MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2021/2022 ACADEMIC YEAR

FOURTH YEAR **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING

EET 416: ELECTRICAL MACHINE DRIVES.

DURATION: 2 HOURS

Instructions to candidates:

1. Question One is compulsory
2. Attempt any other Two questions in section B
3. Mobile phones are not allowed in the examination room
4. You are not allowed to write on this examination question paper

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) Define an Electrical Drive. (3marks)
b) State 5 advantages electrical drives. (5marks)
c) Give some advanced methods of speech control of traction motors. (4marks)
d) Explain the term; Four Quadrant Operation of a DC/AC motor. (3marks)
e) State and Explain three methods of Electrical braking of DC motors using drives. (6marks)
f) Describe AC motor drives and list their main sections. (4marks)
g) Describe the relationship between voltage and frequency in an AC motor when it comes to the operation of AC motor drives. (5marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

A 230V, 960RPM and 200A separately excited DC motor has an armature resistance of 0.02Ω. The motor is fed from a chopper, which provides both motoring and braking operations. The source has a voltage of 230V. Assuming continuous conduction.

i) Calculate the duty ratio of chopper for motoring operation at the rated torque and 350RPM.
ii) Calculate the duty ratio of chopper for braking operation at the rated torque and 350 RPM.
iii) Calculate the speed of the motor for motoring operation if the duty ratio is 0.6 and the armature current 150A
iv) If the maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated, calculate the maximum permissible motor speed obtainable without field weakening and also calculate the resultant power.

QUESTION THREE (20 MARKS)

a) Sketch the circuit of a Single phase, full converter drive connected to a DC series motor. (5marks)

b) A separately excited DC motors fed from a 230V, 50Hz supply via a Single Phase, half- controlled, Bridge Rectifier. Armature parameters are: Inductance 0.06 H, resistance is $Ka = 0.9V/A$ rad/s and the field resistance is $Rf = 104\Omega$. The field current is also controlled by a Semi- converter and is set to the maximum possible value. The load Torque is T_L=50N-m at 800RPM. The inductances of the armature and field current continuous and ripple free. Compute:

i) The field current.

ii) The firing angle of the Converter in the armature circuit. (15marks)

QUESTION FOUR (20 MARKS)

a) Name 2 types of AC machines commonly used in the industry. (2marks)
b) What basic form of maintenance is needed for an AC drive. (2marks)
c) As a sales engineer, advise a customer on the benefit of choosing an Ac drills instead of a conventional motor starter e.g. Direct online or star-delta starter. (6marks)
d) Name the basic Speed control methods used for and Induction motor. (2marks)
e) Draw neatly the circuit diagram of a three phase bridge (DC-AC) Inverter and its output line to neutral wave forms. (8marks).