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VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (EEE: CBCS) VI-Semester Main & Backlog Examinations, May-2019

Switchgear and Protection

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Q. No.	Stem of the question	M	L	CO	PO
Part-A (10 × 2 = 20 Marks)					
1.	Write universal torque equation?	2	1	1	1,2,3,4,5
2.	Extremely inverse relay is able to distinguish between a fault current and inrush current. Justify the statement.	2	5	1	1,2,3,4,5
3.	Draw the operating characteristics of a reactance relay.	2	1	2	1,2,3,4,5
4.	Distinguish between microprocessor based relays and numerical relays.	2	2	2	1,2,3,4,5
5.	What are the difficulties experienced in differential protection of a Generator? How they are over come?	2	1	3	1,2,3,4,10
6.	During fault conditions third harmonic currents are absent in the operating coil of relay used for differential protection. Justify the statement.	2	4	3	1,2,3,4,10
7.	List out the disadvantages of air blast circuit breaker.	2	2	4	1,2,3,4,10
8.	A 50 Hz, 3 – phase alternator with grounded neutral has inductance of 1.5 mH/ phase and is connected to a bus bar through a circuit breaker. The capacitance to earth between alternator and circuit breaker is 0.0025 μF/ phase. The circuit breaker opens when r.m.s. value of current is 7000 A. Determine maximum rate of re-striking voltage.	2	3	4	1,2,3,4,10
9.	List the causes for over voltages in power system.	2	1	5	1,2,3,4,10
10.	What is counter poise and explain its role in overvoltage protection?	2	1	5	1,2,3,4,10
Part-B (5 × 10 = 50 Marks)					
11. a)	Classify the various types of overcurrent relays and give their applications along with their characteristics.	5	2	1	1,2,3,4,5
b)	Explain the concept of primary and back up protection and explain any one method of achieving primary and backup.	5	2	1	1,2,3,4,5
12. a)	Analyze the three step distance protection of transmission lines using Mho relays.	5	4	2	1,2,3,4,5
b)	Examine the duality between amplitude and phase comparators with the help of a phasor diagram.	5	4	2	1,2,3,4,5
13. a)	Why Alternator winding is not completely protected? Explain.	4	1	3	1,2,3,4,10
b)	A 3-Φ, 20 MVA, 11 kV, star connected generator is protected by the current balancing system of protection. If the CT ratio is 1200/5, minimum operating current of the relay is 0.75 A and the neutral point earthing resistance is 6 Ω, calculate the percentage of each phase of the stator winding which is unprotected against earth faults when the machine is operating at normal voltage. Show quantitatively, the effect of varying the neutral earthing resistance.	6	5	3	1,2,3,4,10

14. a)	Describe with a neat sketch the principle of operation of a minimum oil circuit breaker? Why it is so called?	6	2	4	1,2,3,4,10
b)	In a system of 132 kV, the circuit phase to ground capacitance is $0.02\mu\text{f}$, inductance is 5H. Calculate the voltage appearing across the pole of a circuit breaker if a magnetizing current of 800A is interrupted instantaneously. Also calculate the value of pre insertion resistance to be used across the contact space.	4	3	4	1,2,3,4,10
15. a)	Describe the construction and working of metal oxide surge arrester. Enumerate its advantages.	5	2	5	1,2,3,4,10
b)	Identify the need for insulation coordination in power system. With the help of an illustration, explain the basic principles of achieving insulation coordination.	5	4	5	1,2,3,4,10
16. a)	Compare time grading, current grading and time- current grading protection of power system. Enumerate their advantages and disadvantages.	5	4	1	1,2,3,4,5
b)	Illustrate the implementation of microprocessor based distance relaying with block diagram.	5	2	2	1,2,3,4,5
17.	Answer any two of the following:				
a)	Explain the operation of Buchholtz relay with a neat diagram	5	2	3	1,2,3,4,10
b)	Determine the rate of rise of re-striking voltage for the circuit-breaker installed on a 400 kV, 3 ϕ , 50 Hz system. Following data were recorded, when a short circuit grounded fault occurs. Given recovery voltage is 97% of full line voltage. Power factor at the fault is 0.45. Natural frequency for symmetrical breaking current 16 kHz.	5	3	4	1,2,3,4,10
c)	What is Peterson coil grounding and derive the expression for the value of inductance to limit the value of fault current.	5	1	5	1,2,3,4,10

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	56.85
2	Knowledge on application and analysis (Level-3 & 4)	34.73
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	8.42

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