



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2010/2011**

COURSE NAME : ELECTRICAL MACHINES AND DRIVES

COURSE CODE : DEK 3143

PROGRAMME : 3 DEE/DET

EXAMINATION DATE : APRIL/MAY 2011

DURATION : 2 ½ 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 500 V, 4-poles DC compound generator has an armature resistance of 0.02Ω , series field resistance of 0.04Ω and a shunt field resistance of 100Ω . If the line current at full load is 100 A, calculate the generated voltage. (Assume a voltage drop per carbon brush being 1 V).

(10 marks)

- (c) A 250 V shunt DC generator has an armature resistance of 0.25Ω . At no load, the generator takes a line current of 5.0 A while running at 1200 rpm. If the line current at full load is 52 A with excitation voltage of 280 V, calculate :

- (i) The field resistance
- (ii) The full load speed
- (iii) The full load speed if the field resistance is doubled

(10 marks)

- Q2 (a) Based on the construction of the dc machines describe the operating principles of a DC motor.

(5 marks)

- (b) A 440 V, 2-poles pairs DC permanent magnet motor has an armature current of 50 A. If the armature resistance is 0.28Ω , the magnetic flux is 0.023 Wb and if the motor has a lap winding of 888 conductors, calculate the speed of the motor.

($c=2$ for wave winding, $c = P$ for lap winding)

(10 marks)

- (c) A 300 V compound DC motor has armature resistance 0.18Ω , series field resistance 0.3Ω and shunt field resistance 100Ω . The rotational losses are 200 W. On full load line current is 25 A and the motor runs at 1800 rpm. Determine :
- The developed mechanical power.
 - The output power
 - The output torque
 - The efficiency at full load
- (10 marks)

- Q3 (a) Deduce the rms induced voltage of a transformer

(5 marks)

- (b) Short-circuit and open-circuit tests were performed on a 100 kVA 7200/277 V, with the results as tabulated below. Assuming step-down operation, determine the equivalent circuit parameters of the transformer referred to the high voltage side.

Table Q3(b) : Data of short-circuit and open-circuit test

Short-Circuit	Open-Circuit
$V_{sc} = 414 \text{ V}$	$V_{oc} = 277 \text{ V}$
$I_{sc} = 13.89 \text{ A}$	$I_{oc} = 14.88 \text{ A}$
$P_{sc} = 1126 \text{ W}$	$P_{oc} = 1000 \text{ W}$

(20 marks)

- Q4 (a) With the help of drawings, illustrate the existing of the rotating magnetic field in the stator of the 3-phase induction motor.

(10 marks)

- (b) A 3-phase, delta connection, 4-poles, 50 Hz induction motor having a rotor speed of 1200 rpm and 45 kW input power at 0.85 power factor lagging. The copper losses and iron losses in the stator amount to 1.5 kW and the windage and friction losses are 3 kW. Determine:

- The net output power
- The efficiency of the motor
- The input current

(15 marks)

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

(10 marks)

- (b) A 3-phase star connected synchronous generator supplies a load of 10 MW at 0.85 lagging power factor and at a terminal voltage of 11 kV. The armature resistance is 0.1Ω /phase and synchronous reactance of 0.66Ω /phase. Calculate :-

- (i) The armature current
- (ii) The internal generated voltage
- (iii) The voltage regulation

(15 marks)

- Q6** (a) With the help of diagram, describe the following aspect of a Shaded Pole 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)

Faculty: Centre for Diploma Studies
 Programme: Diploma of Electrical Engineering
 Subject: Electrical Machines and Drives
 Code: DEK 3143

Course Learning Outcomes	LO-1		LO-2		LO-3		LO-4		LO-5		LO-6		LO-7		LO-8		LO-9		Delivery	Assessment
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		
Apply theory knowledge to practical	C3																		Lecture/ Tutorial	Test/ Final Exam
Able to differentiate between DC machine, synchronous machine and induction machine.							A2												Lecture/ Tutorial/ Assignment	Test/ Report/ Final Exam
Operates DC machine, synchronous machine and induction machine		P3							P3										Lecture/ Tutorial	Test/ Final Exam
Total	1	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0		

Level of Learning Taxonomy	
Psychomotor	Cognitive
P1 Perception	C1 Knowledge
P2 Set	C2 Comprehension
P3 Guided Response	C3 Application
P4 Mechanism	C4 Analysis
P5 Complex Overt Response	C5 Synthesis
P6 Adaptation	C6 Evaluation

1 = substantial contribution to outcome
 2 = moderate contribution to outcome

