Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2010 SESSION

SUBJECT CODE	:	FED 20102
SUBJECT TITLE	:	ELECTRICAL MACHINES
LEVEL	:	DIPLOMA
TIME / DURATION	:	8.00pm – 10.00pm (2 HOURS)
DATE	:	06 MAY 2010

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 answer on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This questions paper consists of FIVE (5) questions. 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 dc self excited shunt generator equivalent circuit and describe the main components .

(9 marks)

(b) A shunt generator delivers 100 A at terminal voltage at 240 V. The armature resistance and shunt field resistance are 0.04 Ω and 60 Ω respectively. The mechanical losses equal to 800 W. Determine:-

i. the total copper loss.

(4 marks)

ii. the input power of the generator

(2 marks)

(c) A separately excited dc generator has a no-load voltage (E_g) of 120 V at a field current of 2 A, when driven at 1500 r/min. Calculate :-

i. the generated voltage when the field current is increased to 2.5 A and the speed is unchanged.

(5 marks)

ii. the generated voltage when the speed is reduced to 1400 r/min and the field current is increased to 2.8 A.

(5 marks)

Question 2

(a) Develop the torque equation of the dc motor.

(5 marks)

(b) A shunt motor has an armature resistance of 0.25 Ω. The motor takes 125 A from 400 V supply and runs at 1000 r/min. If the total torque developed remains unchanged, calculate the speed and armature current if the magnetic field is reduced to 80% of the initial value.

(8 marks)

(c) A 230 V dc shunt motor has an armature circuit resistance of 0.4 Ω and field resistance of 115 Ω. This motor drives a constant torque load and takes an armature current of 20 A at 800 r/min. If motor speed is to be raised from 800 r/min to 1000 r/min. Find the resistance that must be inserted in the shunt field circuit.

(12 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) Show through a power flow diagram, how electrical input is converted into mechanical power output in an induction motor.

(5 marks)

(b) A 415 V, 50 Hz, three phase star connected, 4 pole induction motor has stator impedance, $Z_1 = (0.07 + j\ 0.3)\ \Omega$ and rotor impedance $Z_2 = (0.08 + j\ 0.3)\ \Omega$. The magnetizing reactance is $j10\ \Omega$ and resistance representing core loss is $50\ \Omega$. Assume a slip of 4 % and by using approximation equivalent circuit. Calculate :-

i. stator current and power factor.

(10 marks)

ii. developed torque inside the air gap

(7 marks)

iii. output power and efficiency of the motor.

(3 marks)

Question 5

(a) A 2.5 kW, 120 V, 50 Hz capacitor-start motor has the following impedances for the main and auxiliary windings.

$Z_{main} = 4.5 + j3.7\ \Omega$

$Z_{aux} = 9.5 + j3.5\ \Omega$

Find the value of starting capacitance that will place the main and auxiliary winding .

(5 marks)

(b) A 110 V, 50 Hz, four pole, capacitor –start motor has the following equivalent circuit parameters value and losses.

$R_{1,main} = 2.02\ \Omega$ $X_{1,main} = 2.79\ \Omega$

$R_{2,main} = 4.12\ \Omega$ $X_{2,main} = 2.12\ \Omega$

$X_{m,main} = 66.8\ \Omega$

Core loss = 24 W Friction and windage loss = 13 W

For a slip of 0.05, determine :

i. stator current

(8 marks)

ii. output power

(8 marks)

iii. efficiency

(4 marks)

END OF QUESTION