

JK Lakshmipat University Jaipur

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2019
B. Tech. in Electrical Engineering, Semester VI

Roll No.....

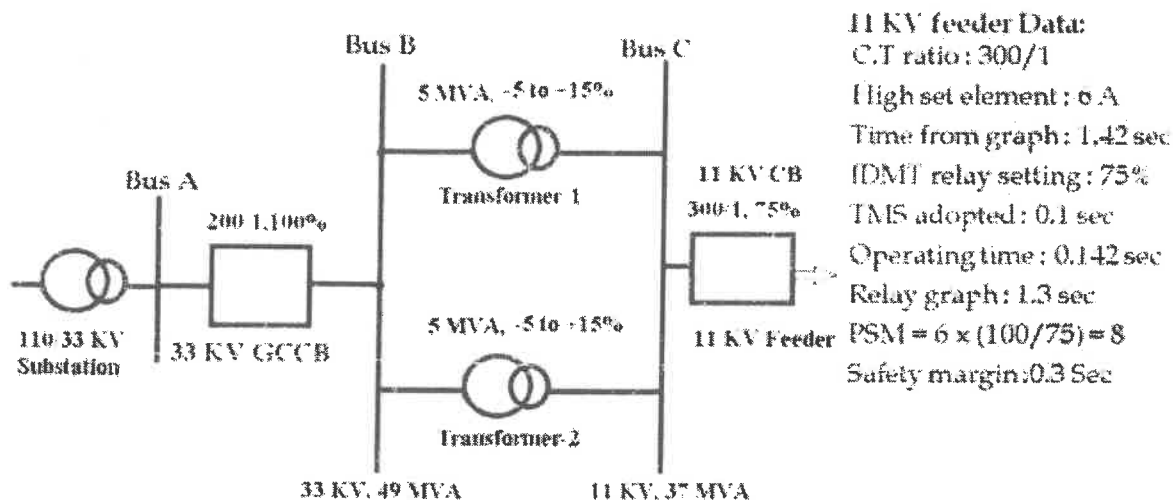
Course Code :EE 602
Course Name: Switch gear and Protection

Time: 03 hours Max. Marks: 60

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Attach graph sheet with answer sheet properly

Q.1 A 110/33-11 V substation have two identical transformer-1 and transformer-2 as shown below. Thus these transformers will share equal load as well as fault current. 20



IDMT and high set element relay is associated with 11 KV and 33 KV circuit breaker. The TMS of both the over current relays and earth fault relays of 11 KV feeder are set at minimum, i.e. at 0.05 sec for 3 second relays and at 0.1 sec for 1.3 second relays.

Decide the switching status (opening or closing) of high set element at 33 KV GCCB This decision is subjected to selection of IDMT Relay Type for two cases. In case 1 have choice for IDMT Relay-Type 1 and IDMT Relay-Type 2, whether case 2 have choice for IDMT Relay-Type 3 and IDMT Relay-Type 4.

The highest TMS for each IDMT Relay Type will considered for high set element opening or closing (at 33 KV GCCB) for particular case.

Case 1: How to decide that high set element at 33 KV GCCB is to keep open or close.

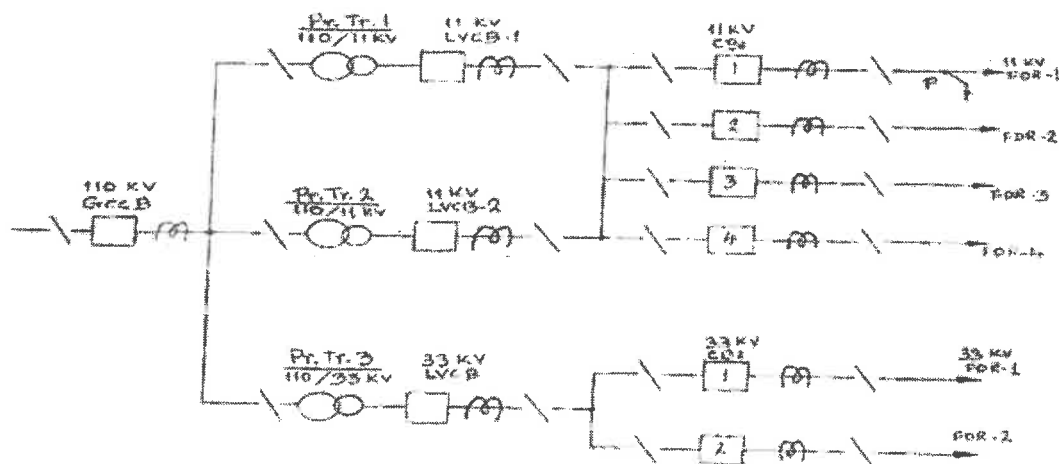
Case	IDMT Relay Type	Operating Time
Case 1	IDMT Relay-Type 1	$= \frac{13.5}{(PSM^{0.02} - 1)}$
	IDMT Relay-Type 2	$= \frac{0.14}{(PSM^{0.02} - 1)}$

OR

Case 2: How to decide that high set element at 33 KV GCCB is to keep open or close.

