DRONACHARYA GROUP OF INSTITUTIONS, GREATER NOIDA

COURSE: B.TECH. (III SEM)

QUESTIONS BANK

SUBJECT NAME: EMEC I

SUBJECT CODE: EEE 301 **BRANCH: EEE**

1. What is a transformer and how does it work?

Ans: A transformer is an electrical apparatus designed to convert alternating current from one voltage to another. It can be designed to "step up" or "step down" voltages and works on the magnetic induction principle. A transformer has no moving parts and is a completely static solid state device, which insures, under normal operating conditions, a long and trouble-free life. It consists, in its simplest form, of two or more coils of insulated wire wound on a laminated steel core. When voltage is introduced to one coil, called the primary, it magnetizes the iron core. A voltage is then induced in the other coil, called the secondary or output coil. The change of voltage (or voltage ratio) between the primary and secondary depends on the turns ratio of the two coils.

2. What are taps and when are they used?

Ans: Taps are provided on some transformers on the high voltage winding to correct for high or low voltage conditions, and still deliver full rated output voltages at the secondary terminals. Standard tap arrangements are at two-and-one-half and five percent of the rated primary voltage for both high and low voltage conditions. For example, if the transformer has a 480 volt primary and the available line voltage is running at 504 volts, the primary should be connected to the 5% tap above normal in order that the secondary voltage be maintained at the proper rating. The standard ASA and NEMA designation for taps are "ANFC" (above normal full capacity) and "BNFC" (below normal full capacity).

3. What is the difference between "Insulating," "Isolating," and "Shielded Winding" transformers?

Ans: Insulating and isolating transformers are identical. These terms are used to describe the isolation of the primary and secondary windings, or insulation between the two. A shielded transformer is designed with a metallic shield between the primary and secondary windings to attenuate transient noise. This is especially important in critical applications such as computers, process controllers and many other microprocessor controlled devices. All two, three and four winding transformers are of the insulating or isolating types. Only autotransformers, whose primary and secondary are connected to each other electrically, are not of the insulating or isolating variety.

4. Can transformers be operated at voltages other than nameplate voltages?

Ans: In some cases, transformers can be operated at voltages below the nameplate rated voltage. In NO case should a transformer be operated at a voltage in excess of its nameplate rating, unless taps are provided for this purpose. When operating below the rated voltage, the KVA capacity is reduced correspondingly. For example, if a 480 volt primary transformer with a 240 volt secondary is operated at 240 volts, the secondary voltage is reduced to 120 volts. If the transformer was originally rated 10 KVA, the reduced rating would be 5 KVA, or in direct proportion to the applied voltage.

5. Can 60 Hz transformers be operated at 50 Hz?

Ans: The transformers rated below 1 KVA can be used on 50 Hz service. Transformers 1 KVA and larger, rated at 60 Hz, should not be used on 50 Hz service, due to the higher losses and resultant heat rise. Special designs are required for this service. However, any 50 Hz transformer will operate on a 60 Hz service.

7. Can Transformers be reverse connected?

Ans: The dry-type distribution transformers can be reverse connected without a loss of KVA rating, but there are certain limitations. Transformers rated 1 KVA and larger single phase, 3 KVA and larger three phase can be reverse connected without any adverse effects or loss in KVA capacity. The reason for this limitation in KVA size is, the turns ratio is the same as the voltage ratio. Example: A transformer with a 480 volt input, 240 volt output— can have the output connected to a 240 volt source and thereby become the primary or input to the transformer, and then the original 480 volt primary winding will become the output or 480 volt secondary. On transformers rated below 1 KVA single phase, there is a turns ratio compensation on the low voltage winding. This means the low voltage winding has a greater voltage than the nameplate voltage indicates at no load. For example, a small single phase transformer having a nameplate voltage of 480 volts primary and 240 volts secondary, would actually have a no load voltage of approximately 250 volts, and a full load voltage of 240 volts. If the 240 volt winding were connected to a 240 volt source, then the output voltage would consequently be approximately 460 volts at no load and approximately 442 volts at full load. As the KVA becomes smaller, the compensation is greater— resulting in lower output voltages. When one attempts to use these transformers in reverse, the transformer will not be harmed; however, the output voltage will be lower than is indicated by the nameplate.

8. Can a Single Phase Transformer be used on a Three Phase source?

Ans: Yes. Any single phase transformer can be used on a three phase source by connecting the primary leads to any two wires of a three phase system, regardless of whether the source is three phase 3-wire or three phase 4-wire. The transformer output will be single phase.

9. What is exciting current?

Ans: Exciting current, when used in connection with transformers, is the current or amperes required for excitation. The exciting current on most lighting and power transformers varies from approximately 10% on small sizes of about 1 KVA and smaller to approximately .5% to 4% on larger sizes of 750 KVA. The exciting current is made up of two components, one of which is a real component and is in the form of losses or referred to as no load watts; the other is in the form of reactive power and is referred to as KVAR.

