

# National Institute of Technology, Hamirpur (HP)

Name of the Examination: B.Tech. End Semester Nov., 2023

Branch :Electrical Engineering Semester :Fifth

Course Name :PROTECTION AND Course Code : EED-311  
SWITCHGEAR

Time: 3 Hours

Maximum Marks: 50

Note: Attempt all the questions. Marks allotted for each question are given in bracket. Assume missing data if any suitably.

1. (a) Discuss the principle of symmetrical components. Derive the necessary equations to convert phase quantities into symmetrical components and vice versa. State the application of symmetrical components in power system. (5)
- (b) State the tripping and blocking criteria of distance relays. State the operating characteristics of impedance and reactance relay on R-X plane and state application of distance relays. (5)
2. (a) State the bus-bar protection against phase to phase fault. Briefly explain linear coupler and its application. (5)
- (b) The currents in a three phase unbalanced system are given as  $I_R = (12+j6)$  A,  $I_Y = (12-j12)$  A and  $I_B = (-15+j10)$  A. The phase sequence is RYB. Calculate the zero, positive and negative sequence components of the currents in rectangular as well as in polar form. (5)
3. (a) Draw and explain the scheme of protection against rotor earth fault using DC injection technique. (5)
- (b) A 3-phase, 500 KVA, 11 KV/0.4KV transformer is connected in delta-star. The protection transformer on LV side have turns ratio of 500/5. What will be the CT ratio on the HV side of the transformer? Also draw the connection diagram of this protection scheme. (5)
4. (a) Briefly explain the implementation of microprocessor based impedance relay with the help of a schematic diagram and flow chart. (5)
- (b) Draw the circuit and explain the working and application of harmonic restraint relay installed in power transformers. (5)
5. (a) Explain the construction and working of vacuum circuit breaker with the help of a neat diagram. State the advantages of vacuum circuit breaker over SF<sub>6</sub> circuit breaker and also state its suitability. (5)
- (c) In a 132 KV system, the reactance per phase upto the location of the circuit breaker is 5 Ohms and capacitance to earth is 0.03 micro farad, respectively. Calculate: (i) The maximum value of restriking voltage (ii) The maximum value of RRRV and (iii) the frequency of transient oscillations (5)