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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FED 20102
SUBJECT TITLE	:	ELECTRICAL MACHINES
LEVEL	:	DIPLOMA
TIME / DURATION	:	12.30 pm – 2.30 pm (2 HOURS)
DATE	:	13 NOVEMBER 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 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) How is the induced voltage of a separately excited dc generator affected if;

i. The speed increases.

ii. The exciting current is reduced

(5 marks)

(b) The data of dc shunt generator in figure 1 is as follows:

Voltage across armature resistance, V_{Ra} = 10 V

Armature resistance, Ra = 0.5 Ω

Shunt resistance , Rsh = 200 Ω

Load resistance, R_L = 20 Ω

Determine armature current and load current.

(10 marks)

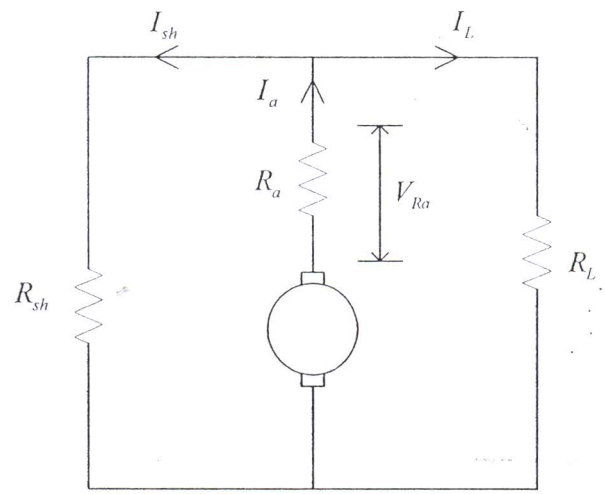

Figure 1

(c) A series dc generator 4 poles, wave armature winding has 200 conductors and runs at 1200 rpm supplied a full load output of 10 kW at 250 V. Armature resistance 0.2 Ω, series field winding 0.55 Ω, with mechanical losses at 500 W, Find :-

(10 marks)

i. Armature current

ii. Flux per pole

iii. Efficiency at full load.

Question 2

(a) For dc shunt motor, shows that :-

The speed , N = $K\frac{V_s - I_a R_a}{\phi}$

Where K is constant parameter.

(5 marks)

(b) A shunt motor runs at 460 rpm when taking 240 A at 100 V. What will be the speed of the motor when taking 90 A at 220 V. Armature resistance and shunt resistance are 0.032 Ω and 46 Ω. At what speed would it have to run as a generator to give 150 A at 180 V.

(10 marks)

(c) The torque measured at the pulley of a series motor is 130 Nm, when motor taking 50 A at 200 V and runs at 600 rpm. Armature and field winding resistance are 0.3 Ω and 0.2 Ω respectively. Find :-

(10 marks)

i. Output power.

ii. Total of copper losses.

iii. Motor's efficiency (take mechanical losses equal to 571 W)

Question 3

(a) Explain, why the speed of induction motor drops as the motor's load increase ?

(3 marks)

(b) A 6 pole, 50 Hz squirrel cage motor runs on load at a shaft speed of 970 rpm.

Calculate :-

i. The percentage slip

ii. The frequency on induced current in the rotor.

(5 marks)

(c) A 415 V, 3 phase, 4 pole, 50 Hz, 5 hp Y connected induction motor .

The equivalent circuit parameters are :-

$R_1 = 0.45\ \Omega$ $R_2 = 0.4\ \Omega$

$X_1 = X_2 = 0.8\ \Omega$ $X_m = 30\ \Omega$

The stator core loss is 50 W and rotational loss is 150 W. For a slip of 0.04 .

Find :-

(17 marks)

i. Input current

ii. Air gap power

iii. Efficiency

Question 4

(a) List the types of losses that occurs in a transformer.

(5 marks)

(b) Show that the ratio of the total voltage on the primary of a transform to the total voltage on the secondary of a transformer is given as :-

$$\frac{Vp}{Vs} = \frac{Np}{Ns} = a$$

(7 marks)

c) A 20 kVA, 8000 / 227 V distribution transformer has the following resistances and reactances :_

$R_P = 32\ \Omega$ $R_S = 0.05\ \Omega$

$X_P = 45\ \Omega$ $X_S = 0.06\ \Omega$

$R_C = 250\ k\Omega$ $X_M = 30\ k\Omega$

(13 marks)

i. Find the approximation equivalent circuit of this transformer referred to the high voltage side.

ii. Assume that this transformer is supplying rated load at 277 V and 0.8 PF lagging.

iii. What is the transformer efficiency under the condition of part ?.

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