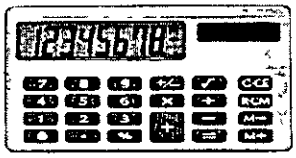
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

EMM2602
REM2602

May/June 2015

ELECTRICAL MACHINES II (THEORY)

Duration 3 Hours

100 Marks

EXAMINERS
FIRST MR PTA MAHLARE
SECOND MR AF COTTRELL

Programmable pocket calculator is permissible

Closed book examination

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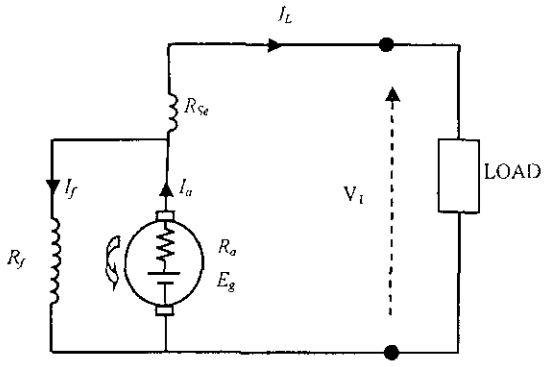
This examination question paper consists of 4 pages

Answer all the questions

PLEASE NOTE: IF YOU HAVE THE OPINION THAT INSUFFICIENT INFORMATION IS SUPPLIED FOR YOU TO ANSWER A PARTICULAR QUESTION, MAKE A REALISTIC ASSUMPTION, MOTIVATE IT AND THEN ANSWER THE QUESTION.

QUESTION 1

A short shunt compound generator delivers 200A at a terminal voltage of 100V The armature resistance, series field and shunt field winding resistances are 0 04Ω, 0 03Ω and 60Ω respectively **Ignore** brush resistance Determine



1 1 The series field voltage (2)
1 2 The shunt field voltage (2)
1 3 *The shunt field current* (2)
1 4 The armature current (2)
1 5 The armature resistance voltage drop (2)
1 6 The generated e m f (2)
1 7 The e m f generated if the same machine is connected as a long shunt (4)
[16]

QUESTION 2

A 6-pole, D C Shunt generator, with 760 wave-connected armature conductors, running at 600rpm, supplies a resistive load of 12 5Ω at a terminal voltage of 75V The armature resistance is 0 25 Ω and the field resistance is 220Ω Find

2 1 Draw the equivalent circuit of a shunt generator (4)
2 2 The armature current (6)
2 3 The induced e m f (2)
2 4 The flux per pole (2)
[14]

QUESTION 3

3 1 A 4 pole, 32 conductors, wave-wound D C shunt generator with voltage terminal of 200V delivering 12A to the load has armature resistance of 2Ω and field circuit resistance of 200Ω It is driven at 1000 r/min Calculate the flux per pole in the generator (8)

3 2 If the machine has to be run as motor with the same terminal voltage and drawing a current of 5A from the mains, maintaining the same flux magnetic field, Find the speed of the generator (7)

[15]

QUESTION 4

The following data refers to a single phase transformer

R_1 = 25Ω X_1 = 95Ω
R_2 = 0 06Ω X_2 = 0 20Ω

The primary HV side has a no-load current is 1 5A at a power factor of 0 25 lagging The secondary side delivers 150A at a power factor of 0 80 lagging and the turn ratio is 0 06288 Calculate the following

4 1 The series equivalent secondary resistance (2)
4 2 The series equivalent secondary reactance (2)
4 3 The series equivalent secondary impedance (2)
4 4 The secondary current referred to the primary side (2)
4 5 The primary current (2)

[10]

QUESTION 5

A single phase, 50kVA, 2200/110V, 50Hz transformer has a percentage impedance-volt of 4 536% Calculate

5 1 The voltage you would apply to the high voltage side during the short circuit test, if you want rated full load currents to flow (2)
5 2 The series equivalent impedance, referred to the high voltage side, using the result of 5 1, above (4)
5 3 If the high and low voltage winding resistances are 1Ω, and 2 3075mΩ, **(milli-ohm!!)** respectively, find the leakage reactance referred to the high voltage side (6)

[12]

QUESTION 6

An Open, and Short circuit test was carried out on a 50kVA, 2200/110V, 50Hz, single phase transformer, yielding the following results

Open Circuit Test		
Voltage applied to LV side	V_o	= 110V
Current on LV side	I_o	= 10A
Wattmeter	P_i	= 400W
Short Circuit Test		
Voltage applied to HV side	V_T	= 90V
Current on HV side	I_T	= 20 5A (**not** full-load current)
Wattmeter reading	P_T	= 808W

From these tests, determine

6 1 The efficiency at a power factor of 0 866 lagging, at

6 1 1 Full load (6)
6 1 2 ¾ full load (2)
6 1 3 The fraction of full load at which maximum efficiency occurs, and the value of this efficiency (4)

6 2 The voltage regulation at the following power factors

6 2 1 0 866 lagging (7)
6 2 2 Unity (2)
6 2 3 0 82 leading (2)

6 3 The value of the core loss resistance and the magnetizing reactance (10)
[33]

TOTAL MARKS: 100

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