Mansoura University.
Faculty of Engineering.
Electrical Engineering Dept.

كهرباء

First Semester.
Date: 30 -12-2012.
Time: Three Hrs for Two Parts.
Full Mark: (55)

Exam of (Electrical Machines II)
For 3rd Grad Electrical Engineering Dept. students.

<u>Answer All Questions.</u>   الامتحان من جزأين: من فضلك أجب كل جزء من الامتحان في اتجاه مختلف من ورقة الإجابة.

First Question: *(5 + 8 + 12 marks)*

1-1) <u>**What**</u> do you mean by voltage regulation of an alternator? **<u>Describe</u>** the methods for determining the voltage regulation of an alternator?

1-2) **<u>Draw</u>** the vector diagram of synchronous machine (generator and motor) at different operating power factors (Unity, Lag.& Lead) and **<u>find</u>** a general formula of no-load E.M.F described the synchronous machine at full-load.

1-3) An 11 kV, 1000 kVA, 50 Hz, star-connected, three-phase alternator has a resistance of 2 Ω/phase. The open circuit and full-load zero power factor lagging characteristics are given below. **<u>Find</u>** the voltage regulation of the alternator at full-load current, 0.8 lagging power factor by:

   1- Synchronous impedance method;   2- A.T method; and   3- Potier method.
   (Compare between the results)

Field current [A]	40	50	110	140	180
O.C phase voltage [V]	3350	4040	7220	7940	8660
Z.P.F-full load phase voltage [V]	0	870	4900	6060	7040
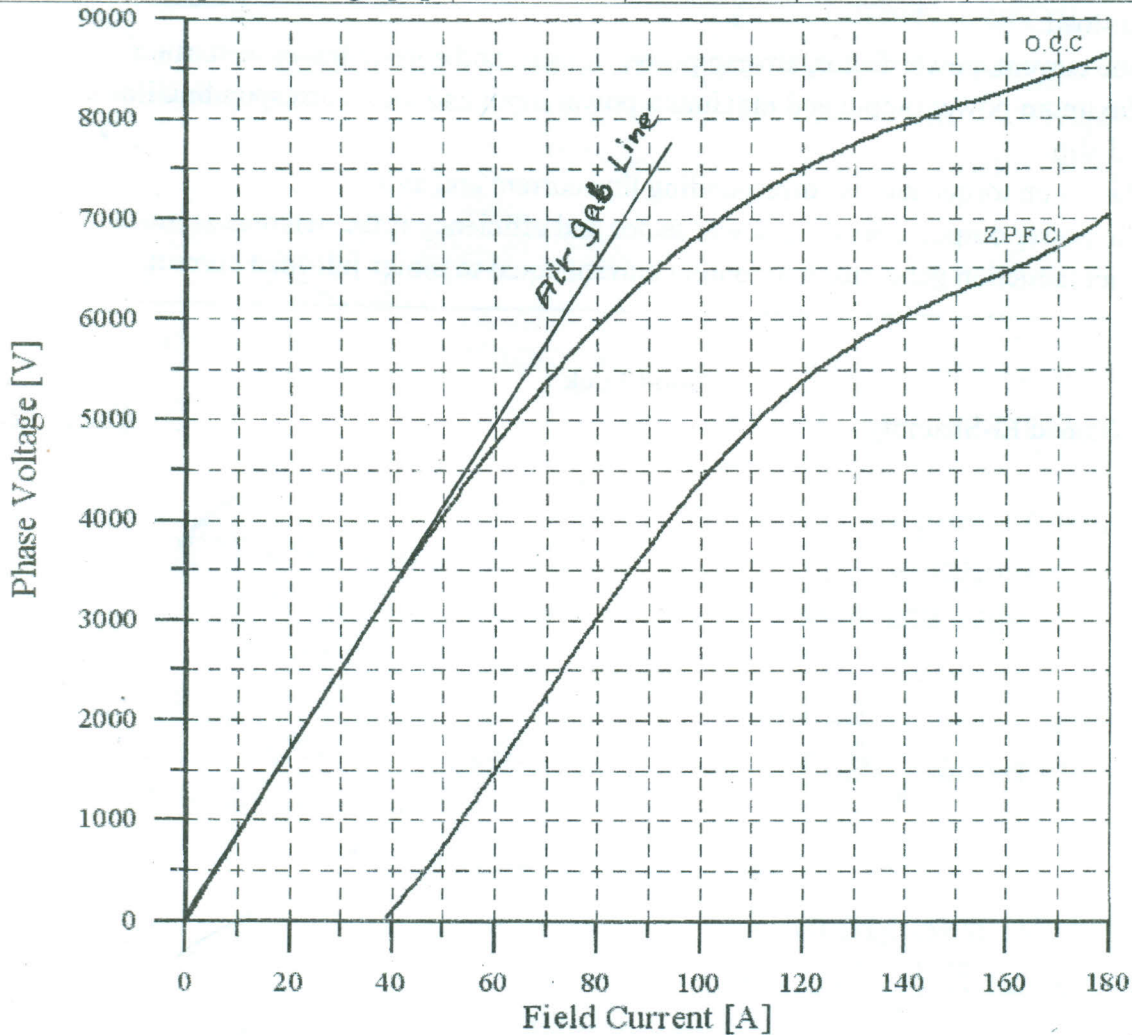
2-1) **Draw** the distribution of power inside three-phase induction machine at the following operating cases:

    i) Full-load as motor and generator,

    ii) Stand-still and synchronous speed,

Then, **prove that**: at full-load: $P_g : P_{cu2} : P_m = 1 : S : 1\text{-}S$.

2-2) **Explain** the methods adopted for starting the following motors:

    i) 3-phase induction motors with squirrel cage and slip-ring wound rotor types; and

    ii) Single phase induction motor with explaining why it has not starting torque?

2-3) **State** the condition under which a three-phase induction machine will have:

    i) Rotor frequency equal to stator frequency,

    ii) Rotor frequency higher than the stator frequency,

    iii) Maximum voltage and current induced in the rotor, and

    iv) Minimum voltage and current induced in the rotor.

2-4) A three-phase, 4-pole, 4.5 kW, 400 V, 50 Hz, delta connected induction motor gave the following test results:

	Applied voltage [V]	Line current [A]	Input power [W]
No-load test:	400	4.2	480
Blocked rotor test:	215	15	1910

Stator and rotor ohmic losses at stand-still are assumed equal.

Draw the circle diagram with scale 1 Cm/1 A, and then **find** the following:

    i) Line current, power factor, slip, air-gap power, torque, copper-losses and efficiency at full-load.

    ii) Line current, power factor, air-gap power, torque, and copper-losses at starting.

    iii) Maximum power output and maximum power input and their corresponding line current and slip.

    iv) Maximum torque ant its corresponding line current and slip.

    v) The power output, operating power factor and efficiency if the machine is made to work as an induction generator with output current equal to motor full-load current.

Good Luck.

Prof. Dr. Mohamed El-Shamoty.