EE 2683
Electric Circuits & Machines (for non-Electricals)

Dr. A.M. Sharaf, Rom GC117 sharaf@unb.ca

COURSE REQUIREMENTS and MARKING EVALUATIONS

MWF 9:30 - 10:20 am Room HC13 Tutorial: 11:30 am-12:30pm Room HC13 Labs: MWF 2:30pm-5:00pm	1. All lab experiments **must** be performed (please see important note at right). 2. A lab schedule with assigned groups will be posted outside ECE office 3. A lab group will consist of 3-4 persons who will submit one report for each experiment. 4. Each group member is required to act as a scribe at least once. 5. A lab **oral test** will be conducted during the last two weeks of classes (worth 5%).	1. If all experiments are not performed, a grade of F will be assigned to the full group 2 Lab manuals-WebCT or at Department 3. Lab reports are due one week after the lat - based on the lab schedule. 4 The mark earned will be that for each of the members who participate 5. The remaining 50% will be based on oral lab test. 6. Strict rules will be imposed for laboratory report plagiarism.

ASSIGNMENTS & TUTORIALS

Requirements	Important Notes
1. Attendance at tutorial is mandatory!!! 2. A 10 to 15 minute quiz will be held during all scheduled tutorials (on Thursdays) (only 8 will be counted). 3. Only solutions to quizzes and given assignments will be placed in the Engineering Library on Tuesday of each week, following submission. No other solutions will be given.	1 Tutorials begin the first week. 2. All quizzes MUST be done by EACH student, otherwise an F grade will be submitted. 3. These will be announced at the Monday previous to the due date. * 6-8 assignments will be assigned. * 6-8 quizzes will be assigned at the end of each topic.

MIDTERMS: There will be two midterms given during a regular lecture period. The first midterm will be on February 23, 2007 and the second on March 23, 2007. The Final Exam will be scheduled by the Registrar and will cover the entire course materials (usually Chapters 1-12 of the textbook).

COURSE EVALUATION:

Assignments (5)/Quizzes (8)	10% (5% each)
Tests	20%
Project	10%
Labs / Oral Lab Test	10% (5% each)
Final Exam ***	50%

Numerical Letter Grade Conversion

A+	85-100	B-	60-64
A	80-84	C+	55-59
A-	75-79	C	50-54
B+	70-74	D	40-49
B	65-69	F	<40

*** A student should secure 40% or above in the Final Examination to pass this course: below 40% a grade of F will be assigned.

TEXTBOOK: "Electrical Machines, Drives and Power Systems" by T. Wilde / Prentice Hall Publisher.

LABS:
1. Phase relationships in AC circuits.
2. Direct current machines.
3. Transformers
4. Alternating AC current motors.

Consulting Hours: MWF from 8:30 - 9:30 am in Room GC117; Thurs 10:30 - 11:30 am and during tutorials
By appointment - email Dr. Sharaf at sharaf@unb ca

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MWF 9:30-10:20 am – HC13
Tutorial TH 11:30 am-12:20pm – HC13
Labs: (1) M 2:30-5:30 (2) W 2:30-5:30 pm (3) F 2:30-5:30

CEAB **Approval Date: Oct. 19th, 2005**

Lectures/weeks	3 hours	Math	5%
Tutorials/week	1 hour	Basic Science	5%
Labs/week	3 hours	Complementary Studies	0 %
Weeks/term	12.4	Engineering Science	70%
		Engineering Design	20%

Calendar Description

Network analysis including ac. Introduction to transformers, dc machines and ac machines.
Prerequisites: EE 1813 or EE 1013 or equivalent, Math 1013.

Course Content

1.	Basic Electric Circuits and Electromagnetics: Basic electric circuit laws; sinusoidal waveforms, RMS, and phasor representation; elements of electric circuits; basic electromagnetics	4
2.	AC Single Phase: Active, reactive and apparent power; power factor and power factor correction.	2
3.	AC Polyphase Circuit: Two phase system; three phase system, Wye & Delta; balanced load Wye & Delta; power measurement (meter connections) (Wattmeter & Watt Hr. Meters); three phase circuit analysis.	6
4.	Transformers: Theory (polarity, etc.); equivalent circuit; open & short circuit tests; three phase connections; voltage regulation and efficiency; special transformers.	8
5.	DC Machines: Basic windings (Lap & Wave); excitation methods; commutation & armature reaction; external characteristics; equivalent circuit and speed & torque equations; motor starters and controllers.	8
6.	AC Machines: Rotating magnetic field; induction motor; alternators; synchronous motor (power factor control); single phase motors	9
7.	Midterm test	2
	Total hours	39

TEXTBOOK

"Electrical Machines, Drives and Power Systems", by T. Wilde / Prentice Hall Publisher.

