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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012**

COURSE NAME : ELECTRIC MACHINES AND DRIVES
COURSE CODE : BEX 42403 / BEE 4123
PROGRAMME : BEE
EXAMINATION DATE : JUNE 2012
DURATION : 2 HOURS 30 MINUTES
INSTRUCTION : ANSWER ALL QUESTIONS.

THIS PAPER CONSISTS OF **THREE (3) PAGES**

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- Q1**
- (a) List four (4) types of losses that can occur in a transformer. (4 marks)
- (b) A single phase transformer 11KV/240V, 50Hz, 20KVA has following data: R and L primary are $9\ \Omega$ and 50mH and R and L secondary are $2.5\text{m}\ \Omega$ and 0.01mH.
- Determine the transformer impedance referred to the secondary side (low voltage side)
 - Draw the equivalent circuit referred to the low-voltage side
 - Find the input current at full load operation
 - Based on the available data given find the efficiency of the transformer at full load operation
- (15 marks)
- (c) If the three units of the transformers in Q1(b) are connected in wye-delta, and connected with three-phase load of 50kVA, determine:
- Current in the outgoing transmission line
 - Current in the incoming transmission line
- (6 marks)
- Q2**
- (a) Explain three (3) methods to control the speed of an induction motor. (6 marks)
- (b) A 3ϕ , 380V, 50Hz, 2 pole, 2800 rpm and the rotational loss is 50W, Y-connected induction motor has the following parameter referred to the stator.
- $$R_1 = 0.1\ \Omega$$
- $$X_1 = 0.7\ \Omega$$
- $$X_m = 35\ \Omega$$
- $$R_2 = 0.3\ \Omega$$
- $$X_2 = 0.7\ \Omega$$
- Based on the information given, draw the equivalent circuit
 - Determine slip of this motor
 - Find the stator current, I_1
 - Calculate the power factor, pf
 - Determine the efficiency of the motor at nominal operation
 - Calculate the torque and the corresponding slip
- (19 marks)

- Q3** (a) Explain briefly how to determine the synchronous reactance of a three-phase generator. (6 marks)

(b) A 3 ϕ , 5kVA, 400V, four-pole, 50Hz, Y connected synchronous machine has a negligible stator winding resistance and a synchronous reactance of 8Ω per phase at rated terminal voltage. The output terminals are then connected with three phase RL load in Y connection ($R = 15$ ohm series with $L = 100$ mH) across the terminal.

- (i) Sketch the equivalent circuit diagram of the generator and load in three-phase connections
- (ii) Determine the induced voltage per phase
- (iii) Calculate the synchronous reactance per phase
- (iv) Calculate the output voltage per phase
- (v) Draw the phasor diagram of this generator

(19 marks)

- Q4** (a) List any four (4) types of DC motors (4 marks)

(4 marks)

(b) During nominal operating a DC shunt motor produce counter emf 48 V, at armature current of 25 A and 3000 rpm. The motor has an armature resistance of 0.5 ohm and a field resistance of 0.2 ohm.

- (i) Sketch the equivalent circuit diagram of this motor
- (ii) Determine the nominal input voltage
- (iii) Find the induced torque of the motor
- (iv) Find the starting line current of the motor
- (v) Find the new speed for the motor if the load torque reduced 50% and the input voltage reduced 10%

(21 marks)