KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE360-05 Electromechanical Devices 071

January 1, 2008 Time: 6:30-8:00 PM

[**MAJOR EXAM # 2**]

Instructor: Dr. Mahmoud Kassas

Name:	
ID #:	
Section	

PROBLEM #	SCORE	MAXIMUM
1		20
2		20
3		20
TOTAL		**60**

Problem 1:

Three single phase, 10 kVA, 2400/120-V, 60 Hz transformers are connected to form a three-phase, 4160/208-V transformer bank. The equivalent impedance of each single phase transformer referred to primary side is 10+j25 Ω. The transformer bank delivers 27 kW at 208 V and 0.9 PF leading.

(a) Draw the three phase schematic diagram showing the transformer connection. Draw a per-phase equivalent circuit.
(b) Determine the primary current and power factor.
(c) Determine the primary voltage.
(d) Determine the voltage regulation.
(e) Draw the phasor diagram at the primary side.

Problem 2:

A 500 V, 450 rpm, 750 kW, separated excited DC generator operates at rated conditions with rotational losses of 12180W. The armature resistance R_a =0.007Ω and the field resistance R_f = 35Ω. Assume that the armature reaction is negligible, then find at rated conditions:

(a) the generated EMF,
(b) the input mechanical power,
(c) the input shaft torque,
(d) the efficiency if the field resistance draws a current of 15A,
(e) If the speed changed to half rated value without adjustment of field current, find the maximum electrical power output possible without overheating armature winding.

Problem 3:

A 6600-V, three-phase, Y-connected, synchronous motor takes 400 kW at 0.8 PF lagging. The synchronous reactance Xs = 20Ω per phase and the armature resistance is negligible.

(I) Determine:

(a) the armature current.
(b) the induced voltage, **E**.
(c) the power angle, δ.

(II) If the induced voltage is increased by 25% and the power input to the motor remains the same, find:

(a) the new power angle, δ'.
(b) the new value of the armature current.
(c) the new power factor.

(III) Draw the phasor diagram for both conditions mentioned above.