Labs

1.	Phase relationships in AC circuits	3.	Direct current machines
2.	Transformers	4.	Alternating AC current motors

Course Evaluation

Assignments/Quizzes*	10% (5% each)	Labs/Lab Test***	10% (5% each)
** Tests	20%	Final	50%
One Project (PBL)	10%		

* = Tutorial quizzes will be weighted as 5%.

** = Two tests will be given -- one February 23, 2007 and one March 23, 2007. The best mark of the two will be counted.

*** = Oral Lab Test will be weighted 5%.

STUDENT NAME: _____

STUDENT NUMBER: _____

EE 2683 FINAL EXAM

Dr. A.M. Sharaf (2 hours) April 11, 2006
7:00 - 9:00 pm

Solve all four problems

Each is weighted at 10%

*** A Minimum 40% in the Final Exam is required to pass the course.

40% minimum mark to pass = 16/40.

Problem	Mark (10)
1	
2	
3	
4	
40% total	

GOOD LUCK !

PROBLEM 1
[10 marks]

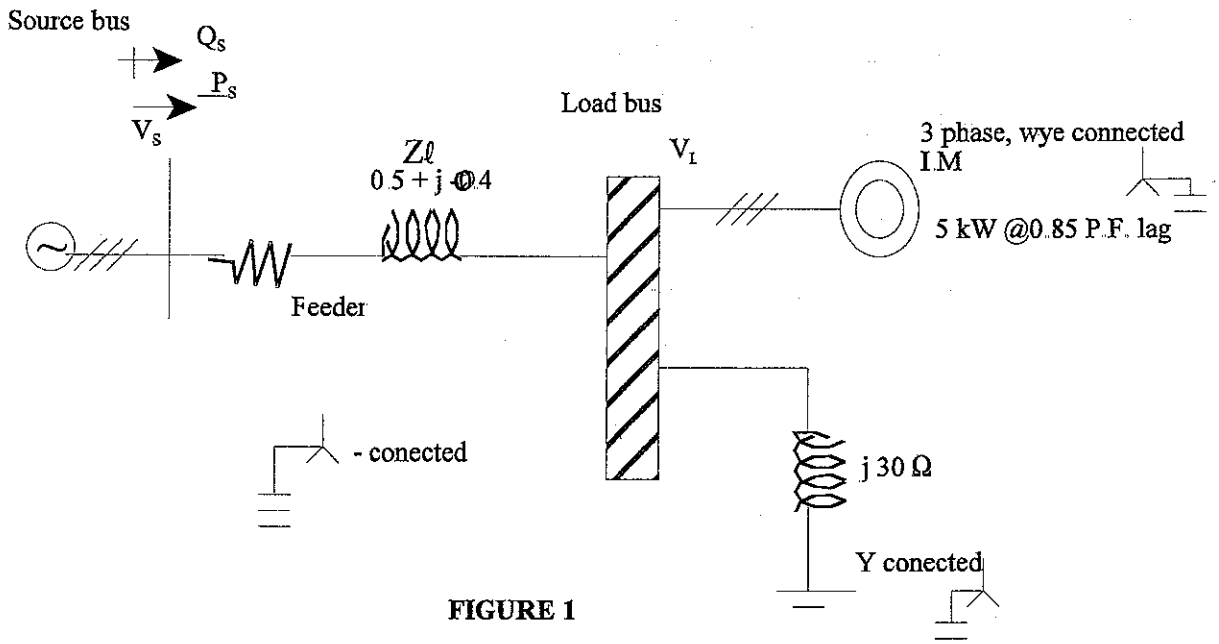

FIGURE 1

$V_{LN} = 240V$

$V_{AN} = 240\angle 0 volts$

$V_{BN} = 240\angle -120^0 volts$

$V_{CN} = 240\angle +120^0 volts$

(i) Calculate the source power (P_S, Q_S) and power factor.
For the three phase load fed from a 240V (L-N) via a short feeder of $Z\ell$ = (0.5 + j 0.40) (See Figure 1).

