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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2013 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) Give two (2) reasons for the cause of failure build up voltage in DC self excited shunt generator.

(5 marks)

(b) The Open Circuit Characteristic of D.C generator running at 800 rpm is as follows :

Field Current, A :	0.5	1.0	1.5	2.0	2.5	3.0	3.5
E.m.f, V :	60	120	138	145	149	151	152

The machine is run as a shunt generator at the same speed and its field resistance is adjusted to 53 Ω, find :

i. The generated voltage.
ii. Load current supplied when output voltage is 100 V.

Take armature resistance = 0.1 Ω.

(12 marks)

(c) A separately excited D.C generator, when running at 1200 rpm supplies 200 A at 125 V to a circuit of constant resistance. What will be the current when the speed is dropped to 1000 rpm and the field current is reduced to 80 %. Armature resistance = 0.4 Ω and total drop at brushes = 2 V.

(8 marks)

Question 2

(a) List three (3) methods for controlling speed of DC motor.

(6 marks)

(b) A 220 V, shunt motor takes 22 A at rated voltage and runs at 1000 rpm. Its field resistance is 100 Ω and armature resistance is 0.1 Ω. Compute the value of additional resistance required in the armature to reduce the speed to 800 rpm, when :

i. The load torque is proportional to speed.
ii. The load torque varies as the square of the speed.

(12 marks)

(c) A 500 V series motor takes current of 180 A to develop 80 kW. The armature and field resistances are 0.1 Ω and 0.04 Ω respectively. If the output is reduced to 40 kW, find the input current and efficiency.

(7 marks)

Question 3

(a) How can the equivalent impedance of a transformer be determined ?

(5 marks)

(b) The corrected instrument readings obtained from open and short circuit tests on 10 kVA, 450 / 120 V, 50 Hz transformer are :

O.C. Test : (V_1, W_1 and I_1 were read on the low voltage side)

V_1 = 120 V, I_1 = 4.2 A, W_1 = 80 W

S.C.Test : (low voltage winding short circuited)

V_1 = 9.65 V I_1 = 22.2 A W_1 = 120 W

Calculate :

i. The approximation equivalent circuit constants referred to low voltage side.
ii. The efficiency and voltage regulation for 0.8 lagging power factor.
iii. The efficiency at half full load and 0.8 lagging power factor.

(20 marks)

Question 4

(a) List three (3) advantages and disadvantages of 3 phase squirrel cage induction motor.

(6 marks)

(b) A 3 phase, star connected, 400 V, 50 Hz, 4 pole induction motor has the following per phase constants parameter :

$R_1 = 0.15\ \Omega$ $jX_1 = j\ 0.45\ \Omega$

$R_2 = 0.12\ \Omega$ $jX_2 = j\ 0.45\ \Omega$

$jX_m = j\ 28.5\ \Omega$

If the fixed losses are (core, friction and windage losses) 380 W and the motor is operated at rated voltage and frequency at a slip of 4 %, calculate :

i. Stator current
ii. Rotor speed
iii. Output torque
iv. Efficiency

(19 marks)

Question 5

(a) Explain with reason, why reluctance motor has a low efficiency

(6 marks)

(b) The constant of a one-quarter H.P, 230 V, 4 pole, 60 Hz, single phase induction motor are as follows :

Stator resistance, R_1 = 8.0 Ω
Rotor resistance, R'_2 = 12.0 Ω
Rotor reactance, jX'_2 = j 10.0 Ω
Magnetizing reactance, jX_m = j 270 Ω

The total load is such that the machine runs at 4 % slip, when the voltage is at 230 V. The iron losses are 40.0 W at 230 V. Calculate :

i. Input current
ii. Power mechanical developed
iii. Output torque (if mechanical losses are 8 W)

(19 marks)

END OF QUESTIONS PAPER