Half controlled: These rectifiers are made from SCR as well as diodes.*
  - *ii) Full controlled: it is purely made from SCR & provides full control over the voltage through the external triggering pulse.*

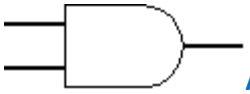
92) Explain the different types of Logic Gates

- **Basic logic gates**

There are seven basic logic gates: AND, OR, XOR, NOT, NAND, NOR, and XNOR.

AND | OR | XOR | NOT | NAND | NOR | XNOR

The **AND** gate *is so named because, if 0 is called "false" and 1 is called "true," the gate acts in the same way as the logical "and" operator. The following illustration and table show the circuit symbol and logic combinations for an AND gate. (In the symbol, the input terminals are at left and the output terminal is at right.) The output is "true" when both inputs are "true." Otherwise, the output is "false." In other words, the output is 1 only when both inputs one AND two are 1.*

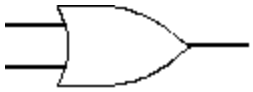


AND gate

Input	Input 2	Output

1		
	1	
1		
1	1	1

The **OR** gate *gets its name from the fact that it behaves after the fashion of the logical inclusive "or." The output is "true" if either or both of the inputs are "true." If both inputs are "false," then the output is "false." In other words, for the output to be 1, at least input one OR two must be 1.*

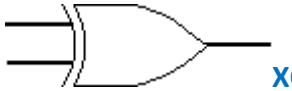


OR gate

Input 1	Input 2	Output
	1	1
1		1
1	1	1

The **XOR** *(* exclusive-OR *)* gate *acts in the same way as the logical "either/or." The output is "true" if either, but not both, of the inputs are "true." The output is "false" if both inputs are*

"false" or if both inputs are "true." Another way of looking at this circuit is to observe that the output is 1 if the inputs are different, but 0 if the inputs are the same.



XOR gate

Input 1	Input 2	Output
	1	1
1		1
1	1	

A logical inverter*, sometimes called a* **NOT** gate *to differentiate it from other types of electronic inverter devices, has only one input. It reverses the logic state. If the input is 1, then the output is 0. If the input is 0, then the output is 1.*

Inverter or NOT gate

Input	Output
1	
	1

The **NAND** *gate* operates as an AND gate followed by a NOT gate. It acts in the manner of the logical operation "and" followed by negation. The output is "false" if both inputs are "true." Otherwise, the output is "true."

NAND gate

Input 1	Input 2	Output
		1
	1	1
1		1
1	1	

The **NOR** gate *is a combination OR gate followed by an inverter. Its output is "true" if both inputs are "false." Otherwise, the output is "false."*

NOR gate

Input 1	Input 2	Output
		1
	1	

1		
1	1	

The **XNOR** (exclusive-NOR) gate *is a combination XOR gate followed by an inverter. Its output is "true" if the inputs are the same, and "false" if the inputs are different.*

XNOR gate

Input 1	Input 2	Output
		1
	1	
1		
1	1	1

93) What is the role of a transistor in Circuit?

- ***Mainly the transistor can be used for two reasons.***

- ***Switching: to switch ON/OFF the flow of current in a circuit. The switching depends on the input voltage or current.***
- ***Amplification: to increase or amplify the input signal that has very low power into a high power signal.***

94) What is a transistor composed of?

- ***Transistor is made of different combinations of P-type & N-type semiconductors. The doping & combination & different shapes of***

semiconductors form different types of transistors with different electrical properties.

95) Explain the operation of inverter.

- *An **inverter can be defined as** it is a compact and rectangular shaped electrical equipment used to convert direct current (DC) voltage to alternating current (AC) voltage in common appliances.*

There are four switches. A DC source connected with the switches and load. When switch S1 and S2 are ON, S3 and S4 OFF, the direction of current through the load are positive in this condition. It gives a positive half cycle of the AC output.