[8] The load comprises:

(I) a 3 phase induction motor rated 5 kW at 0.85 P.F. lag, wye grounded.

(II) a Wye connected balanced three phase inductive load X_L = j 30 Ω per phase.

(III)[2] Discuss how a three phase capacitor bank of (-j30Ω) per phase Wye connected at load bus - V_L can affect power delivery to the hybrid load.

PROBLEM 2
[10 marks]

For the single phase transformer shown in Figure 2, rated at 50 KVA, 11000/240V (L-N).

The measured parameters referred to secondary low voltage side are:

$$R_1'' = R_2 = 0.01 ohm$$
$$X_{\ell 1}'' = 0.035 ohm \simeq X\ell_2$$
$$R_C'' = 200 ohm$$
$$X_m'' = 120 ohm$$

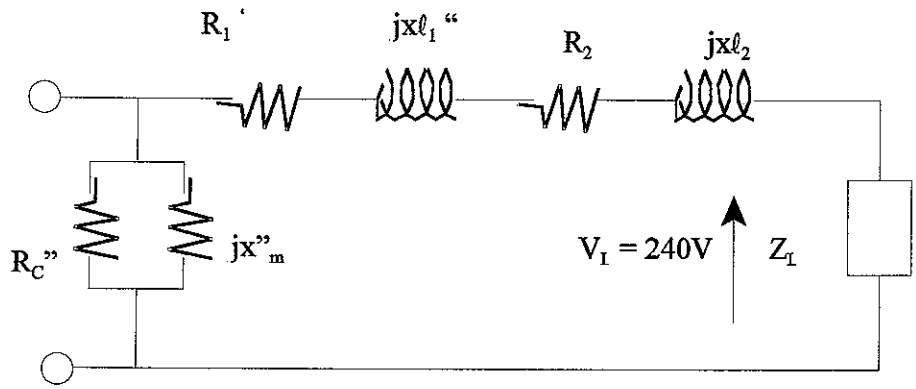

FIGURE 2

[marks]

(1.) [7] Calculate power efficiency and voltage regulation at <u>rated load</u> and 0.80 power factor lagging.

(2.) [2] How power efficiency and voltage regulation can be enhanced.

(3.) [1] How to select a good transformer, what is the selection criteria?

PROBLEM 3
[10 marks]

For the DC shunt-motor shown in Figure 3.

The motor is rated 10 hp, 1800 rpm, DC motor with the following parameters:

$R_a = 0.20\ \Omega$ (armature) $\qquad V_t = 240 volt$
$R_f = 120\ \Omega$ (field)

The machine constant $K a \phi_O$ @ $I_{fo} = 2A$ is equal to 1.25. $\qquad K a \phi_O = 125$

[Marks]

(1.) [2] How motor speed can be generally controlled.

(2.) [3] Calculate the motor speed at a load torque of 25 Nm

(3.) [3] Calculate the starting resistance (R start) needed to limit current to 300% of rated.

(4.) [2] How cogging can be avoided and dynamic braking be implemented.

