

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– VII (New) EXAMINATION – WINTER 2019

Subject Code: 2170908

Date: 26/11/2019

Subject Name: Switch Gear and Protection

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

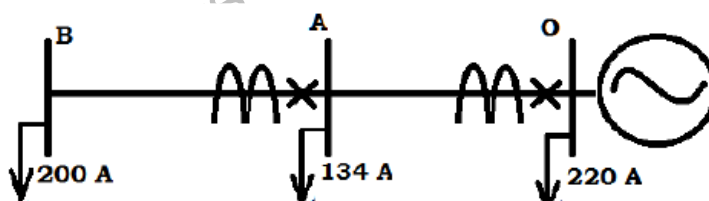
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

- Q.1**
- (a) With neat diagram explain the working of shaded pole type electromagnetic induction disc relay. **03**
 - (b) Classify the types of relays with respect to different category. **04**
 - (c) Explain the following protection scheme as applied to synchronous generator: **07**
 - (a) Loss of excitation protection
 - (b) Stator inter-turn fault protection
- Q.2**
- (a) Discuss the difficulties in implementing HVDC circuit breaker. **03**
 - (b) Explain the behavior of Merz–Price protection during normal load, external fault and internal fault condition. **04**
 - (c) Compare the performance of distance relay in respect of its sensitivity to following: **07**
 - (a) Effect of arc resistance,
 - (b) Effect of power swing
 - (c) Directional property

OR

- (c) Select CT ratios and determine the TMS, and Plug setting of the IDMT relays at location O and A, for the over-current protection of radial feeder shown in Fig.1. The characteristic of IDMT relay is given in the Table-2. Minimum fault currents at each point are given Table-1. Maximum load current from each bus are indicated in the Fig. ____.



	Location O	Location A	Location B
If,Min	3000 A	2000 A	1000 A

Table-1

PSM	2	3	3.6	5.5	6	8	10	18
Top for TMS=1	10	6.2	5	4.25	4	3.5	3	2.1

Table-2

- Q.3**
- (a) Draw logic diagram for implementing 3-step distance protection scheme using impedance relay. **03**
 - (b) Explain the loss of excitation protection as applied to synchronous motor. **04**
 - (c) Which are the types of SF6 circuit breaker? With neat diagram, explain the working of Puffer type SF6 circuit breaker. **07**

OR

- Q.3**
- (a) Explain the line trap units for carrier-aided protection of transmission line. **03**
 - (b) What are the advantages of carrier current protection scheme? **04**

- (c) With the help of schematic block diagram, explain the realization of transformer protection using numerical protection. **07**
- Q.4** (a) Draw the flow chart for implementing over current protection scheme using numerical relay. **03**
- (b) Differentiate between transfer trip and permissive inter trip. **04**
- (c) Determine the plug setting and % bias setting to permit 25% overload for 50 MVA, 132 kV/66 kV, delta-star transformer. The CT ratios on delta and star side is 300/5 and 1200/5 respectively. **07**
- OR**
- Q.4** (a) Explain Slepian's theory of arc interruption. **03**
- (b) Explain the phenomena of field emission and thermionic emission at the time of contact separation in circuit breaker. **04**
- (c) To obtain complete damping of transient oscillations analyze the critical value of shunt resistance. Also draw transient oscillations for different values of R. **07**
- Q.5** (a) Classify the various types of faults and abnormal condition in motors. **03**
- (b) Explain the application of reverse phasing protection to induction motor. **04**
- (c) Analyze the performance of the CT by drawing its equivalent circuit and vector diagram. Also differentiate between protective CT and measuring CT. **07**
- OR**
- Q.5** (a) Define reach, under reach, and over reach of the relay. **03**
- (b) Classify the faults and abnormal operating conditions in synchronous machine. **04**
- (c) A 50 Hz, 13.6 kV, 3-phase alternator with grounded neutral has inductance of 12 mH per phase and is connected to busbar through a circuit breaker. The capacitance to earth between the alternator and the location of circuit breaker is $0.03\mu\text{F}$ per phase. Neglect the resistance of the alternator. calculate the following: **07**
- i) Maximum value of restriking voltage across the contacts of circuit breaker.
 - ii) Frequency of transient oscillations
 - iii) Maximum value of RRRV
