Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2170908 **Date: 02/05/2017**

Subject Name: Switch Gear and Protection

Time: 02.30 PM to 05.00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **Short Questions** **14**

1 Power system protection is provided so that:
(a) faults are prevented (b) damage subsequent to faults is mitigated
(c) information is relayed (d) economic operation of power system is achieved

2 At 50 Hz, the time period of one cycle is:
(a) 2 ms (b) 20 ms (c) 200 ms (d) 0.2 ms

3 Probability of faults on which element of the power system is highest:
(a) generator (b) transformer (c) transmission line (d) motor

4 If wattmeter is considered as a directional relay, then its MTA will be:
(a) 90^0 (b) zero (c) 30^0 (d) 60^0

5 Plug setting = 1.5 A, I_{relay} = 9 A, for an OC relay. The PSM will be:
(a) 13.5 (b) 0.16 (c) 1.35 (d) 6

6 For a CT feeding an OC relay:
(a) ratio error is important (b) phase angle error is important
(c) both are important (d) neither ratio nor phase angle error is important

7 System impedance ratio is defined as:
(a) Zs / Z_L (b) Z_L / Zs (c) Z_{surge} / Z_L (d) Z_L / Z_{surge}

8 The most dominant harmonic in the inrush wave form is:
(a) third harmonic (b) second harmonic
(c) fifth harmonic (d) seventh harmonic

9 Which protection would you recommended as a primary protection for a 250 MVA power transformer:
(a) over current protection (b) simple differential protection
(c) % biased differential protection with harmonic restraint (d) distance protection

10 The reach of first step of 3-stepped distance protection is set at:
(a) 100 % of the line section (b) 80-85 %
(c) 150 % (d) 60 %

11 The power line carrier frequency is of the order of:
(a) 50 Hz (b) 3 GHz – 6 GHz
(c) 20 Hz – 50 Hz (d) 50 KHz – 200 KHz

12 If the stator of an alternator gets unbalanced supply, which of the following will happen:
(a) it will pull out of synchronism (b) only stator will get overheated
(c) only rotor will get overheated (d) both will get overheated

13 SF_6 gas is:
(a) 6 times heavier than air (b) 5 times heavier than air
(c) 3times heavier than air (d) weights the same as air

14 Possibility of current chopping is more in which types of CB:
(a) bulk oil (b) MOCB
(c) air blast and vacuum (d) SF_6

Q.2	**(a)**	Define reach, under reach, and over reach of the relay.	**03**
	(b)	Explain primary and back-up protection.	**04**
	(c)	Draw and explain basic trip circuit.	**07**
		OR	
	(c)	Explain induction disc relay. Also derive torque equation for it.	**07**
Q.3	**(a)**	Explain zone of protection of the differential relay.	**03**
	(b)	Write and explain drawback of over current relay.	**04**
	(c)	Write short note on Buchholz relay.	**07**
		OR	
Q.3	**(a)**	Compare Reactance relay with Mho relay.	**03**
	(b)	Explain 3-stepped distance protection.	**04**
	(c)	A 3 phase transformer having a line voltage ratio of 400 V/33,000 V is connected in star-delta. The CTs on the 400 V side have a current ratio of 1000/5. What must be the ratio of CTs on the 33,000 V side?	**07**
Q.4	**(a)**	Explain the line trap units for carrier-aided protection of transmission line.	**03**
	(b)	State various faults and abnormal operating conditions of a turbo alternator.	**04**
	(c)	Explain phase comparison relaying (unit scheme).	**07**
		OR	
Q.4	**(a)**	Describe protection against loss of excitation in generator.	**03**
	(b)	Explain following with respect to induction motor protection: (a) Single phasing (b) ground fault	**04**
	(c)	The neutral of a 3-phase, 20 MVA, 11 KV alternator is earthed through a resistance of 5 ohm. The relay is set to operate when there is an out of balance current of 1.5 A. The CT's have a ratio of 1000/5. What % of the winding is protected against an earth fault? What should be the minimum value of the earthing resistance to protect 90 % of the winding?	**07**
Q.5	**(a)**	Draw the block diagram of numerical relay.	**03**
	(b)	Explain Following with reference to Circuit Breaker: (a) Breaking Current (b) Making Current	**04**
	(c)	Calculate the RRRV of a 220 KV Circuit Breaker with earthed neutral. The short-circuit test data is as follows: The Current broken is symmetrical & restriking voltage has an oscillatory frequency of 15 kHz. The power factor of the fault is 0.2. Assume short-circuit to be an earthed fault.	**07**
		OR	
Q.5	**(a)**	Compare protective CT with measuring CT.	**03**
	(b)	Write short note on air break circuit breaker.	**04**
	(c)	Explain puffer-type SF_6 circuit breaker.	**07**

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