Now, switch S3 and S4 is ON, S1 and S2 OFF. The current flowing in the opposite direction. It gives a negative half cycle of the AC output.
The ON and OFF time of switches decides the output frequency. The output of the inverter is a square wave. The filters used to generate a sine wave.

96) Explain how an UPS works.

Generally, the UPS system is categorized into On-line UPS, Off- line UPS and Line interactive UPS. Other designs include Standby on-line hybrid, Standby-Ferro, Delta conversion On-Line.

Off-line UPS

This UPS is also called as Standby UPS system which can give only the most basic features. Here, the primary source is the filtered AC mains. When the power breakage occurs, the transfer switch will select the backup source. Thus we can clearly say that the stand by system will start working only when there is any failure in mains. In this system, the AC voltage is first rectified and stored in the storage battery connected to the rectifier. When power breakage occurs, this DC voltage is converted to AC voltage by means of a power inverter, and is transferred to the load connected to it. This is the least expensive UPS system and it provides surge protection in addition to back up. The transfer time can be about 25 milliseconds which can be related to the time taken by the UPS system to detect the utility voltage that is lost.

On-line UPS

In this** type of UPS**, double conversion method is used. Here, first the AC input is converted into DC by rectifying process for storing it in the rechargeable battery. This DC is converted into AC

by the process of inversion and given to the load or equipment which it is connected. This type of UPS is used where electrical isolation is mandatory. This system is a bit more costly due to the design of constantly running converters and cooling systems. Here, the rectifier which is powered with the normal AC current is directly driving the inverter. Hence it is also known as Double conversion UPS. When there is any power failure, the rectifier have no role in the circuit and the steady power stored in the batteries which is connected to the inverter is given to the load by means of transfer switch. Once the power is restored, the rectifier begins to charge the batteries. To prevent the batteries from overheating due to the high power rectifier, the charging current is limited. During a main power breakdown, this UPS system operates with zero transfer time. The reason is that the backup source acts as a primary source and not the main AC input. But the presence of inrush current and large load step current can result in a transfer time of about 4-6 milliseconds in this system.

Line Interactive UPS

For small business and departmental servers and webs, line interactive UPS is used. This is more or less same as that of off-line UPS. The difference is the addition of tap changing transformer. Voltage regulation is done by this tap-changing transformer by changing the tap depending on input voltage. Additional filtering is provided in this UPS result in lower transient loss.

97) How does a Voltage Stabilizer work?

- *The voltage regulation is required for two distinct purposes; over voltage and under voltage conditions. The process of increasing voltage from under voltage condition is called as boost operation, whereas reducing the voltage from overvoltage condition is called as buck operations.*

These two main operations are essential in each and every voltage stabilizer. The components of voltage stabilizer include a transformer, relays, and electronic circuitry. If the stabilizer senses the voltage drop in incoming voltage, it enables the electromagnetic relay so as to add more voltage from transformer so that the loss of voltage will be compensated. When the incoming voltage is more than normal value, stabilizer activates another electromagnetic relay such that it deducts the voltage to maintain the normal value of voltage.

98) What is holding current in SCR?

- *It is the minimum current required to hold the SCR in forward conduction state.*
  When the forward current becomes less than holding current, SCR turns from forward conduction state to forward blocking state.

99) What is latching current in SCR?

- *It is the minimum current required to latch(turn on) the SCR from forward blocking state to forward conduction state.*

100) What are the different methods to turn on a SCR?

- *Forward voltage triggering*
  Gate Triggering
  dv/dt triggering
  Temperature triggering
  Light triggering

101) **What is a Snubber circuit?**

- *The snubber circuit is used for the dv/dt protection of the SCR. It is a series combination of a resistor and a capacitor in parallel with the SCR.*

102) What are the types of Commutation? Explain.

- *There are two types of commutation.*

i) Natural Commutation : The process of the current flowing through the thyristor goes through a natural zero and enable the thyristor to turn off is called as natural commutation.

ii) Forced Commutation: The process of the current flowing through the thyristor is forced to become zero by external circuitry is called as forced commutation.

