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MATRIC NO: 17/ENG04/043

DEPARTMENT: ELECTRICAL ELECTRONICS ENGINEERING

COURSE: EEE 326 ELECTRICAL MACHINES

ASSIGNMENT

1. DISCUSS THE EFFECTS OF HARMONICS ON SYNCHRONOUS MACHINES
2. IDENTIFY THE HARMONICS
3. DISCUSS THE EFFECTS ON MOTORS
4. DISCUSS THE EFFECTS ON GENERATORS

ANSWERS

1. Generators and motors are adversely affected by harmonics in the networks to which they are connected. Some typical effects are:

* Increased heating due to [iron and copper losses](https://electrical-engineering-portal.com/transformer-heat-copper-and-iron-losses) at the harmonic frequencies
* Higher audible noise emission as compared with sinusoidal excitation
* Harmonic currents in the rotor

The harmonic currents noted above are caused by harmonics in the stator winding, which will produce harmonic currents in the rotor, e.g., 5th- and 7th-order stator harmonics will produce 6th-order rotor harmonics, while 11th- and 13th-order stator harmonics will produce 12th-order rotor harmonics.These rotor harmonic currents will result in increased rotor heating and pulsating or reduced torque.

2. VOLTAGE HARMONICS

CURRENT HARMONICS

3. i. Retarding torque in induction engine 5th Harmonic produces flux moving in the opposite direction of main flux in induction engine. This flux generates Induction Motor Retarding Torque.

ii. Crawling in Induction Motor 7th Harmonic produces dip at 1/7th the Synchronous Level in Torque Speed Curve of Induction Motor. This may result in the Synchronous Speed induction engine running at 1/7th. The name is Creeping.

4. i. Skin Effect :Due to Self Inductance in Conductors, Current flows in peripheral or skin of transmission lines in AC Current. Increases with higher Frequency Skin influence. Efficient Resistance increases due to Skin Impact. This causes Degradation and Temperature rise.

ii. Hysteresis Loss and Eddy Current Loss consist of an increase in Iron Loss in Transformers related to Generator Iron Loss. Loss of hysteresis f and current loss of Eddy f2. As a consequence, Iron Loss increases leading to higher loss in transformer core and increased temperature.