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CONFIDENTIAL

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UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FEB 24083**
SUBJECT TITLE	:	**ELECTRICAL MACHINES**
LEVEL	:	**BACHELOR**
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. **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) Explain why the commutator is employed in D.C generator.

(5 marks)

(b) A separately excited generator running at 1000 rpm, gave the following O.C.C as shown in **table 1**.

Table 1 : Open circuit characteristic for DC separately excited generator

Field current, A	1.2	2.4	3.6	5	6.2	7.4
Armature voltage, V	140	280	375	440	490	520

Calculate:

(i) The voltage generated when the generator is excited as a shunt generator with a field resistance of 80 Ω at :
(a) 1000 rpm
(b) 800 rpm

(ii) The additional resistance which should be inserted in the field circuit to reduce the voltage to 360 V at 1000 rpm.

(20 marks)

Question 2

(a) A DC shunt motor takes an armature current of 20 A from 230 V supply. The resistance of armature is 0.5 Ω. Calculate the additional resistance required in series with the armature to halve the speed. Assume that the load torque is constant.

(15 marks)

(b) The armature and field resistances of a 500 V shunt motor are 0.2 Ω and 100 Ω respectively. Find the resistance of field winding regulator to increase the speed from 800 rpm to 1000 rpm, if the current taken by the motor for both speed is 450 A.

(10 marks)

Question 3

(a) Define the purpose of laminating the core in a transformer.

(5 marks)

(b) The following readings were obtained on O.C and S.C tests on a 200 / 400 V, 50 Hz, of a single-phase transformer.

(20 marks)

Table 2 : Open and short circuit tests data.

Open circuit test (L. V)	200 V	0.6 A	60 W
Short circuit test (H.V)	15 V	9 A	80

(i) Draw an approximation of equivalent circuit with refers to the secondary side

(ii) Calculate the secondary input voltage when it is delivering 4 kW at 0.8 lagging power factor.

Question 4

(a) Explain the condition for maximum torque for 3 phase induction motor, when it is running.

(5 marks)

(b) A 415 V, 50 Hz, 4 pole, star connected three phase induction motor has the following impedances per phase in ohms referred to the stator side:

(20 marks)

R_s = 0.641 Ω X_s = j1.106 Ω

R_r = 0.332 Ω X_2 = j 0.464 Ω

X_m = j 26.3 Ω

Mechanical losses are assumed constant at 1.1 kW and core losses are assumed negligible. If the slip is 2.2 % at rated voltage and frequency, calculate:

(i) Motor speed.

(ii) Stator current and power factor.

(iii) Motor output and input power.

(iv) Efficiency of motor.

Question 5

(a) Explain the function of capacitor in single phase induction motor.

(5 marks)

(b) Explain why single phase induction motor is not a self starting type.

(5 marks)

(c) The constants of a ¼ hp, 230 V, 4-pole, 50 Hz, single phase induction motor are as follows :

$R_1 = 10\ \Omega$ $jX_1 = j12.8\ \Omega$

$R_2 = 11.65\ \Omega$ $jX_2 = j12.8\ \Omega$

$jX_m = j258\ \Omega$

The total load is such that the machine runs at 3 % slip, the iron losses are 35.5 W. Calculate :

(i) Input current

(ii) Mechanical power

(iii) Output power (if mechanical losses are 10 W)

(iv) Motor efficiency

(15 marks)

END OF QUESTIONS PAPER