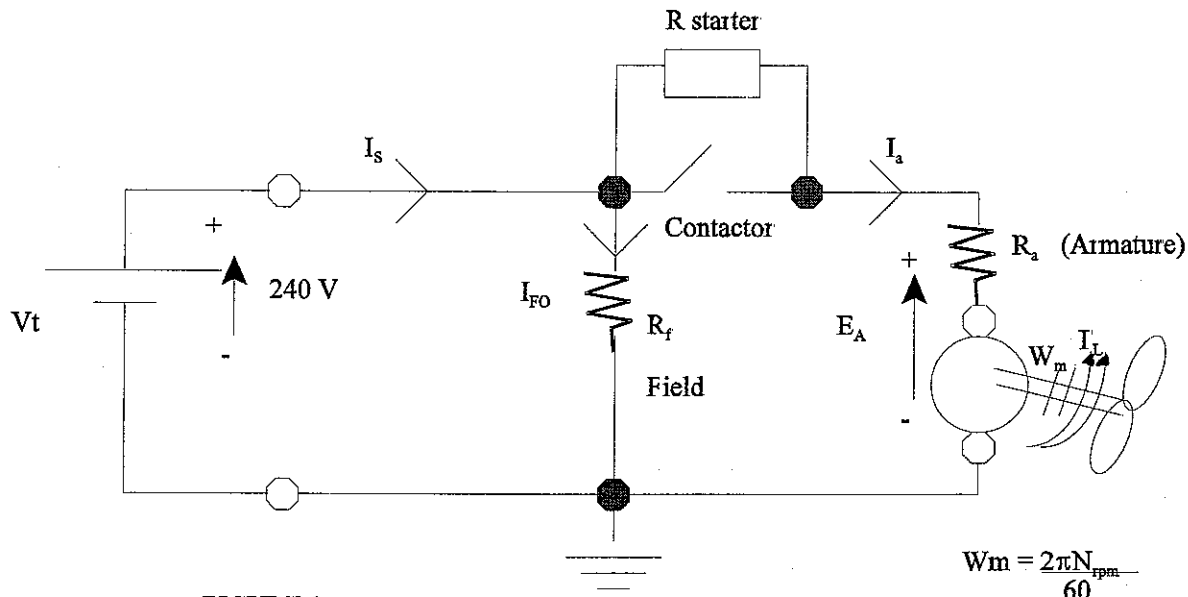

FIGURE 3

PROBLEM 4
[10 marks]

For the three phase squirrel cage induction motor shown in Figure 4 with the following equivalent (approximate) circuit parameters (referred to stator)

$$R_S = 3.1\Omega, \qquad R_\Omega' = 6.6\Omega, \qquad X_m' = 190\Omega$$

$$R_C' = 450\Omega, X\ell_1 = X\ell_2' = 7.25\Omega$$

230V (L-L_. 6 pole, 60 HZ motor)
with rotor rated speed = 1125 r/min (small slip)

(1.) [4] Calculate stator and rotor currents and power factors (I_S, I'_R)

(2.) [3] Calculate the shaft torque (Te) and mechanical power at the rated speed.

(3.) [1] How the speed of AC induction and synchronous motor can be controlled.

(4.) [2] Calculate maximum torque (T_{max})

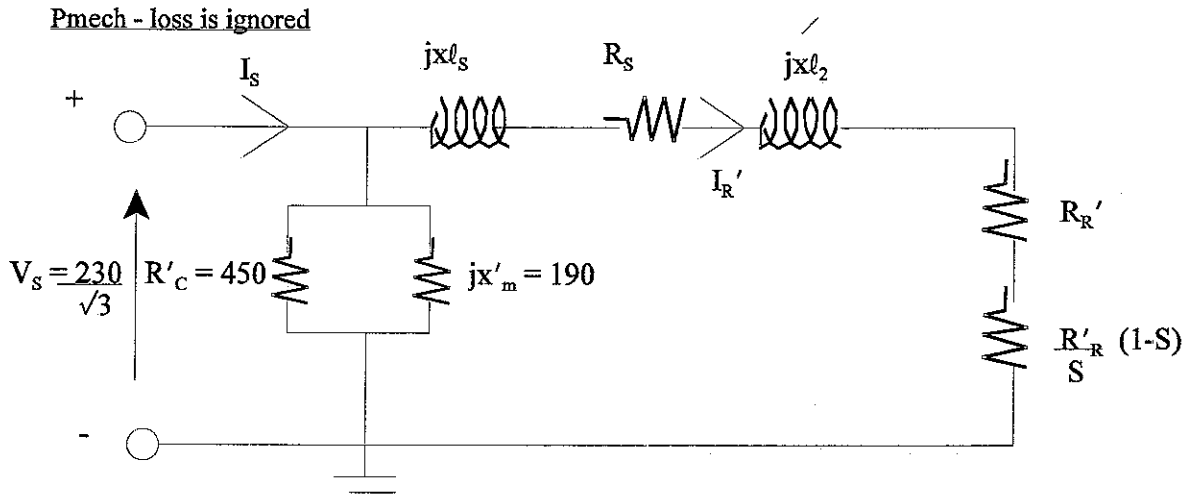

FIGURE 4