



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING

EED 212: ELECTRICAL INSTALLATION TECHNOLOGY IV

DATE: 10/11/2020

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer Question One and any Other Two Questions

QUESTION ONE (30 MARKS)

- a) Describe with the aid of a labeled diagram the construction of a d.c machine (9 marks)
- b) Derive from first principles the expression for the Generated emf equation of a d.c machine. (5 marks)
- c) A shunt d.c generator with a shunt field resistance of 50Ω and armature resistance 0.03Ω delivers 450a at 230v. calculate the generated emf. (5 marks)
- d) Calculate the maximum overload that can be carried by a 20KW output motor if the temperature rise is not to exceed 50°C after 1 hour on overload. The temperature rise on full load after 1 hour is 30°C and after 2 hours is 40°C . Assume losses are proportional to square load. (6 marks)
- e) State the following
 - i. Any two functions of the commutator in a d.c Generator machine. (2 marks)
 - ii. Any three advantages of an Individual electrical drive. (3 marks)

QUESTION TWO (20 MARKS)

- a) Describe the following types of motor enclosures;
 - i. Screen- protected enclosure
 - ii. Drip-proof enclosure (4 marks)

- b) State any three advantages of a three-phase induction motor. (3 marks)
- c) Define the following types of motor ratings;
- Short-time rating
 - Continuous maximum rating (4 marks)
- d) Explain the following types of Electric drives for driving mechanical loads;
- Group drive
 - Individual drive (4 marks)
- e) a 4-pole, 220v d.c shunt motor has 540 lap- wound conductors and takes 32a from the supply mains to develop an output power of 5.595kw. If the field winding takes 1a and the armature resistance is 0.09Ω with the flux per pole being 30mWb, calculate
- the speed
 - the torque developed in N – m. (5 marks)

QUESTION THREE (20 MARKS)

- a) State any three disadvantages of a group Industrial drive. (3 marks)
- b) An 8 – pole d.c shunt generator has 778 wave - connected armature conductors that runs at 500 r.p.m while supplying a load of 12.5Ω resistance at a terminal voltage of 250 V. If the armature resistance is 0.24Ω and the field resistance is 250Ω , calculate the following;
- The armature current
 - The flux per pole (4 marks)
- c) i Describe with the aid of a labeled diagram the construction and operation of a faceplate starter for a d.c shunt motor with overload and no – voltage protective device. (9 marks)
- ii Derive from first principles the expression for the speed equation of a d.c motor. (4 marks)

QUESTION FOUR (20 MARKS)

- a) Describe the following types of motor enclosures;
- Duct- ventilated type enclosure
 - Totally enclosed machine (4 marks)
- b) explain with the aid of a power and control circuit diagrams the operation of direct on line starting of a 3 – phase induction motor. (8 marks)
- c) A 150 h.p. motor has a temperature rise of 85°C when run continuously on full load. It has a time constant of 120 minutes. Assuming that the losses are proportional to the square of

the load and that the motor cools down completely between each load period, determine the 3/ 4 hr. rating of the motor for the same temperature rise. (4 marks)

d) Define the following terms;

i. Heating time constant

ii. Cooling time constant. (4 marks)

QUESTION FIVE (20 MARKS)

a) With the aid of a circuit diagram describe a single-phase capacitor – start induction motor (6 marks)

b) Explain the principle of operation of a single – loop d.c generator machine. (6 marks)

c) Describe the following methods for transmission of mechanical power developed by a motor

i. Belt drive

ii. Gear drive (4 marks)

d) Explain any two factors that may be considered when selecting a motor for a particular Industrial drive. (4 marks)