



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR CERTIFICATE IN
ELECTRICAL AND ELECTRONICS ENGINEERING

EED 204: ELECTRICAL MACHINES 1

DATE: 6/6/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Explain different methods of speed control in dc motor. (4 marks)
- (b) Define Armature reaction. (2 marks)
- (c) State and explain properties of an ideal transformer. (4 marks)
- (d) State type of Transformer connections. (5 marks)
- (e) Derive the efficiency of a D.C generator. (4 marks)
- (f) A 220 V shunt motor has the following parameters: $R_a = 0.6 \Omega$, $R_F = 100 \Omega$ and rotational (core, mechanical and stray) losses are 50 W. On full load, the line current is 19.5 A and the motor runs at 1200 rpm, find:
 - i. The developed power. (4 marks)
 - ii. The output power. (4 marks)
 - iii. The output torque. (3 marks)

QUESTION TWO (20 MARKS)

- (a) Explain the principle of operation of a DC generator. (5 marks)
- (b) A shunt machine, connected to a 200V main has an armature resistance of $0.15\ \Omega$ and field resistance is $100\ \Omega$. Find the ratio of its speed as a generator to its speed as a motor, line current in each case being 75 A. (6 marks)
- (c) Describe with sketches the construction of a DC machine. (4 marks)
- (d) Derive the *e.m.f* equation of DC generator. (5 marks)

QUESTION THREE (20 MARKS)

- (a) Distinguish between shunt and series field coil construction. (2 marks)
- (b) Describe types of D.C. generator and their characteristics. (6 marks)
- (c) An 8-pole, wave-connected armature has 600 conductors and is driven at 625 rev/min. If the flux per pole is 20 mWb, determine the generated e.m.f. (7 marks)
- (d) A Determine the terminal voltage of a generator which develops an e.m.f. of 200 V and has an armature current of 30 A on load. Assume the armature resistance is $0.30\ \Omega$ (5 marks)

QUESTION FOUR (20 MARKS)

- (a) Explain the process of commutation in a DC machine. (3 marks)
- (b) Define armature reaction. (2 marks)
- (c) Draw and explain the load phasor diagram of a single-phase transformer. (8 marks)
- (d) Plot and briefly explain the torque-speed characteristics of dc shunt motor (7 marks)

QUESTION FIVE (20 MARKS)

- (a) State and explain types of DC Motors. (6 marks)
- (b) A 10 kW shunt generator having an armature circuit resistance of 0.75Ω and a field resistance of 125Ω generates a terminal voltage of 250 V at full load. Determine the efficiency of the generator at full load, assuming the iron, friction and windage losses amount to 600 W. (5 marks)
- (c) Derive the expression for efficiency of D.C. machines. (5 marks)
- (d) State types of losses in D.C machines. (4 marks)