UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2011 SESSION

SUBJECT CODE	:	FEB 20102
SUBJECT TITLE	:	ELECTRICAL MACHINES
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00am – 11.00am (2 HOURS)
DATE	:	15 MAY 2011

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.

2. This question paper is printed on both sides of the paper.

3. Please write your answers on the answer booklet provided.

4. Answer should be written in blue or black ink except for sketching, graphic and illustration.

5. Answer four (4) questions only.

6. Answer all questions in English.

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FOUR questions only.

Please use the answer booklet provided.

Question 1

(a)   Draw the circuit diagram for separately excited d.c generator and derive voltage and current relationship.

(8 marks)

(b)   Table 1, give the open circuit characteristic of a d.c shunt generator running at 400 rpm.

Table 1

Field current, I_f (A)	Armature voltage, E_g (V)
0	7.5
2	92
3	132
4	162
5	183
6	190
7	212

i.   Determine the voltage to which machine will excite if field circuit resistance is 50 Ω and runs at 500 rpm.

(7 marks)

ii.   Calculate additional resistance would have to be inserted in the field circuit to reduce the voltage to 150 V at 500 rpm.

(5 marks)

iii.   Without additional resistance, determine the load current supplied by generator when terminal voltage is 250 V. Armature resistance is 0.2 Ω.

(5 marks)

Question 2

(a)   Write the speed equation and hence explain the factor affecting the speed of a d.c motor.

(5 marks)

(b)   A 4 pole, 250 V d.c shunt motor takes 4A on no load, running at 1200 rpm. The armature resistance is 0.1 Ω and field resistance is 125 Ω. If it takes total current of 61 A on full load, calculate its full load speed. Assume that flux gets weakened by 5% on full load condition.

(8 marks)

(c)   The full load armature current of 460 V d.c shunt motor is 82 A at 1000 rpm. When resistance of 2 Ω is inserted in series with armature, the load torque is reduced to 80% on full load torque. Calculate the speed if Ra = 0.3 Ω and Rf = 230 Ω.

(12 marks)

Question 3

(a)   Explain the important of kVA value of transformer when designing load supply voltage ?

(5 marks)

(b)   A 40 kVA, 400 / 200 V, 50 Hz, single phase transformer gave the following results .

Table 2

| Open circuit test (H. V) | 400 V | 5 A | 500 W |
| Short circuit test (L.V) | 10 V | 50 A | 150 W |

i.   Draw an approximation equivalent circuit of the transformer and shows the transformer parameters when referred to L.V side.

(10 marks)

ii.   Determine input voltage, Es and current, Ip' if transformer supplying load at full load with 0.8 lagging power factor.

(10 marks)

Question 4

(a)   Define the term slip of the three phase induction motor.

(5 marks)

(b)   A 415 V, 50 Hz, 3 phase, 6 pole star connected induction motor has the following values for the various parameter of its equivalent circuit.

Stator impedance   = (0.3 + j0.4) Ω
Equivalent rotor impedance   = (0.2 + j0.4) Ω
Magnetizing reactance   = j20 Ω
Resistance to account for core loss   = 100 Ω

Using the approximation equivalent circuit calculate for a slip 4 % .
Assume the mechanical losses to be 3 kW.

i.   Motor speed

(4 marks)

ii.   Stator current

(8 marks)

iii.   Motor output

(4 marks)

iv.   Motor efficiency

(4 marks)

Question 5

(a) Explain, why single phase induction motor is not self starting ?

(5 marks)

(b) A ¼ hp, 240 V, 50 Hz, four pole single phase induction motor has the following parameters and losses :

$R_1 = 10\ \Omega$; $X_1 = X_2 = j12.5\ \Omega$; $R_2 = 11.5\ \Omega$; $X_m = j250\ \Omega$
Friction and windage loss = 45 W

For a slip of 0.05, determine :

i. Stator current

(10 marks)

ii. Developed power in air gap.

(6 marks)

iii. Efficiency.

(4 marks)

END OF QUESTIONS PAPER