Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	ELECTRICAL MACHINES AND DRIVES
COURSE CODE	:	DAE 32303
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JUNE 2017
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Name **four** (4) major parts of the DC generator.

(2 marks)

(b) State the function of the following:-

(i) Slip ring in AC generator,
(ii) Carbon brush in AC generator.

(4 marks)

correction.

(c) Draw and completely label the power flow diagram of the DC series. — DC series motor.

(3 marks)

(d) Draw and completely label the basic circuit of the DC series motor.

(4 marks)

(e) From the circuit of DC series motor in **Q1(d)**, derive the equation of counter emf (E_m) by using Kirchhoff Current law (KCL) and Kirchhoff Voltage law (KVL).

(6 marks)

(f) Write **three (3)** advantages of DC machines.

(3 marks)

(g) State the relationship between power losses and efficiency in the DC machines.

(3 marks)

Q2 (a) The main purpose of constructing an open circuit test and short circuit test In a practical transformer is to determine the transformer impedances. Based upon this statements;

(i) Describe briefly the step by step procedure in constructing the short circuit test.

(3 marks)

(ii) Describe briefly the step by step procedure in constructing the open circuit test

(3 marks)

(b) Short-circuit and open-circuit tests were performed on a 100kVA transformer,50 Hz, rated at 120V/2400V, and the results are listed as follows:

V_{sc} = 40 V	V_{oc} = 120 V
I_{sc} = 43.57 A	I_{oc} = 7 A
P_{sc} = 380 W	P_{oc} = 50 W

(i) Draw the equivalent circuit with the necessary parameters of the transformer referred to the low voltage side.

(6 marks)

correction.

(ii) Draw the equivalent circuit with the necessary parameters of the transformer referred to the low voltage side. → high voltage side.

(6 marks)

(iii) Based on the equivalent circuit gained from **Q2(b)(ii),** calculate the terminal voltage , V_1 and the Voltage regulation, VR if the load at 0.8 power factor lagging is connected to 2400 V side.
(neglect the magnetizing impedance)

(7 marks)

Q3 (a) State **two (2)** advantages and **two (2)** disadvantages of an Induction machines.

(4 marks)

correction (b) A 3-phase, Y connected, 50 Hz, 4 pair poles, induction motor having 800 → 710 rpm rpm full load speed. The motor is connected to 415 V supply. The machine has the following impedances in ohms per phase referred to the stator circuit:

R_1 = 0.3 Ω	X_1 = 2.2 Ω
R_2 = 0.85Ω	X_2 = 4.2 Ω
X_m = 60 Ω	

If the total friction & windage losses are 220 W, determine the following;

(i) Find the slip, s

(3 marks)

(ii) Solve the input power, P_{in}.

(4 marks)

(iii) Estimate the air gap power, P_{ag}.

(4 marks)

(iv) Indicate the mechanical power, P_m.

(4 marks)

(v) Identify the torque induced by the motor, τ_{ind}.

(3 marks)

(vi) Identify the efficiency of the motor.

(3 marks)

Q4 (a) A 3-phase Y-connected synchronous generator supplies a load of 20MW at power factor 0.85 lagging and the terminal voltage is 11 kV. The armature resistance is 0.3 Ω/phase and synchronous reactance of 0.75 Ω/phase.

(i) Calculate the armature current

(2 marks)

(ii) Indicate the internal generated voltage

(2 marks)

(iii) Estimate the voltage regulation.

(1 marks)

(iv) Draw the phasor diagram.

(2 marks)

b) A 2400 V, 60 kW, 60 Hz, 3 pair poles, delta-connected synchronous motor has a synchronous reactance of 4 Ω/phase and armature resistance of 2 Ω/phase. At full load, the efficiency is 90 %. Find the following requirements for this machine when it is operating at full load at rated power factor of 0.85 lagging.

(i) Sketch the phasor diagram to represent back emf,

(2 marks)

(ii) Calculate the supply voltage , E_A

(3 marks)

(iii) Indicate the armature current.

(3 marks)

(iv) Indicate the voltage regulation.

(2 marks)

(v) Estimate the input power

(2 marks)

(vi) Solve the developed mechanical power

(4 marks)

(vii) Sketch the power flow diagram

(2 marks)

Q5 (a) Draw and label completely the basic circuit of the split-phase motor.

(3 marks)

(b) Describe the principle of operation of the split-phase motor.

(6 marks)

(c) 1-hp, 240 V, 50 Hz of the single phase motor is installed to construct 1-hp of an air conditioning. If the motor has the power factor of 0.8 and run with the rotor speed of 980 rpm, determine the:-

(i) synchronous speed, N_S
(ii) number of poles, p
(iii) percentage of slip, %S
(iv) operating current, I

(8 marks)

(d) Write **six(6)** examples of applications of the Universal (Series) motor in domestic, commercial and service sectors.

(3 marks)

(e) State the relationship between output power, efficiency, losses and Current consumption of the motors.

(5 marks)

Q6 (a) Define power electronics.

(3 marks)

(b) Draw and label completely the following symbols:-

(i) Unijunction Transistor, UJT
(ii) Gate Turn Off Thyristor, GTO

(4 marks)

(c) Name the device used to invert DC signal into AC signal.

(2 marks)

(d) Briefly explain the speed control of the DC motor drives using the field flux control method.

(5 marks)

(e) Briefly explain the speed control for the AC motor drives using the pole changing method.

(5 marks)

(f) State **three (3)** disadvantages of Ward Leonard Drive.

(3 marks)

(g) Give **six (6)** applications of DC motor drives in industries.

(3 marks)

-END OF QUESTION -