Mansoura University.
Faculty of Engineering.
Electrical Engineering Dept.

Second Semester.
Date: 8 -6-2013.
Time: Three Hrs for Two Parts.
Full Mark: (55)

Exam of (Power and Electrical Machines)
For 3rd Grad Mechanical Engineering Dept. students.

Answer All Questions. **Part (I)**

First Question: *(5+5+10 Marks)*

a) With the help of neat diagrams, **describe** the starting methods adopted for:
i- Three-phase squirrel-cage induction motor. **ii-** Three-phase slip-ring induction motor.

b) With the help of neat diagrams, **classify** the single-phase motors according to their starting method, and **mention** their applications?

c) A 440-V, 3-phase, 4-pole, 50-Hz, 37.3 kW, Y-connected induction motor has the following parameters:

$R_1 = 0.1\ \Omega$, $X_1 = 0.4\ \Omega$, $R_2' = 0.15\ \Omega$, $X_2' = 0.44\ \Omega$

Motor has stator core loss of 1250 W and rotational loss of 1000 W. When motor operates at a slip of 3%, using simplified equivalent circuit **calculate (i)** input line current and p.f. **(ii)** electromagnetic torque developed in N-m **(iii)** output shaft power and **(iv)** efficiency of the motor.

Second Question: *(8+12 Marks)*

a) For a three-phase synchronous generator connected to the bas bar **explain** the following
i) Synchronism conditions;
ii) Advantages of parallel operation.
iii) Effect of prime-mover speed change.
iv) Effect of field current change.

b) A 10 MVA, 6.6 kV, 3-phase, Y-connected alternator has provided O.C.C. and S.C.C. test tables as under:

Field Current [A]	25	50	75	100	125	150	175	200	225
Line E.M.F. [kV]	2.4	4.8	6.1	7.1	7.6	7.9	8.15	8.35	8.5
S.C.C [A]			875						

The dc resistance measured between the two terminals is 0.173. **Calculate** the voltage regulation by: (i) Synchronous impedance method, (ii) Ampere-turns method at
a) 90% of full-load and 0.8 lagging p.f ;
b) Full-load and unity p.f.
(**Comment** about the results)

Third Question: *(15 Marks)*

Choose the correct Answer:

(1) A single phase induction motor employs.....rotor.
i) Squirrel cage ii) Wound
iii) Either squirrel cage and wound
iv) None of all

(2) For the same rating, the size of a single phase induction motor is about.....
i) That of a 3-phase induction motor
ii) Three times 3-phase induction motor
iii) 1.5 times 3-phase induction motor
iv) 0.33 times 3-phase induction motor

(3) For the same rating, the power factor of a single-phase induction motor is ..... that of 3-phase induction motor.
i) The same as ii) less than
iii) More than iv) none of all

(4) The purpose of starting winding in a single phase induction motor is to.....
i) Reduce losses ii) Limit temperature rise
iii) Produce rotating flux in conjunction with main windings
iv) None of all

(5) A capacitor-start, capacitor-run motor has.....
i) Low power factor ii) High power factor
iii) Low efficiency iv) Low starting torque

(6) The nameplate of a single-phase, 4-pole, induction motor gives the following data: Output 373 W, 230 V, 50 Hz, input current 2.9 A, power factor 0.71, and speed 1410 r.p.m. the full-load slip of the motor is:
i) 6% ii) 2% iii) 4% iv) 3%

(7) In the above question, what will be the efficiency of the motor:
i) 65.3% ii) 78.7%
iii) 89.2% iv) 70.6%

(8) The maximum voltage is induced in the rotor of a 3-phase induction motor when it.....
i) Runs at no-load ii) Runs at full-load
iii) Is blocked iv) None of all

(9) The reactance of the rotor circuit of a 3-phase induction motor is maximum.....
i) At no-load ii) At full load
iii) At half full-load iv) None of all

(10) If the slip of a 3-phase induction motor increases, the power factor of the rotor circuit...
i) Is increased ii) Is decreased
iii) Remains unchanged iv) None of all

(11) The maximum torque of a 3-phase induction motor under running conditions is....
i) Inversely proportional to supply voltage
ii) Inversely proportional to rotor reactance at stand still
iii) Directly proportional to rotor resistance
iv) None of all

(12) In a synchronous machine, if ϕ is the flux per pole and f is the frequency of the emf induced E, then
i) $E \propto (\phi f)$ ii) $E \propto (1/\phi f)$
iii) $E \propto (\phi/f)$ iv) $E \propto (f/\phi)$

(13) The voltage regulation of alternator delivering only resistive load is:
i) zero ii) low-positive
iii) high-positive iv) negative

(14) The voltage regulation of alternator delivering only inductive load is:
i) zero ii) low-positive
iii) high-positive iv) negative

(15) Short pitch winding results in
i) Higher terminal voltage
ii) Higher efficiency
iii) High power factor
iv) Better voltage wave form