



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2014 SESSION

SUBJECT CODE : FED 20103 / FED 20102
SUBJECT TITLE : ELECTRICAL MACHINES
LEVEL : DIPLOMA
TIME / DURATION : 9.00 AM – 11.00 AM
(2 HOURS)
DATE : 4 JANUARY 2015

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 the advantages on DC series generator as compared to DC shunt generator.
(5 marks)

- (b) A shunt generator supplied 30 kW at a terminal voltage of 300 V. The resistance of armature and shunt are 0.5Ω and 300Ω . The efficiency at the above load is 84 %.
Determine :

Determine :

- (i) Voltage generated, E_g . (3 marks)
(ii) Input power, P_i . (3 marks)
(iii) Mechanical losses, P_w (4 marks)

- (c) The following data obtain for 250 V DC shunt generator.

$$Z = 180, P / A = 1$$

Flux, $\Phi = 0.375 \text{ Wb}$.

Armature resistance = 1Ω

The generator is coupled to induction motor whose produced generated torque (T_g) inside generator equal to 80 Nm.

Determine :

- (i) Armature current, I_a . (7 marks)
(ii) Speed of generator, N (3 marks)

Question 2

- (a) Explain two advantages of DC series motor as compared to DC shunt motor. (5 marks)
- (b) A 15 kW, 250 V, 1200 r/min shunt motor has 4 poles, 900 lap winding armature conductors with $R_a = 0.2 \Omega$. At rated speed and rated output the armature current is 75 A and field current, $I_f = 1.5$ A.
Calculate :
- (i) Flux, Φ (4 marks)
 - (ii) Generated Torque, T_g (2 marks)
 - (iii) Mechanical losses, P_w (2 marks)
 - (iv) Output Torque, T_o (2 marks)
- (c) A 200 V, series motor runs at 850 r/min to give a total torque of 100 Nm. The current taken by the motor at this torque is 95 A. If the total resistance of the motor is 0.8Ω . Calculate the torque developed when motor runs at 1200 r/min. (10 marks)

Question 3

- (a) Explain the main purpose of power transformer.

(2 marks)

- (b) Consider a transformer equivalent circuit referred to primary side and show that :

$$R_r' = a^2 R_r$$

(6 marks)

- (c) A 20 kVA, 8000 / 230 V distribution transformer has the following resistances and reactances as below :

$$\begin{array}{ll} R_p = 32 \, \Omega & jX_p = 45 \, \Omega \\ R_s = 0.05 \, \Omega & jX_s = 0.06 \, \Omega \\ R_c = 250 \, \text{k}\Omega & jX_m = 30 \, \text{k}\Omega \end{array}$$

Determine :

- (i) Exact equivalent circuit of this transformer, when referred to primary side.
(6 marks)
- (ii) Input current of transformer if supplying rated load at 230 V and 0.8 pf lagging.
(9 marks)
- (iii) Total copper losses, ΣCu .
(2 marks)

Question 4

- (a) State two advantages of a three phase induction motor when compare 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.

$$R_s = 1.2 \, \Omega$$

$$jX_s = 1.16 \, \Omega$$

$$R_r = 0.4 \, \Omega$$

$$jX_r = 1.16 \, \Omega$$

$$jX_m = 35 \, \Omega$$

$$\text{Rotational losses} = 800 \, \text{W}$$

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)

Question 5

(a) Explain the function of auxiliary windings for a single phase induction motor.

(5 marks)

(b) A 120 V, 1/3 Hp, 50 Hz, 4-pole, split phase induction motor has the following impedances :

$$\begin{array}{lll} R_1 = 2.0 \, \Omega & jX_1 = 2.56 \, \Omega & jX_m = 60.5 \, \Omega \\ R_2 = 2.8 \, \Omega & jX_2 = 2.56 \, \Omega & \end{array}$$

At a slip of 0.05, the motor rotational losses are 51 W. Determine :

(i) Input current and power factor.

(8 marks)

(ii) Input power and mechanical power

(6 marks)

(iii) Output power and generated torque.

(6 marks)

END OF QUESTION PAPER