

**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT**

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code 

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Seventh Semester B.E. Degree Examinations, February 2025

**HIGH VOLTAGE AND POWER SYSTEM PROTECTION**

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
<b><u>Module-1</u></b>			
1.	a. Derive the expression for the current in the air gap that is $i=i_0e^{\alpha d}$ considering Townsend first ionization coefficient. What are the limitations of Townsend's Theory?	10	(2 : 1 : 1.4.1)
	b. Explain the following breakdown methods in the liquid insulators (i) Suspended particle theory      (ii) Bubble Theory (OR)	10	(2 : 1 : 1.4.1)
2.	a. Explain about the breakdown in non-uniform fields and Corona discharge.	10	(2 : 1 : 1.4.1)
	b. Explain the following breakdown methods in the solid insulators (i) Intrinsic Breakdown      (ii) Thermal Breakdown (OR)	10	(2 : 1 : 1.4.1)
<b><u>Module-2</u></b>			
3.	a. With a neat circuit diagram and waveform explain the cascaded voltage multiplier circuit.	10	(2 : 2 : 1.4.1)
	b. With a neat circuit diagram explain the high ohmic series resistance and resistance potential divider methods for DC voltage measurement. (OR)	10	(2 : 2 : 1.4.1)
4.	a. With a neat circuit diagram explain the electrostatic generator.	10	(2 : 2 : 1.4.1)
	b. With a neat circuit diagram explain the Chubb-Frotschue method for peak voltage measurement.	10	(2 : 2 : 1.4.1)
<b><u>Module-3</u></b>			
5.	a. Discuss briefly the various types of faults and consequences of faults on a power system.	08	(2:3:1.4.1)
	b. Draw a neat sketch of an induction disc relay and explain its operating principle.	08	(2:3:1.4.1)
	c. Explain various methods of back-up protection.	04	(2:3:1.4.1)
<b>(OR)</b>			
6.	a. Explain various types of over current relays with its characteristic curve.	08	(2:3:1.4.1)
	b. Describe the operating principle, constructional features of reverse power directional relay.	08	(2:3:1.4.1)
	c. With a neat diagram, explain the protection scheme for parallel feeders.	04	(2:3:1.4.1)

#### **Module-4**

7. a. Define the term "pilot" with reference to power line protection. List the different types of wire pilot protection schemes and explain any one of the scheme. 10 (2:4:1.4.1)
- b. Explain with neat diagram the working of Buchholz relay. 10 (2:4:1.4.1)

**(OR)**

8. a. Describe the behaviour of simple differential protection scheme during normal, internal fault condition. 10 (2:4:1.4.1)
- b. With a neat sketch, explain the principle operation of 'MHO' relay. 10 (2:4:1.4.1)

#### **Module-5**

9. a. For a 132 kV system, the reactance and capacitance up to the location of circuit breaker is 3 ohms and 0.015  $\mu$ F. Respectively. Calculate the following : 08 (3:5:2.1.2)
- (i) The frequency of transient oscillations.
- (ii) The maximum value of restriking voltage across the contacts of the circuit breaker and
- (iii) The maximum value of RRRV.
- b. Explain working of SF6 circuit breaker with the help of diagram. List any two advantages. 08 (2:5:1.4.1)
- c. Explain recovery rate theory to explain the zero current interruption of the arc. 04 (2:5:1.4.1)

**(OR)**

10. a. Describe the phenomenon of lightning and explain the terms pilot streamer, stepped leader, return streamer, dart leader. 08 (2:5:1.4.1)
- b. With a neat sketch explain the construction and working of klydanograph. 08 (2:5:1.4.1)
- c. Explain the term insulation coordination. 04 (2:5:1.4.1)

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