103) What are the control strategies of Chopper?

- *The control strategies of chopper are*
  1. Pulse width modulation PWM (Variable TON, Constant frequency)
  2. Frequency modulation (Constant TON or TOFF, Variable frequency)
  3. Current Limit Control (CLC)

104) What is a filter? How many types of Filter are there? Explain in short.

- *A filter is a circuit capable of passing (or amplifying) certain frequencies while attenuating other frequencies. Thus, a filter can extract important frequencies from signals that also contain undesirable or irrelevant frequencies.*

  The four primary types of filters based on their Frequency Response include the

  - *Low-pass filter: Low Pass filter allow low-frequency signals without any attenuation (decrease in power) but it rejects any high-frequency signals.*
  - *the high-pass filter: The type of filter that allows the high-frequency signals to pass without any attenuation in its amplitude & blocks (rejects) any low-frequency signal is called high pass filter.*
  - *The band-pass filter: This type of filter allows a specific band of frequencies & blocks any other frequencies lower or higher than its passband frequencies.*
  - *The notch filter (or the band-reject or band-stop filter): This type of filter attenuates the signal whose frequencies lies in a fixed band of frequencies.*

According to the construction of the filters, there are two types of filters i.e. Passive Filters & Active filter.

- *Passive Filters*

As the name suggests, passive filters are made up of passive components, such as resistors, capacitors & inductors. It does not need any external source of energy. Therefore there is no voltage gain in these filters. The output voltage is always less than its input voltage.
It can easily filter a high-frequency signal but it cannot process any low frequencies.
Although its design is simple but connecting a load to this filter impacts on its characteristics. Cascading the passive filters for higher order filter affects the characteristics of the filter.

- ***Active Filters***

In addition to the resistor & capacitor, Active filter uses an active component such as an operational amplifier, transistors, etc.
The downside is that it needs an external source of power, but it provides a high voltage gain. This gain is used for amplifying any weak input signals.
The active filter can filter very low-frequency signals but it cannot process very high-frequency signal.

105) What are the advantages of speed control using Thyristor?

- ***Advantages :***
  - ***The response of the control device is faster as it eliminates the time lag introduced by the inductances of the generator field and the armature.***
  - ***Due to low voltage drop across the thyristor, the efficiency of the control system is high.***
  - ***The control device is smaller in size, lighter in weight, cheaper in cost, requiring less space and minimal maintenance.***
  - ***Simple and reliable operation.***

106) What is a system?

- ***When the number of elements connected performs a specific function then the group of elements is said to constitute a system or interconnection of various components for a specific task is called system.*** *Example:* ***Automobile.***

107) **What is control system?**

- ***Any set of mechanical or electronic devices that manages, regulates or commands the behavior of the system using control loop is called the Control System. It can range from a small controlling device to a large industrial controlling device which is used for controlling processes or machines.***

108) ***What are the types of Control System? Explain.***

There are two types of Control System-

1. ***Open loop control system.***
2. ***Closed loop control system.***

Open loop control System: An open-loop control system is a system in which the control action is independent of the desired output signal. Examples: Automatic washing machine, Immersion rod.

Closed loop control System: A closed-loop control system is a system in which control action is dependent on the desired output. Examples: Automatic electric iron, Servo voltage stabilizer, an air conditioner.

109) **What are the advantage and disadvantages of Open-Loop System?**

Advantages of the open-loop control system

- ***Open loop systems are simple.***
- ***These are economical.***
- ***Less maintenance is required and is not difficult.***

Disadvantages of the open-loop control system

- ***Open loop systems are inaccurate.***
- ***These systems are not reliable.***
- ***These are slow.***
- ***Optimization is not possible.***

110) **What are the advantages of Closed-Loop System?**

Advantages of closed-loop systems

- ***The closed loop systems are more reliable.***
- ***Closed loop systems are faster.***
- ***Many variables can be handled simultaneously.***
- ***Optimization is possible.***

Disadvantages of closed-loop systems

- ***Closed loop systems are expensive.***
- ***Maintenance is difficult.***
- ***Installation is difficult for these systems.***

111) **What feedback in control system?**

When the input is fed to the system and the output received is sampled, and the proportional signal is then fed back to the input for automatic correction of the error for further processing to get the desired output is called as feedback in control system.

