ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL ANDCOMPUTER ENGINEERING

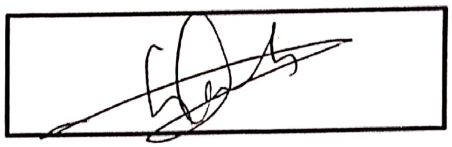
FIRST SEMESTER EXAMINATION, 2017/2018 ACADEMIC SESSION

COURSE TITLE: ELECTRICAL MACHINES 1

COURSE CODE: EEE315/MEE351

EXAMINATION DATE: 26TH MARCH, 2018

COURSE LECTURER: OSHIN OLA AUSTIN



HOD's SIGNATURE

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. ANSWER FIVE QUESTIONS ONLY
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

QUESTION 1

a. Using a suitable diagram, describe the importance of Chamfered pole in the operation of a dc machine. **[4 marks]**

b. What are interpoles? Why are they important in an electrical machine? **[4 marks]**

c. What is meant by cross magnetism in an electrical machine **[4 marks]**

d. A 4-pole generator has a wave –wound armature with 1000 conductors. It delivers 98 A on full load and the field current is 12A. The brush lead is 10^0electrical, calculate

i. The armature demagnetization AT_d/ pole. **[4 marks]**

ii. Cross magnetizing ampere turns per pole AT_C/ pole. **[4 marks]**

QUESTION 2

The following data pertain to the magnetization curve or open circuit characteristics or no load characteristics of a dc shunt generator at 1400rpm

$I_{f\ amps}$	0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.0
$E_{1\ 1400}$	5	57.5	110	170	198	213	223	230	232

For this generator, draw the no load characteristics curve and show the field resistance line.

[5 marks]

Hence, obtain

i. The voltage on open circuit to which the machine will be built up (the no load e.m.f) for a total shunt field resistance of 100 Ω **[3 marks]**

ii. The critical value of the shunt field resistance at 1400 rpm **[3 marks]**

iii. The critical speed for the shunt field resistance of 100 Ω **[3 marks]**

iv. The magnetization curve at 1100 rpm and therefore the open circuit voltage for field resistance of 100 Ω **[3 marks]**

v. The terminal voltage of the generator if the armature resistance is 0.28 Ω, armature current is 52 A, and the speed is 1400rpm. Neglect the armature reaction. **[3 marks]**

QUESTION 3

a. State the D.C motor suitable for (i) traction or electric locomotive (ii) heavy planer (iii) reciprocating pump **[4 marks]**

b. Distinguish between Power transformers and Distribution transformers **[4 marks]**

c. A 415V, three-phase, 50Hz, 4-pole, star-connected induction motor runs at 23 rev/s on full load. The rotor resistance and reactance per phase are 0.2 Ω and 3.6 Ω respectively, and the effective rotor-stator turns ratio is 0.84:1 Calculate:

i. the synchronous speed **[2 marks]** ii. the slip **[2 marks]** iii. the full load torque **[2 marks]**

iv. the power output if mechanical losses amount to 800W **[2 marks]**

vi. the maximum torque **[2 marks]**

vii. the speed at which maximum torque occurs [2 marks] vii. the starting torque **[2 marks]**

QUESTION 4

a. Explain with suitable diagram, the constructional feature of a D.C machine. **[4 marks]**

b. What do you understand by air-gap eccentricity in an electrical machine **[4 marks]**

c. Explain the meanings of excitation and commutation in a D.C generator **[4 marks]**

d. On full-load, a 300 V series motor takes 94 A and runs at 16.2 rev/sec. The armature resistance is 0.1Ω and the series winding resistance is 50 mΩ. Determine the speed when developing full load torque but with a 0.26 Ω diverter in parallel with the field winding. Assume that the flux is proportional to the field current. **[8 marks]**

QUESTION 5

a. i. Mention the three categories of faults in an induction motor and state one example of each. **[3 marks]**

ii. Using a Star-connected stator winding diagram, identify the different types of stator winding faults **[5 marks**

b. State 4 conditions necessary for the parallel operation of synchronous generators **[4 marks]**

c. A series motor having a series field resistance of 0.25 Ω and an armature resistance of 0.12 Ω is connected to a 220 V supply and a particular load runs at 18 rev/sec when drawing 20 A from the supply. Calculate the e.m.f generated at this load. Determine also the speed of the motor when the load is changed such that the current is increased to 24 A. Assume the flux increases by 25% **[8 marks]**

QUESTION 6

a. State one application of each of the following motors: Servomotors, Stepper Motor, Precision Motors, Linear Induction Motor, Universal Motor and Hysteresis Motor **[3 marks]**

b.State three methods of starting of induction motors **[3 marks]**

c Mention five reasons why a running generator will not produce output power **[5 marks]**

d. A separately-excited DC generator develops a no-load e.m.f. of 200 V at an armature speed of 22 rev/s and a flux per pole of 0.15Wb.

i. Determine the generated e.m.f. when the speed increases to 30 rev/s and the pole flux remain unchanged **[3 marks]**

ii. if the pole flux is decreased to 0.1Wb and the generated e.m.f rises to 220V, find the speed of the generator at this instance **[3 marks]**

iii. Determine the generated e.m.f. when the speed increases to 24 rev/s and the pole flux is decreased to 0.08Wb. **[3 marks]**

QUESTION 7

a. Explain using suitable diagram, the advantage of using field pole lamination with some rectangular holes punched in them in a D.C machine. **[4 marks]**

b. Explain using suitable diagram what is meant by armature reaction in a d.c machine **[4 marks]**

c. Design a single phase, single layer AC lap winding for a 4 pole AC machine comprising 24 slots **[6marks]**

d. A series motor runs at 900 rev/minute when the voltage is 415V and the current is 28 A. The series field resistance is 0.22Ω and the armature resistance is 0.45Ω. Determine the resistance of the field regulator to be connected in series with the armature winding to reduce the speed to 700 rev/min with the same current. **[6 marks]**