

# *National Institute of Technology, Hamirpur (HP)*

Name of the Examination: B.Tech. End Semester Dec., 2020

Branch : Electrical Engineering Semester : Fifth  
 Course Name : Protection & Switchgear Course Code : EE-311

Time: 2 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) State the important characteristics of unsymmetrical faults with examples. Explain the 3 phase short circuit on an unloaded generator, clearly mentioning the different periods and significance of each one of them. (5)
- (b) Three phase unbalanced voltages are  $V_{a0} = 30\angle -30^\circ$ ,  $V_{a1} = 450\angle 0^\circ$ ,  $V_{a2} = 225\angle 40^\circ$ , unbalanced currents are  $I_{a0} = 10\angle 190^\circ$ ,  $I_{a1} = 6\angle 20^\circ$ ,  $I_{a2} = 5\angle 50^\circ$ . Calculate line currents, line voltages and complex power by
  - a) Symmetrical components
  - b) Unbalanced phase components
2. (a) Draw and state the protection scheme of alternator against phase to phase fault. State its limitations. (5)
- (b) A three phase, 200 KVA, 11KV/400V transformer is protected by differential protection and is connected in delta-star. The CT's on low voltage side have turns ratio of 500/5. Determine the CT ratio on high voltage side. Also draw the connection diagram for this differential protection and obtain the circulating current when fault of 750 A of earth fault takes place in protective zone. (5)
3. (a) State briefly the causes of faults in transformers and role of various inbuilt safety devices installed in transformers. (5)
- (b) Draw the 3 zone protection scheme for transmission line. State the operating characteristics of all the three zones stating the various delays and purpose of creating zones. (5)
4. (a) The performance of an OCR was monitored over a period of one year. It was found that the relay operated 14 times, out of which 12 were correct trippings. If the relay failed to issue trip signal on 3 occasions, compute dependability, security, and reliability of the relay. (5)
- (b) Explain the construction and working of a vacuum circuit breaker with the help of a neat diagram. (5)
5. (a) Draw the carrier aided protection of transmission line, briefly stating the function of each carrier aided equipment used in protection. (5)
- (b) In a 132 KV system, the inductive reactance and capacitance upto the breaker location are 3 Ohm and 0.015 micro-farad, respectively. Calculate: (i) the frequency of oscillations (ii) The maximum value of restriking voltage across the circuit breaker contacts (iii) The maximum value of RRRV. (5)