112) **What are the necessary components of a feedback control system?**

- *The processing system (open loop system), feedback path element, an error detector, and controller are the necessary components of the feedback control system.*

113) ***What is a signal flow graph? State its essential characteristics.***

- ***The graphical representation of the system's relationship between the variables of a set of linear equations is called SFG (Signal Flow Graph). Signal flow graphs do not require any reduction technique or process.***
- ***The essential characteristics of the signal flow graph are:***

- ***It represents a network in which nodes are used for the representation of system variable which is connected by direct branches.***

- *SFG is a diagram which represents a set of equations. It consists of nodes and branches such that each branch of SFG having an arrow which represents the flow of the signal.*
- *It is only applicable to the linear system.*

114) **What is the basic rule for Block Reduction Technique?**

- *The basic rule for block diagram reduction is that if we make any changes in the diagram, then that changes do not create any changes in the input-output relationship of the system.*

115) **What is the "Order of the System"?**

- *Order of the system is the highest derivative of the order of its equation. Similarly, it is the highest power of 's' in the denominator of the transfer function.*

116) **Why is negative feedback preferred in Control System?**

- *Negative Feedback results in the better stability of the system and rejects any disturbance signals and is less sensitive to the parameter variations. Hence in control systems negative feedback is considered.*

117) ***What is effect of positive feedback on the stability system?***

- *Positive feedback increases the error signal and drives the system to the instability that is why it is not generally used in the control system. Positive feedbacks are used in minor loop control systems to amplify internal signals and parameters.*

118) **What is the "Pole of the System"?**

- *The value at which the function F(s) becomes infinite is called the Pole of the function F(s), where F(s) is a function of complex variables.*

119) **What is "Zero of the System"?**

- ***The value at which the function F(s) becomes zero is called the Zero of the function F(s), where F(s) is a function of complex variables.***

120) **What is transfer function?**

- ***Transfer function of a system is defined as the ratio of Laplace transform of output*** *to the* ***Laplace transform of input with all the initial conditions as zero.***

$$T(s)=\frac{C(s)}{R(s)}=G(s)$$

Where,

1. ***T(S) = Transfer function of system.***
2. ***C(S) = output.***
3. ***R(S) = Reference output.***
4. ***G(S) = Gain.***

121) **How can we use Control System in Electrical Engineering?**

- *An* ***electrical control system*** *is a physical interconnection of devices that influences the behaviour of other devices or systems. A simple electronic system is made up of an input, a process, and an output. Both input and output variables to the system are signals. Examples of such systems include circulation pumps, compressors, manufacturing systems, refrigeration plant and motor control panels.*

122) **Define Linear and Non-Linear System.**

- *Linear system:* ***Linear systems are the systems which possess the property of homogeneity and superposition. The term superposition means that an input $r_1(t)$ gives an output $c_1(t)$ and $r_2(t)$ will give the output $c_2(t)$. If we apply both the input $r_1(t)$ and $r_2(t)$ together, then the output will be the sum of $c_1(t)$ and $c_2(t)$.***

- *Non-Linear System:* ***Non-linear systems are the systems which do not possess the property of superposition and homogeneity, and the output of these systems are not directly proportional to its input. In these types of systems, the stability of the system depends upon the input and initial state of the system.***

123) **What is the use of Control System in IT industry?*****

-

124) **What is MATLAB?**

MATLAB is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs.

125) **What is AutoCAD?**

***AutoCAD*® is computer-aided design (CAD) software that architects, engineers, and construction professionals rely on to create precise 2D and 3D drawings.**