



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

**THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DIPLOMA IN
ELECTRICAL AND ELECTRONIC ENGINEERING**

SEE 1323 – POWER SYSTEMS PROTECTION

DURATION: 2 HOURS

DATE: 19TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

- a) Outline three requirements of a protective system (3 marks)
- b) With the aid of a labeled diagram, explain the operation of a graded time protection in a radial system. (6 marks)
- c) Explain the following terms as applied to power system protection
- i. Selectivity
 - ii. Sensitivity
 - iii. Reliability (6 marks)
- d) Explain the following types of protective relays
- i. Inverse time relay
 - ii. Definite time relay (4 marks)
- e) State three methods of achieving delay in inverse time relays (3 marks)
- f) With the aid of labeled diagrams, describe the principle of operation of the following types of electromagnetic attraction relays
- i. Attracted armature structure
 - ii. Solenoid type structure (8 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

- a) Explain any two methods for correcting malfunction of a differential relay. (4 marks)
- b) With the aid of a labeled diagram, describe the operation of a directional overcurrent relay (10 marks)
- c) A 15MVA, 11KV, 50Hz star-connected alternator has a per phase synchronous reactance of 2.5Ω and a resistance of 0.755Ω . the neutral is earthed through a 5Ω resistor. If a translay relay system is used to protect the alternator and operates when the out of balance current exceeds 26% of the load current, determine the portion of the winding that is unprotected. (6 marks)

QUESTION THREE

- a) Explain three basic functions of circuit breakers when used in conjunction with relays in protective systems. (3 marks)
- b) State three advantages of sulphur hexafluoride over airblast circuit breakers. (3 marks)
- c) Briefly describe the principles of arc extinction in circuit breakers. (6 marks)
- d) With the aid of a diagram, explain the principle of magnetic tripping mechanism of circuit breakers. (8 marks)

QUESTION FOUR

- a) Explain the term protective relay as applied to power system protective schemes. (3 marks)
- b) With the aid of a diagram, describe the operation of the following relays:
 - i. Biased beam relay (5 marks)
 - ii. Translay scheme protection of alternators (6 marks)
- c) Describe with the aid of a labeled diagram the working principle of parallel feeders protection scheme. (6 marks)