Benha University | **First semester examination**

Faculty of Engineering- Shoubra | **January 2017**

Electrical Engineering Department | **Testing(4) -3rd year power**

- Answer all the following questions
- Illustrate your answers with sketches when necessary.
- The examination consists of one page
- No. of questions: 3
- Total Mark: 50 Marks

Question (2)

a)What is meant by no-load saturation curve for a dc generator? describe a method for obtaining such curve.

b)Tests are performed on a 1-phase, 10 kVA, 60 Hz transformer and the following results are obtained.

Open-circuit test (high voltage side open) 220V 2.5 A 100 W

Short circuit test(low-voltage side shorted) 150 V 4.55 A 215 W

(i) Determine the parameters for the approximate equivalent circuits referred to the low-voltage side and the high-voltage side.

(ii) Determine the power factor for the no-load and short-circuit tests.

(17 Marks)

Solution of Question No. (2)Testing(4)3rd year power

Question(2)

a) Saturation curve is relation between field current and open circuit voltage at No-load for Dc separately -excited generator

This test is carried out at constant speed

b) (i) From open circuit test $P_{oc}=V^2/R_c$ $R_{cL}=220^2/100=484$ ohm

$I_{cL}=220/484=0.45$ A

$I_{mL}=(I_L^2-I_{cL}^2)^{1/2}$ $I_{mL}=(2.5^2-0.45^2)=2.46$ A

$X_{mL}=V/I_{mL}=220/2.46=89.4$ ohm

The corresponding parameters for the high voltage side obtained as follows:

turns ratio a=2200/220=10

$R_{cH}=a^2R_{cL}=10^2x484=48400$ ohm

$X_{mH}=10^2x89.4=8940$ ohm

The equivalent circuit with low voltage winding shorted

$P_{sc}=I_H^2R_{eqH}$ $R_{eqH}=215/4.55^2=10.4$ ohm

$Z_{eqH}=V_H/I_H$ $Z_{eqH}=150/4.55=32.97$ ohm

$X_{eqH=}(Z_{eqH}^2-R_{eqH}^2)^{1/2}=(32.97^2-10.4^2)^{1/2}=31.3$ ohm

The corresponding parameters for low voltage side are

$R_{eqL}=R_{eqH}/a^2$ $R_{eqH}=10.4/10^2=0.104$ ohm

$X_{eqH}=31.3/10^2=0.313$ ohm

ii)power factor at no-load =power/volt-ampere

100/220x2.5=0.182

power factor at short circuit=215/150x4.55=0.315