UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	ELECTRICAL MACHINES AND DRIVES
COURSE CODE	:	DEK 3143 / DAE 32303
PROGRAMME	:	3 DET/ DAE/ DAL
EXAMINATION DATE	:	OCTOBER 2012
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

Q1 (a) With the help of drawings, describe the physical construction of a DC machines.

(5 marks)

(b) A compound DC motor rated at 240 V, 50 Hz, 1800 rpm has armature resistance, 0.2 Ω, series field resistance, 0.6 Ω and shunt field resistance,120 Ω. The rotational losses are 150 W. The full load line current is 40 A.

(i) Find the back emf, E_c
(ii) Find the developed mechanical power, P_{mech}
(iii) Find the output power, P_{out}
(iv) Find the output torque, τ_{out}
(v) Find the efficiency of the motor, η
(vi) Draw the power flow diagram for this type of motor

(20 marks)

Q2 (a) The following test results were obtained for a 20 kVA, 50 Hz, 2400/240 V distribution transformer as tabulated below. Assuming step-down operation, supplying a rated load at 0.85 lagging power factor, determine the voltage regulation referred to the high voltage side.

Table Q2(a) : Data of short-circuit and open-circuit test

Short-Circuit	**Open-Circuit**
$V_{sc} = 57.5$ V	$V_{oc} = 240$ V
$I_{sc} = 8.34$ A	$I_{oc} = 1.066$ A
$P_{sc} = 284$ W	$P_{oc} = 126.6$ W

(25 marks)

Q3 (a) With the help of drawings, explain briefly the derivation of
(i) the applied voltage and induced voltage transformation of an ideal transformer,
(ii) the current transformation of an ideal transformer
(iii) the impedance transformation of an ideal transformer.

(10 marks)

(b) The purpose of open circuit and short circuit test is to determine the shunt and series branch parameter of a practical transformer. Briefly explain open circuit and short circuit test to determine circuit parameter of the practical transformer.

(15 marks)

Q4 (a) A 415 V, 50 Hz, 20hp, 3-phase, star connection, 4-poles, induction motor has the following impedances in ohms per phase referred to the stator circuit:

$R_s = 0.65\Omega$ $R_R = 0.45\Omega$
$X_s = 1.25\Omega$ $X_R = 0.65\Omega$
$R_C = \infty$ $X_m = 25\Omega$

At full load condition, the rotational losses are 1.2 kW and assumed to be constant. The core loss is lumped in with the rotational losses. For a rotor slip 0f 3% at the rated voltage and rated frequency, using approximate equivalent circuit, find the motor's

(i) Speed
(ii) Stator current
(i) Power factor
(ii) Input power
(iii) Air gap power
(iv) Converted power
(v) Torque induced by the motor
(vi) Load torque
(vii) Efficiency
(viii) Power flow diagram

(25 marks)

Q5 (a) With the help of a phasor diagram, outline the three loading conditions of the synchronous motor.

(9 marks)

(b) A 2300V 100hp, 50Hz,eight pole, star connected synchronous motor has a rated power factor of 0.8 leading. Motor operate at rated load of efficiency is 0.85 percent. The armature resistance is 1.1 Ω/phase and synchronous inductance is 63.666 mH/phase. Find the following quantities for this machine when it is operating at full load.

(i) output torque
(ii) input power
(iii) The induced emf per phase
(iv) Converted power
(v) The voltage regulation
(vi) Draw the phasor diagram.

(16 marks)

Q6 (a) Describe the following aspect of a Stepper motor.

(i) The physical construction of the motor
(ii) The performance of the motor

(12 marks)

(b) Illustrate the following with regard to a Reluctance Motor

(i) The constructional design of the motor
(ii) The operating fundamentals of the motor

(13 marks)