



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR DIPLOMA IN
MECHANICAL ENGINEERING

MED-PR 214: ELECTRICAL MACHINES

DATE: 5/6/2017

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

SECTION A - COMPULSORY (30 MARKS)

1. (a) Define the following terms with regard to armature windings of a d.c machine
 - i) Commutator pitch
 - ii) Back pitch
 - iii) Resultant pitch (6 marks)
- b)
 - i) State two disadvantages of the flux control method used in speed control of d.c shunt motor. (2 marks)
 - ii) Explain with the aid of a diagram speed control of a d.c series motor obtained using the field diverter in the flux control method. (5 marks)
- c) Describe the following types of power losses in a transformer;
 - i) Iron losses
 - ii) Copper losses. (4 marks)

- d) Explain with a diagram the construction of the following types of transformers;
- i) core – type transformer.
 - ii) shell – type transformer (6 marks)
- e) A 25 kVA transformer has 500 turns on the primary winding and 50 turns on the secondary winding. The primary is connected to 3000 V , 50 Hz supply.
- Calculate ,
- (i) the full – load primary current.
 - (ii) the secondary emf.
 - (iii) the maximum flux in the core. (7 marks)

SECTION B. ATTEMPT ANY TWO QUESTIONS

2. a) A d.c motor takes an armature current of 110 A at 480 V. The armature circuit resistance is 0.2Ω . The machine has 6 – poles and the armature is lap – connected with 864 conductors. The flux per pole is 0.05Wb. Calculate;
- i) The speed
 - ii) The gross torque developed by the armature. (4 marks)
- b) Define the term “speed regulation “about a d.c motor. (2 marks)
- c) Explain with a diagram the Rheostatic method of electric braking for a d.c shunt motor. (7 marks)
- d) i) State three features of an ideal transformer. (3 marks)
- ii) With the aid of a phasor diagram derive the emf equation of an ideal transformer on no – load. (4 marks)
3. a) (i) A d.c series motor operates at 800 rpm with a line current of 100 A from 230 V mains . The armature circuit resistance is 0.15Ω and its field resistance is 0.1Ω . Calculate the speed at which the motor runs at a line current of 25A , assuming that the flux at this current is 45% of the flux at 100A. (4 marks)

- (ii) With the aid of a diagram and Torque – armature current characteristics curve explain the operation of a d.c shunt motor. (6 marks)
- (b) (i) With the aid of a diagram describe the open – circuit test of a transformer. (6 marks)
- (ii) State any four conditions for satisfactory parallel operation of two transformers. (4 marks)
4. (a) Explain with the aid of a diagram the construction of a d.c motor. (9 marks)
- (b) A single – phase transformer has 1000 turns on the primary and 200 turns on the secondary. The no – load current is 3A at a power factor of 0.2 lagging. When the secondary current is 280A at a power factor of 0.8 lagging, calculate;
- (i) the primary current.
- (ii) power factor. (6 marks)
- (c) (i) State any three advantages of an autotransformer. (3 marks)
- (ii) Define the term “voltage Regulation “with regard to a transformer. (2 marks)
5. (a) Describe any three methods of cooling in a transformer. (3 marks)
- (b) A 2200/200 V transformer draws a no – load primary current of 0.6A and absorbs 400W.
- Calculate; (i) the magnetizing current
- (ii) the Iron - loss current. (3 marks)
- (c) (i) Describe with a diagram the plugging method of braking a d.c shunt motor. (7 marks)
- (ii) Explain the operating characteristics of a d.c series motor.
- (d) State any three applications of a d.c series motor. (3 marks)