Case	IDMT Relay Type	Operating Time
Case 2	IDMT Relay-Type 3	$= \frac{120}{(PSM^{0.02} - 1)}$
	IDMT Relay-Type 4	$= \frac{80}{(PSM^2 - 1)}$

- Q.2 (a) Consider the single line diagram of non-grid station as shown below. There is a fault occurred at location "P" on the 11KV lines No (1). Identify the at least three ways to isolate above fault at location "P" from healthy system. 05

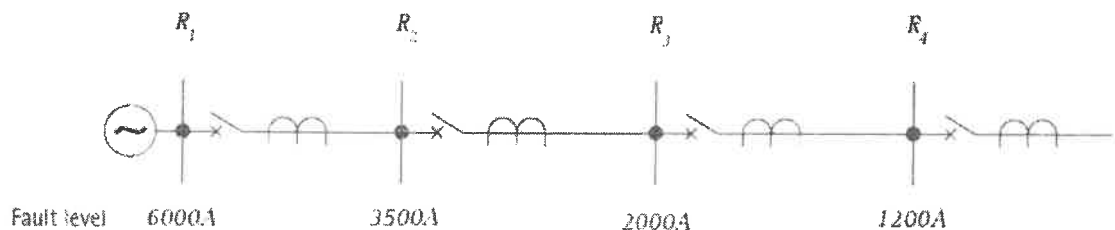


- (b) Discuss in short about the various schemes of alternator protection and specify their relative merits and demerits? 05
- Q.3 (a) A star-connected, 3-phase, 100MVA, 11 kV alternator has a per phase reactance of 10%. It is protected by Merz-Price circulating-current principle which is set to operate for fault currents not less than 275 A. Calculate the value of earthing resistance to be provided in order to ensure that only 15% of the alternator winding remains unprotected 05

- (b) Describe the protection scheme for internal faults in a three phase delta/star connected power transformer. Draw a neat sketch and explain clearly why the CTs are to be connected in a particular fashion only. 05

OR

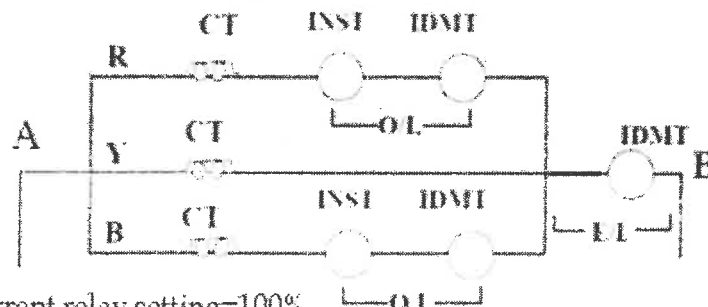
- (a) Enumerate two major reasons behind the use of biased differential protection scheme for the protection of power transformers. 05
- (b) A fault occurred at location R1, R2, R3, and R4 on the below feeder. Identify fault location for maximum transient frequency. Also substantiate your answer. 05



- Q.4 (a) For below relay diagram, Check whether the above relay system will act or not. If not then, suggest the value of plug setting for over current relay and earth fault relay for acting relay system. 06

Accuracy limit factor=15

CT Ratio: 400/1A, Burden: 30 VA, Class: 5P15



IDMT over current relay setting=100%

IDMT over current burden=3VA

High set Inst. Element burden=5VA

Earth fault relay setting=20%

- (b) Identify possible causes and remedies for trouble occurred in power transformer 04
- (a) Rise in Temperature (c) Core Failure
- (b) High Exciting Current (d) Bushing flashover

OR

- (a) A circuit breaker is rated 2500 A, 1500 MVA, 33 KV, 3 sec, 3-phase oil circuit breaker. 03
- Determine (i) the rated normal current (ii) breaking current (iii) making current (iv)

short time rating current.

- (b) With the help of suitable diagram, describe the construction and working of an SF6 circuit breaker? 07

Q.5 (a) Discuss the process of arc extinction in the medium of oil and what characteristics it should have? Discuss various types of OCBs used in power network. 05

- (b) A 50 Hz, 11 kV, 3-phase alternator with earthed neutral has a reactance of 5 ohms per phase and is connected to a bus-bar through a circuit breaker. The distributed capacitance upto circuit breaker between phase and neutral is $0.01 \mu\text{F}$. Determine 05
- (i) peak re-striking voltage across the contacts of the breaker
 - (ii) frequency of oscillations
 - (iii) the average rate of rise of re-striking voltage upto the first peak

OR

- (a) A 3-Phase star/delta 33/6.6 KV transformer is protected with biased differential scheme. The ratio on its low voltage side is 400/5. Show the connection diagram of the scheme depicting also the rating of the high voltage side C.Ts. 05
- (b) With neat sketch, explain the principle of operation of "Induction disc type" Over Current (O.C) relay. How the time delay mechanism is adjusted in the O.C. IDMT relay characteristics? 05