



ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO
STATE
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER
ENGINEERING

FIRST SEMESTER EXAMINATION, 2016/2017 ACADEMIC SESSION

COURSE TITLE: ELECTRICAL MACHINE I

COURSE CODE: EEE315/MEE351

EXAMINATION DATE: 28th March, 2017

COURSE LECTURER: DR P.K OLULOPE

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HOD's SIGNATURE

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. ANSWER QUESTION 1 AND ANY OTHER THREE QUESTIONS.
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORISED MATERIALS DURING EXAMINATION
3. YOU ARE NOT ALLOWED TO BORROW CALCULATORS AND ANY OTHER WRITING MATERIALS DURING THE EXAMINATION

Question #1

- (a) Distinguish (with two factors) between three phase machines and single phase machine
 (b) Mention two factors to be considered in the choice of generator.
 (c) Mention the D.C motor that will be suitable to drive (i) reciprocating pump, (ii) conveyors (iii) Elevator
 (d) Define armature reaction
 (e) Mention two reasons why a running generator will fail to produce output power
 (f) What do you understand by excitation in DC generator
 (g) State one advantage of series motor over shunt motor
 (h) The O.C.C of a d.c generator driven at 400rev/min is as follows:

Field current (A)	2	3	4	5	6	7	8	9
Terminal volts	110	155	186	212	230	246	260	271

Find:

- (i) Voltage to which the machine will excite when run as a shunt generator at 400rev/min with field resistance equal to 34Ω
 (ii) Resistance of shunt circuit to reduce the O.C. voltage to 220V.
 (iii) Critical value of the shunt field circuit resistance
 (iv) The critical speed when the field circuit resistance is 34Ω
 (v) The lowest possible speed at which an O.C voltage of 225V can be obtained
 (vi) Additional resistance inserted in the field circuit to reduce the no-load voltage to 20 V
 (vii) The O.C.C curve at 200 rev/min and therefrom the open circuit voltage for a field resistance of 34Ω .

(40 marks)

Question #2

- (a) Explain briefly using appropriate diagram armature reaction in a D.C machine
 (b) State the two major principal effects of the distortion of main field under load due to cross-magnetism and state two remedies for field distortion.
 (c) A 4- pole generator has a wave-wound armature with 722 conductors, and it delivers 100A on full load. If the brush lead is 16 degree electrical. Calculate the armature demagnetising and cross magnetising ampere turns per pole.

(20 marks)

Question #3

- (a) What do you understand by commutation in a D.C machine? Explain with appropriate diagram describing the process of commutation.
 (b) List the four methods of improving commutation in d.c machines
 (c) A 440V shunt motor has armature resistance of 0.8Ω and field resistance of 200 ohm. Determine the back emf when giving an output of 7.46kW at 85percent efficiency. (20 marks)

Question #4

- (a) Define energy and co energy for a linear system under the influence of magnetic field
 (b) For a linear system, prove that $W_{fld} = W'_{fld} = 1/2 F_1 \Phi_1 = 1/2 Li_1^2$
 (c) An electromagnetic relay has an exciting coil of 800 turns. The coil has a cross sectional area of 5cm x 5cm. Neglect reluctance of the magnetic field circuit and cringing.

Find the coil inductance if the air gap length is 0.5 cm (ii) find the field energy stored for a coil current of 1.25 amp.

(20 marks)

Question #5

- (a) State two operating characteristics each of series, cumulative compound and shunt motors
 (b) List the three types of losses in D.C generator
 (c) A 4- pole lap-wound, long shunt d.c compound generator has useful flux per pole of 0.007 wb. The armature winding