

610503/610603

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B. Tech. VI - Sem. (Main) Exam., (Academic Session 2021- 2022)

Electrical & Electronics Engineering

6EX4 – 03/6EE4-03 Power System Protection

Time: 2½ Hours

Maximum Marks: 120

Min. Passing Marks:

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 6×3 marks = 18 marks.
Candidates have to answer six questions out of ten.

Part – B: Analytical/Problem solving questions 3×10 marks = 30 marks.
Candidates have to answer three questions out of seven.

Part – C: Descriptive/Analytical/Problem Solving questions 3×24 marks = 72 marks.
Candidates have to answer three questions out of five.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

- ✓ Q.1 What do you mean by discrimination of relay? ✓
- ✓ Q.2 What are the functional characteristics required by a relay with respect to protection?
- ✓ Q.3 What do you understand by zone of protection?
- ✓ Q.4 What are the different types of circuit breakers used for protection of power systems?
- ✗ Q.5 What do you understand by Plug Setting Multiplier (PSM) of a relay?
- ✗ Q.6 What is over fluxing in transformer?

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- Q.7 What do you understand by earth fault protection?
- Q.8 What is the frame leakage protection of bus-bar?
- Q.9 Draw the magnetization characteristics of protective and measurement CTs.
- Q.10 What do you understand by phase angle error of P.T.?

PART - B

- Q.1 With neat sketches, explain the recovery rate theory of arc-interruption in a circuit breaker.
- Q.2 What is simple differential protection scheme? Explain its behavior during normal condition.
- Q.3 Describe, why a power system needs to be protected? Also explain the essential qualities that any effective power system protective scheme should possess?
- Q.4 An IDMT over current relay has a current setting of 150% and a time multiplier setting of 0.6. The primary of relay is connected to a secondary of C.T. having ratio 400/5. Calculate the time of operation if the circuit carries a fault current of 5000 A. The operating time at various P.S.M. is given as -

P.S.M.	2	4	5	8	9	10
Operating time (sec.)	10	8	5	3	2	1.8

- Q.5 The neutral point of a three phase 20 MVA, 11 kV alternator is earthed through a resistance of 5 ohms, the relay is set to operate, when there is an out-of-balance current of 1.5 A? The CTs have a ratio of 1000/5. What is the percentage of winding protected? Also calculate the earthing resistance required to protect 90% of the winding.
- Q.6 Describe the construction principle of operation of a directional over current relay and how the 30°, 60°, 90° connections of directional over current relay are obtained?
- Q.7 Explain the construction and working of Buchholz. Which types of faults are taken care by Buchholz relay?

PART - C

Q.1 What is magnetizing inrush current? What measures are taken to distinguish between the fault and magnetizing inrush current? Discuss the protective scheme which protects the transformer against faults but does not operate in case of magnetizing inrush current.

Q.2 What is universal torque equation? Using this equation derive and draw following characteristics -

- (i) Impedance relay
- (ii) Reactance relay
- (iii) Mho relay

Also discuss the application of the impedance relay, reactance relay and mho relay.

Q.3 (a) What are the different characteristics of a relay? Explain in detail.

(b) A potential transformer ratio 100/10 volt has the following constants -

Primary resistance = 94.5 Ohm

Secondary resistance = 0.86 Ohm

Primary reactance = 66 Ohm

Total equivalent reactance = 100 Ohm

No load current = 0.02 A at 0.4 power factor

Calculate -

- (i) Phase angle error at no load
- (ii) Burden in VA at unity p.f. at which the phase angle will be zero

Q.4 A 3-phase 200 KVA, 10000/500 V transformer is connected in delta-star. The CT's on low voltage side have turn-ratio of 500/5 . Determine the C.T. ratio on high voltage side. Also obtain the insulating current when the fault of 700 A of following types occur on the low voltage side - <https://www.btubikaner.com>

- (i) Earth fault within the protective zone
- (ii) Earth fault outside the protective zone

Assume balanced voltage.

Q.5 Describe the negative sequence protection schemes for generator. Also explain the stator inter-turn fault protection for multi-turn generator with suitable circuit diagram.