M.E. / M.Tech. DEGREE END-SEMESTER EXAMINATIONS – DECEMBER 2019
First Semester
Power Systems Engineering
P19PS102 – DIGITAL POWER SYSTEM PROTECTION
(Regulation 2019)

Time : Three Hours   Maximum : 100 Marks

Answer ALL the questions

PART – A

(10 x 2 = 20 Marks)

1. State Shannon's Sampling theorem and define Nyquist sampling rate.

2. Enlist merits and demerits for numerical protection scheme.

3. What are the different types of faults in an overhead transmission line? Write in the sequence of their severity

4. How are travelling waves generated in long transmission lines?

5. What are the different types of faults in synchronous generators?

6. What is inrush magnetizing current in a transformer and what are the factors affecting it?

7. What are the variables that decide the operating time of an overcurrent relay?

8. Classify the coordination criteria adopted for distance and overcurrent relays.

9. How to compute symmetrical components from three-phase quantities?

10. Inscribe wave equations for fault generated components of voltage and current in a lossless transmission line.

PART – B

(5 x 13 = 65 Marks)

11. a) Develop the functional block diagram of numerical relay and describe each block.

(OR)

b) Demonstrate functional block diagram for implementation of the lease-square algorithm. Describe the role of least-square technique in numerical protection.

1 2. a) Develop a simplified hardware configuration for a microprocessor based relaying scheme. Comment on the functions of each block.

(OR)

b) With necessary mathematical formulations, illustrate the operation of digital protection scheme based on fundamental signals, Also enlist various analog and digital filtering schemes employed.

1 3. a) Discuss the effect of a ground fault (LG) occurring near neutral of a neutral grounded synchronous generator upon the performance of protection scheme. Develop a digital protection scheme based upon the injection of sub-synchronous component in the rotor circuit, of a synchronous generator.

(OR)

b) With a neat block diagram, discuss the theory and principle of operation of unit protection scheme using static components for the protection of delta-wye connected transformer. Also mention why high bias factor is high.

14. a) Enumerate various real time features and functions of a system control center. Also mention the predominant functions of a protection engineer.

(OR)

b) Describe characteristics and various coordination criteria (two terminal and multi-terminal lines) for IDMT overcurrent relays.

15. a) Demonstrate the algorithm for calculating system conditions after occurrence of single line to ground fault and three-phase short circuit fault.

(OR)

b) Describe in detail the fault locating relay scheme. Also draw the lattice diagram for an external fault.

PART – C

(1 x 15 = 15 Marks)

16. a) Discuss the digital protection of a long transmission line based upon travelling wave phenomenon with the help of neat diagrams showing hardware and software details. Discuss also the merits and limitations of this relaying scheme.

(OR)

b) Demonstrate setting of various zones of distance relay with the aid of relevant characteristics, diagrams and operational cases.