INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: DIPLOMA IN ELECTRICAL AND CONTROL ENGINEERING

YEAR/SEM: YEAR 1/SEMESTER 2

COURSE CODE: DEE1203

NAME: ELECTRICAL MACHINES I (DEE)

DATE: 2025-04-16

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Answer Any 2 Questions

Question 1:

a. A 4-pole motor is fed at 440V and takes an armature of 50A. The resistance of the armature circuit is 0.28 ohms. The armature winding is wave-connected with 888 conductors and useful flux per pole is 0.023wb. Calculate the speed of the motor. (10 Marks)

b. The counter e.m.f of a shunt motor is 227V, the field resistance is 160 ohms and field current is 1.5A. If the line current is 39.5A, find the armature resistance. Also find the armature current when the motor is stationary. (10 Marks)

Question 2:

a. The armature of a d.c generator has 81 slots and the commutator has 243 segments. It is wound to give lap winding having 1 turn per coil. If the flux per pole is 30mwb, calculate the generated emf at speed of 1200rpm. Number of poles = 6 .(10 Marks)
b. A 4-pole d.c shunt generator with a wave wound armature has to supply a load of 500lamps each of 100w at 250V. Allowing 10V for the voltage drop in the connecting leads between the generator and the load and drop of 1V per brush, calculate speed at which the generator should be driven. The flux per pole per pole is 30mwb and the armature and shunt field resistance are respectively 0.05 ohms and 65 ohms. The number of armature conductor is 390. (10 Marks)

Question 3:

a. 30kw, 300v d.c shunt generator has armature and field resistances of 0.05 ohms and 100 ohms respectively. Calculate the total power developed by armature when it delivers full load(10 Marks)
b. A 4-pole lap wound d.c shunt generator has a useful flux per pole of 0.07wb. The armature winding consists of 220 turns, each of 0.004 ohms resistance. Calculate the terminal voltage when running at 900 rpm. If the armature current is 50A. (10 Marks)

Question 4:

a. A 20kW, 250V dc shunt generator has armature and field resistance of 0.1 ohms and 125 ohms respectively. Calculate the total armature power developed when running (i) as a generator delivering a 20kW output (ii) as a motor taking 20kW input. (10 Marks)

a. Calculate the value of torque established by the armature of a 4-pole motor having 774 conductors, two paths in parallel, 24mwb flux per pole, when the total armature current is 50A. (10 Marks)

Section B Answer Any 2 Questions

Question 1:

a. A 2000/200V, 20kVA transformer has 66 turns in the secondary. Calculate (i) primary turns (ii) primary and secondary full-load currents. Neglect the losses. (10 Marks)

a. An ideal of 25kVA transformer has 500 turns on the primary winding and 40 turns on the secondary winding. The primary is connected to 3000V, 50Hz supply. Calculate (i) primary and secondary currents on full-load (ii) secondary e.m.f and (iii) the maximum core flux. (10 Marks)

Question 2:

a. An ideal transformer having 90 turns on the primary and 2250 turns on the secondary is connected to 200V, 50Hz supply. The load across the secondary draws a current of 2A at a p.f. of 0.8 lagging. Calculate (i) the value of primary current and (ii) the peak value of flux linked with the secondary. Draw the phasor diagram. (10 Marks)

b. An ideal transformer has 1000 turns on its primary and 500 turns on its secondary. The driving voltage on the primary side is 100V and the load resistance is 5â?¦. Calculate V_2, I_1 and I_2. (10 Marks)

Question 3:

a. An armature of a 6-pole machine 75cm in diameter has 664 conductors each having an effective length of 30cm and carrying a current of 100A. If 70% of total conductors lie simultaneously in the field of average flux density 0.85wb/m^2, calculate (i) armature torque (ii) horse power output at 250 r.p.m. (10 Marks)

b. A 230V dc shunt motor takes a current of 40A and runs at 1100 r.p.m. If the armature and shunt filed resistance are 0.25V and 230 respectively, find the torque developed by the armature. (10 Marks)

Question 4:

a. A transformer takes a current of 0.6A and absorbs 64W when primary is connected to its normal supply of 200V, 50Hz; the secondary being on open circuit. Find the magnetizing and iron loss currents. (10 Marks)

b. A 230/2300V transformer takes a no load current of 6.5A and absorbs 187 W. If the resistance of primary is 0.06 ohms, find (i) the core loss (ii) no load p.f (iii) active component of current and (iv) magnetizing current. (10 Marks)