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CONFIDENTIAL

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UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2013 SESSION

SUBJECT CODE	:	**FED 20103**
SUBJECT TITLE	:	**ELECTRICAL MACHINES**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**2.5 HOURS**
DATE	:	

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. **Answers 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) Derive the e.m.f (Eg) equation for the shunt DC generator. State clearly the meaning and units of the symbols used.

(5 marks)

(b) In a particular DC generator, if P = 8, Z = 400, N = 300 rpm and Φ = 100 mWb, calculate generated e.m.f (Eg) if winding in :-

(i) Lap connected.

(2.5 marks)

(ii) Wave connected.

(2.5 marks)

(c) A 4 pole, lap wound connected 750 rpm DC shunt generator has an armature resistance of 0. 4Ω and field resistance of 200Ω. The armature has 720 conductors and the flux is 30 mWb. If the load resistance is 15Ω, determine the terminal voltage.

(15 marks)

Question 2

(a) Explain two (2) advantages of DC series motor as compared to DC shunt motor.

(2 marks)

(b) A 200 V DC shunt motor has R_a = 0.1 Ω, R_f = 240 Ω and rotational losses of 236 W. On full load, the input current is 9.8 A with motor running at 1450 r/min.

Determine :

(i) Generated power, P_g. (4 marks)

(ii) Output power, Po. (5 marks)

(iii) Load torque, T_O (2 marks)

(iv) Full load efficiency,ħ (2 marks)

c) A DC series motor drives a fan at 800 r/min and takes 20 A when fed from rated voltage of 230 V. The motor resistance is 0.4 Ω. The motor speed is to be raised to 1000 r/min by voltage control. Determine the voltage and current in case the magnetic circuit is saturated. (Hint, Φ = constant).

(10 marks)

Question 3

(a) Draw the equivalent circuit of a transformer with primary quantities referred to the secondary side.

(5 marks)

(b) A 25 kVA, 2200 / 220 V, 50 Hz, distribution transformer is tested for efficiency as follows :

Open circuit test (L.V side) :	220 V	4 A	150 W
Short circuit test (H.V. side) :	90 V	10 A	350 W

If the transformer operates at full load, determine :

(i) transformer parameters.

(ii) transformer approximation equivalent circuit, when referred to secondary side.

(iii) total copper losses, when transformer operating at 0.8 lagging power factor.

(20 marks)

Question 4

(a) State two (2) advantages of a three phase induction motor when compared to a DC motor.
(5 marks)

(b) A 4-pole, 3-phase, 415 V, 50 Hz induction motor has the following parameters of its circuit model.

$R_s = 1.2\ \Omega$

$jX_s = 1.16\ \Omega$

$R_r = 0.4\ \Omega$

$jX_r = 1.16\ \Omega$

$jX_m = 35\ \Omega$

Rotational losses = 800 W

For speed of 1440 r/min , determine:

(i) Stator current and power factor (8 marks)

(ii) Air gap power and mechanical power. (7 marks)

(iii) Output power and efficiency of the motor. (5 marks)

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Question 5

(a) Define the following terms related to a stepper motor.

(i). Holding torque. (2.5 marks)

(ii). Step angle. (2.5 marks)

(b) A single phase 120 V, 50 Hz four pole induction motor has the following constants in the equivalent circuit.

$R_1 = R_2 = 2\ \Omega$

$X_1 = X_2 = j2\ \Omega$

$X_m = j50\ \Omega$

There is a friction and windage loss of 35W.

For a 10% slip, calculate :

(i) Motor input current. (16 marks)

(ii) Motor efficiency (4 marks)

END OF QUESTION PAPER