10. WHAT DOES A TRANSFORMER DO?

Principle of Operation: A transformer operates on the principle of magnetic induction. Each transformer consists of two or more coils of insulated conductor (wire) wound on a laminated steel core. When a voltage is supplied to the PRIMARY (input) coil, it magnetizes the steel core, which in turn induces a voltage on the SECONDARY (output) coil. The voltage induced from the primary to the secondary coils is directly proportional to the turn's ratio between the two coils. (FIG 1)

For example, if a transformer's input or primary leg has twice as many turns of wire as the secondary, then the ratio would be 2:1. Therefore, if you applied 480 volts to the primary, 240 volts would be induced in the secondary. This is an example of a two winding "step-down" transformer. (FIG 2). If the voltage is to be "stepped-up" or increased, the same transformer could be turned around and connected so that the input side would have the 240 volts and the output would be 480 volts. (FIG 3) Standard transformers rated at 3 kVA and larger can be used for either step-up or step-down service. Transformers rated 2 kVA and below have compensated windings and should not be used in reverse feed applications. (Note: some system design considerations apply.)

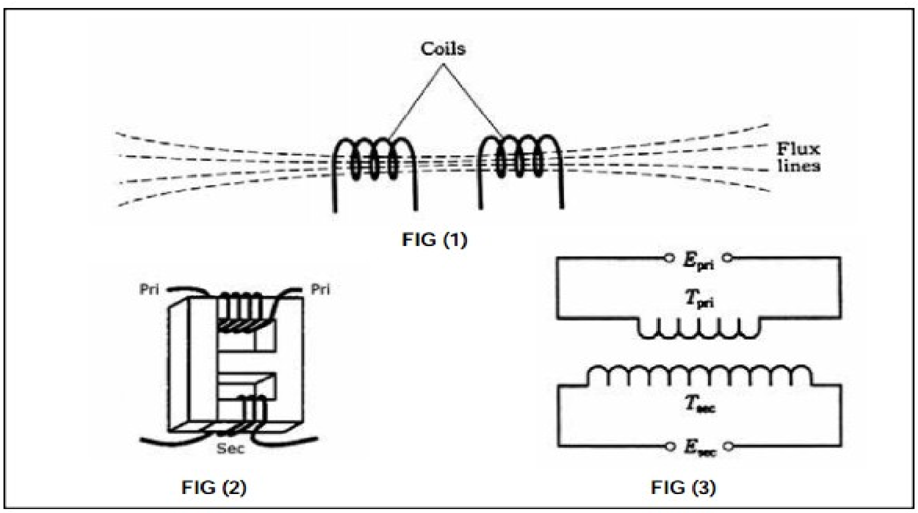

FIG (1)
FIG (2)
FIG (3)

11. What is the benefit of "Vacuum Impregnation" on a Transformer?

Ans: All HPS Control Transformers are vacuum impregnated with "VT Polyester Resin" and oven cured which seals the surface and eliminates moisture. Impregnating the entire unit provides a strong mechanical bond and offers protection from environmental conditions.

12. Explain the "VA" or "Volt Ampere Output" Rating?

Ans: The VA or volt ampere output rating designates the output which a transformer can deliver for a specified time at its rated secondary voltage and rated frequency, without exceeding its specified temperature rise.

13. What is the effect of "Overload"?

Ans: When a transformer is continually overloaded, excessive heat develops and the insulation system will begin to breakdown. As a result, the life expectancy of the transformer is shortened due to the heat exceeding the rating of the insulation system.

14. What is Isolation Transformer?

Ans: A transformer which insulates the primary circuit from the secondary circuit. Also, referred as a two-winding or insulating transformer.

15. What is the function of carbon brush used in D.C generator?

Ans: The function of carbon brush is to collect current from the commutator and supply is to the external load circuit and to the field circuit.

16. Distinguish between lap winding and wave winding used in dc machine?

Ans: a. Lap winding is designed for high current and low voltage machines.

b. Wave winding is designed for low current and high voltages.

17. Write the number of parallel paths in a lap and wave connected windings?

Ans: In a lap wound machine, the number of parallel paths is equal to the number of poles. But in wave wound machine, the number of parallel paths is always two irrespective of number of poles.

18. Name the three things required for the generation of emf?

Ans: a. Presence of armature conductors.

b. Presence of magnetic field.

c. Relative motion between conductor and magnetic field.

19. What is meant by self-excited and separately excited dc generator?

Ans: **Self-excited generators** are those whose field magnets are energized by the current produced by the generator themselves.

Separately excited generators are those whose field magnets are energized from an independent external source of dc current.

20. What is the basic difference between dc generator and dc motor?

Ans: Generator converts mechanical energy into electrical energy. Motor converts electrical energy into mechanical energy. But there is no constructional difference between the two.

21. Write down the emf equation of dc generator. Give the meaning of each symbol?

Ans: Emf induced $E=\Phi ZNP/60A$,

Φ=flux per pole in Weber, Z=total number of armature conductors, N=speed of armature in rpm, P=number of poles, A=number of parallel paths.

22. What is pole pitch?

Ans: The periphery of the armature is divided for a number of poles of the generator. The center to center distance between two adjacent poles is called pole pitch. It is also equal to the number of armature slots or armature conductors per pole.

23. How can the voltage in a DC generator be increased?

Ans: Increasing the main field flux and the speed of the armature can increase the voltage in a DC generator.

24. What is critical resistance of a DC shunt generator?

Ans: The value of resistance of shunt field winding beyond which the shunt generator fails to build up its voltage is known as “critical resistance “.

25. What are the conditions to be fulfilled for a shunt generator to build up Voltage?

Ans: a) There must be some residual magnetism in the field poles.

b) The shunt field resistance should be less than critical resistance.

c) The field coils should be connected with the armature in such a way that current flowing through them should increase the EMF induced by the residual magnetism.