

Enrollment No.....



Faculty of Engineering
End Sem (Even) Examination May-2022
EE3CO24 / EX3CO24 Power System Protection

Programme: B.Tech.

Branch/Specialisation: EE/EX

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

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| Q.1 | i. | The zero-sequence fault current is absent when the fault is- | 1 |
| | | (a) Single line to ground (b) Line to line | |
| | | (c) Double line to ground (d) None of these | |
| | ii. | Series reactor should have- | 1 |
| | | (a) Low impedance (b) High impedance | |
| | | (c) Low resistance (d) None of these | |
| | iii. | Which of the following is an instantaneous relay? | 1 |
| | | (a) Induction type (b) Shaded pole type | |
| | | (c) Thermocouple type (d) Permanent magnet moving coil type | |
| | iv. | Which of the following is a directional relay? | 1 |
| | | (a) Impedance relay (b) Mho relay | |
| | | (c) Reactance relay (d) Both (b) and (c) | |
| | v. | The voltage appearing across the contacts after the opening of the circuit breaker is called____. | 1 |
| | | (a) Arc voltage (b) Recovery voltage | |
| | | (c) Surge voltage (d) Break open voltage | |
| | vi. | Air blast circuit breaker is normally operated at a pressure of- | 1 |
| | | (a) 5 to 10 kg/cm ² (b) 10 to 15 kg/cm ² | |
| | | (c) 15 to 20 kg/cm ² (d) 20 to 30 kg/cm ² | |
| | vii. | Percentage differential protection is used to prevent against- | 1 |
| | | (a) Inter-turn faults (b) Heavy Loads | |
| | | (c) Magnetizing current (d) None of these | |
| | viii. | Pilot wire protection is for- | 1 |
| | | (a) Overhead lines (b) Transformer | |
| | | (c) Motors (d) Cables | |

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| ix. | Lightning arresters are- | 1 |
| | (a) Surge reflectors (b) Surge diverters | |
| | (c) Surge absorbers (d) Surge attenuators | |
| x. | Lightening arrestor should be located at- | 1 |
| | (a) Away from the circuit breaker (b) Near the transformer | |
| | (c) Away from the transformer (d) Near the circuit breaker | |
- Q.2 i. Explain the per unit system representation with example. Write its two advantages. 4
- ii. Explain the symmetrical component of power system in short. Also explain L-L fault with fault impedance Z_f . 6
- OR iii. A three phase 5 MVA, 6.6 kV alternator with a reactance of 8% is connected to feeder of series impedance $(0.12 + j0.48)$ ohm/phase/km. The transformer is rated at 3 MVA, 6.6 kV/33kV and has a reactance of 5%. Determine the fault current supplied by the generator operated under no load voltage of 6.9kV, when 3-phase symmetrical fault occurs at a point 15 km along the feeder. 6
- Q.3 i. Explain the principle of distance relay with suitable diagram. Also draw its operational characteristics. 4
- ii. Explain working of induction type directional overcurrent relay with suitable diagram. Also support the answer with suitable mathematical relationships. 6
- OR iii. Explain static relays with suitable block diagram. Also classify the static relays. 6
- Q.4 i. Explain the following terms: 4
- (a) Restriking voltage (b) Recovery voltage
- (c) Rate of rise of restriking voltage (d) Arc quenching.
- ii. Explain the principle of arc extinction in air-blast circuit breaker. Write different methods of arc quenching. 6
- OR iii. Describe the construction, principle of operation and application of SF6 circuit breaker. Also write its two advantages and two disadvantages. 6

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- Q.5 i. What do you mean by definite distance and time distance protection in transmission line with suitable diagram? 4
- ii. A 3-phase transformer having line-voltage ratio of 400V/11kV is connected in star-delta and protective transformers on the 400 V side have a current ratio of 500/5. What must be the ratio of the protective transformers on the 11 kV side. 6
- OR iii. Enlist and explain the external and internal fault occurs in an alternator. Also explain the differential biased circulating current protection scheme with suitable diagram. 6
- Q.6 Attempt any two:
- i. Explain the phenomena of lightning and protection against lightning 5
- ii. Explain the following: 5
- (a) Expulsion type lightning arrester
- (b) Valve type lightning arresters.
- iii. Explain Insulation Co-ordination principle with suitable example. 5

Marking Scheme
EE3CO24 / EX3CO24 Power System Protection

Q.1	i.	The zero-sequence fault current is absent when the fault is-		1	
		(b) Line to line			
	ii.	Series reactor should have-		1	
		(c) Low resistance			
	iii.	Which of the following is an instantaneous relay?		1	
		(d) Permanent magnet moving coil type			
	iv.	Which of the following is a directional relay?		1	
		(d) Both (b) and (c)			
	v.	The voltage appearing across the contacts after the opening of the circuit breaker is called____.		1	
		(b) Recovery voltage			
	vi.	Air blast circuit breaker is normally operated at a pressure of-		1	
		(d) 20 to 30 kg/cm ²			
	vii.	Percentage differential protection is used to prevent against-		1	
		(c) Magnetizing current			
	viii.	Pilot wire protection is for-		1	
		(a) Overhead lines			
	ix.	Lightning arresters are-		1	
		(b) Surge diverters			
	x.	Lightening arrestor should be located at-		1	
		(b) Near the transformer			
Q.2	i.	Per unit system representation with example	2 marks	4	
		Its two advantages	2 marks		
	ii.	Symmetrical component of power system	3 marks	6	
OR		L-L fault with fault impedance Z_f	3 marks		
	iii.	Determine the fault current supplied by the generator operated under no load voltage of 6.9kV, when 3-phase symmetrical fault occurs at a point 15 km along the feeder.		6	
		As per the solution			
Q.3	i.	Principle of distance relay	2 marks	4	
		Circuit diagram	1 mark		
		Operational characteristics	1 mark		
	ii.	Working of directional overcurrent relay	3 marks	6	
		Diagram	1 mark		
		Mathematical relationships	2 marks		
OR	iii.	Static relays with block diagram	4 marks	6	
		Classification of static relays	2 marks		
Q.4	i.	(a) Restriking voltage (b) Recovery voltage		4	
		(c) Rate of rise of restriking voltage (d) Arc quenching.			
		1 mark for each (1 mark * 4)			
	ii.	Principle of arc extinction in air-blast circuit breaker		6	
			3 marks		
		Different methods of arc quenching	3 marks		
OR	iii.	Principle of operation	3 marks	6	
		Application of SF6 circuit breaker	1 mark		
		Two advantages and two disadvantages	2 marks		
Q.5	i.	Definite distance with diagram	2 marks	4	
		Time distance protection with diagram	2 marks		
	ii.	Ratio of the protective transformers on the 11 kV side		6	
OR		As per the solution			
	iii.	External and internal fault occurs in an alternator	3 marks	6	
		Differential biased circulating current protection scheme with diagram	3 marks		
Q.6		Attempt any two:			
	i.	Phenomena of lightning	3 marks	5	
		Protection against lightning	2 marks		
	ii.	Explain the following:		5	
		(a) Expulsion type lightning arrester	2.5 marks		
		(b) Valve type lightning arresters.	2.5 marks		
	iii.	Insulation Co-ordination principle	3 marks	5	
		With example	2 marks		
