



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND
TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

ELECTRICAL POWER ENGINEERING

**MODULE: Industrial Plant Planning Maintenance
And Equipment Repair**

PAPER NO: 517/23/M07

DURATION: 3 Hours

NOVEMBER/ DECEMBER 2025 EXAMINATION

REQUIREMENTS

1. Answer booklet
2. Non-programmable calculator.

INSTRUCTIONS TO CANDIDATES

1. Answer any five (5) questions.
2. Start each question on a new page.
3. All questions carry equal marks.

This paper consists of 3 printed pages.

QUESTION 1

- a) Describe factors to consider when choosing a hydroelectric power plant. (10 marks)
- b) Compare and contrast a thermal power plant and a geothermal power plant. (10 marks)

QUESTION 2

A 220 V DC shunt motor takes 4A at no load when running at 700rpm. The field resistance of armature at standstill gives a drop of 6V across armature terminals when 10A were passed through it. Calculate:

- a) Speed on load (10 marks)
- b) Torque in N-m (3 marks)
- c) Efficiency. The normal input of the motor is 8kw (7 marks)

QUESTION 3

- a) Explain the reason why an induction motor cannot operate at synchronous speed. (8 marks)
- b) With aid of a diagram, describe the double cage rotor method of starting induction motors. (12 marks)

QUESTION 4

Describe and explain the phasor diagrams and different excitations of a synchronous motor, under and the following headings.

- a) Over excitation (7 marks)
- b) Under excitation (7 marks)
- c) Normal excitation (6 marks)

QUESTION 5

Describe four (4) methods of measuring efficiency in DC machines. (20 marks)

QUESTION 6

Compare and contrast induction motors and synchronous motors with regard to:

- | | |
|---------------------|-----------|
| a) Uses | (4 marks) |
| b) Advantages | (6 marks) |
| c) Disadvantages | (6 marks) |
| d) Starting methods | (4 marks) |

QUESTION 7

A 75KW 3 ϕ , Y connected, 50Hz, 440V cylindrical rotor synchronous motor operates at rated condition with 0.8pf leading. The motor efficiency excluding field and stator losses is 95% and $X_s=2,5\Omega$. Calculate:

- | | |
|--|-----------|
| a) Mechanical power developed | (3 marks) |
| b) Armature current | (3 marks) |
| c) Back emf | (3 marks) |
| d) Power angle | (5 marks) |
| e) Maximum or pull-out torque of the motor | (6 marks) |

QUESTION 8

With the aid of a diagram, describe the operation of a chopper fed drive. (20 marks)

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