



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMATIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN TECHNOLOGY IN MECHANICAL ENGINEERING (PLANT OPTION)

EPL 2305: PLANT ELECTRICAL IV

END OF SEMESTER EXAMINATION

SERIES: NOVEMBER 2024

TIME: 2 HOURS

DATE:

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt **ANY THREE Questions**

Do not write on the question paper.

QUESTION ONE

- a) With the aid of a well-labelled circuit and control diagram(s), describe auto-transformer starting method for a 3- Φ induction motor. (8Marks)
- b) Sketch a neat circuit arrangement that be used to carry out the load test the load test on a 3- Φ induction motor. (4Marks)
- c) An electrical plant desires to install a 3- Φ cage induction motor restricting the maximum line current drawn from a 400 V, 3- Φ supply to 120 A. if the starting current is 6 times full load current, what is the maximum permissible full load kVA of the motor when:
 - i) It is directly connected to the mains
 - ii) It is connected through an auto-transformer with a tapping of 60%
 - iii) It is designed for use with star-delta starter. (8Marks)

QUESTION TWO

- a) Define the following terms as applied to mechanical drive systems:

- i) V-belt
 - ii) Drive train. (2Marks)
- b) Explain the role of the following in mechanical drives systems:
- i) Hydrostatic system
 - ii) Sensor mechanism
 - iii) Electromechanically actuators
 - iv) Magnetic gearboxes
 - v) Continuously variable transmissions (CVTs) (10Marks)
- c) Figure Q 3 (c) shows compound train consisting of a series of pulleys system

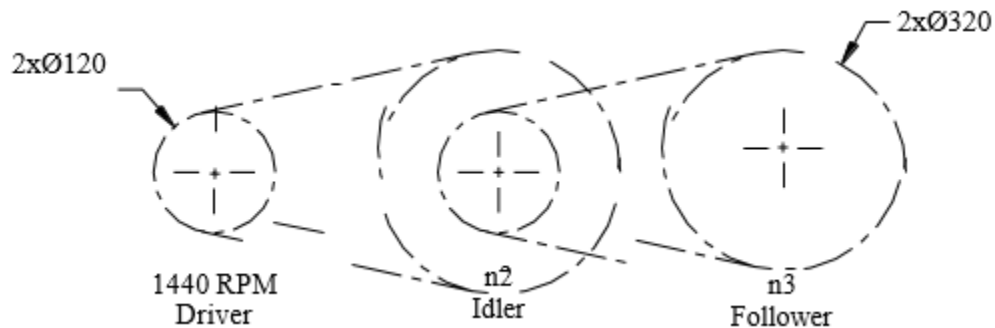


Figure Q 3 (c)

Calculate:

- i) Immediate and final drive speed
- ii) Final reduction ratio. (8Marks)

QUESTION THREE

- a) Define terms as applied to electric motor installation:
- i) Bearing
 - ii) Alignment
 - iii) Balancing (2Marks)
- b) State any FOUR:
- i) Reasons for ensuring precision in motor alignment.
 - ii) Features of an electric motor to be installed on a flat foundation. (8Marks)
- c) Briefly describe the foundation buildings for the following electric motors:
- i) Foot mounted motor
 - ii) Flange mounted motor
 - iii) Pad mounted motors. (9Marks)

QUESTION FOUR

- a) With aid of a block diagram, describe motor speed control by Ward Leonard method (8Marks)
- b) State any TWO:
- i) Advantages of electric drives over their mechanical counterparts
 - ii) Industrial application areas of Ward Leonard drive system (4Marks)
- c) The speed of a 10 HP, 210 V, 1000 rpm, separately excited D.C. motor is controlled by a 1- Φ full-converter. The rated motor armature current is 30 A, and the armature resistance, $R_a = 0.25 \Omega$. The A.C. supply voltage is 230 V. The motor voltage constant is $K_a\Phi = 0.172 \text{ V/rpm}$. Assuming that sufficient inductance is present in the armature circuit to make the motor current continuous and ripple free. For a firing angle $\alpha = 45^\circ$, and rated motor armature current, determine:
- i) The motor torque.
 - ii) The motor speed. (8Marks)

QUESTION FIVE

- a) State any FOUR ways of maintaining motor bearing. (4Marks)
- b) Briefly explain the following types of motor enclosures:
- i) Open-protected enclosure
 - ii) Screen-protected enclosure
 - iii) Pipe-ventilated enclosure
 - iv) Weather-proof enclosure (8Marks)
- c) State any THREE:
- i) Suitable industrial installation areas for totally enclosed motor.
 - ii) Functions of motor enclosures. (6Marks)