



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

ELECTRICAL ENGINEERING DEPARTMENT

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN TECHNOLOGY ELECTRICAL AND ELECTRONICS ENGINEERING

EPL 2204: PLANT ELECTRICAL II

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2019

TIME: 2 HOURS

DATE: Pick Date Select Month Pick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.

Do not write on the question paper.

Question ONE

- a)
- i. Explain the FOUR main types of enclosures for electrical machines
 - ii. State where each enclosure type is applied
 - iii. List the main activities in service and maintenance of electrical machines
- (12 Marks)**
- b) During testing of a 3 phase machine the machine no load consumption was 150W per phase at 0.8 pf, while full load consumption was 350W per phase at 0.6 pf. Estimate:
- i. The current intake during No Load and Full load test
 - ii. The efficiency of machine while supplying a 500W load
- (8 Marks)**

Question TWO

- a)
- i. Show using sketches the difference between wound and squirrel cage rotors of an induction machine
 - ii. State THREE advantages of squirrel cage rotor
 - iii. Explain why a squirrel cage rotor has skewed conductor bars

(9 Marks)

- a) A 60Hz single phase induction machine operating with a slip. It is required to run at 1700 rpm. Estimate

- i. The synchronous speed
- ii. The slip
- iii. The number of poles
- iv. The actual speed if machine is connected to a 50Hz grid

(11 Marks)

Question THREE

- a)
- i. State any FOUR advantages of DC motor drive system over AC induction motor counterparts
 - ii. Explain with sketches the 4-quadrant operation of a sloping conveyer system, for a loading operation:

(12 Marks)

- b) A $110V_{DC}$, 10A, 200rpm rated machine has armature resistance of 1Ω . Sketch the equivalent circuit and calculate the terminal voltage required to achieve the following:

- i. Reverse braking at 100rpm
- ii. Forward motoring at 100rpm

(8 Marks)

Question FOUR

- a)
- i. Sketch labelled circuits of capacitor start and permanent split phase motor and explain the principle
 - ii. Sketch and label a Star-Delta circuit for starting a 3-phase induction machines and explain how it works.

(12 Marks)

- b) A 50Hz, 15kW, 50 single phase synchronous machine has 8 poles. Assuming 90% efficiency and 5% slip, find

- i. the speed of the rotor in revolutions per minute
- ii. the corresponding torque output
- iii. The number of revolutions the machine makes in 1 hour.

(8 Marks)

Question FIVE

a)

- i. Explain with aid of waveforms the revolving magnetic field phenomena in a 3 phase machine
- ii. Describe the possible causes of humming, abnormal vibrations and overheating in a 3- phase induction machine
- iii. Sketch the electronic circuit for a variable voltage drive

(9 Marks)

b) Sketch the per phase equivalent circuit of 1 phase induction machine assuming no stator losses.

- i. Derive the relationship between torque and frequency
- ii. Given for the sketch above $V_{ll} = 415V$; $f = 50Hz$; $P = 8$; slip = 5%; $R_s = 3.5\Omega$; $X_s = 6\Omega$; $R_r' = 0.125$, $X_r' = 2\Omega$ calculate the torque output.
- iii. Assuming it is a NEMA class A machine show using curves the performance of the drive for different frequencies.

(11 Marks)