

CBCS Scheme

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16/17EPS14

First Semester M.Tech. Degree Examination, June/July 2018 Computer Relaying for Power Systems

Time: 3 hrs. .

Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Discuss with the help of a block diagram, the sub systems of Relaying computer. (08 Marks)
b. Explain the expected benefits of computer Relaying. (08 Marks)

OR

- 2 a. With a neat schematic diagram, explain the principle of operation of :
i) Electronic current Transformer
ii) Electronic voltage Transformer (08 Marks)
b. Discuss clearly the operation of directional relay in transmission line protection for loop system. (08 Marks)

Module-2

- 3 a. Obtain the Fourier transform of :
i) $x(t) = \text{Cos } \omega_c t u(t)$
ii) $x(t) = t e^{-at} u(t)$ (08 Marks)
b. Explain Random process, obtain the power density spectrum of the random process given by $x(t) = A \text{Cos } (\omega\tau + \phi)$ (08 Marks)

OR

- 4 a. What is windowing? Discuss the effects of rectangular and hamming window on a periodic signal. (06 Marks)

- b. Find the Z-transform of the signal :

$$x(n) = n \left(\frac{1}{2}\right)^n u(n) * \left[\delta(n) + \frac{1}{2}\delta(n-1)\right]$$

Also find its ROC. (05 Marks)

- c. Find the inverse z-transform of

$$x(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)(1 - 2z^{-1})(1 + z^{-1})}$$

With ROC $1 < |z| < 2$. (05 Marks)

Module-3

- 5 a. Describe error analysis for differential equation algorithm in case of faulted transmission line modeled as a series RL line. (08 Marks)
b. Discuss the concept of protecting series compensated lines using computer relaying. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Explain voltage based restraints algorithm for protecting of power transformer. (08 Marks)
 b. Describe how computers are used for differential protection of stator winding of generators under faulty conditions. (08 Marks)

Module-4

- 7 a. Explain with relevant waveforms, the following :
 i) Oscillatory SWC test (06 Marks)
 ii) Fast transient SWC test. (05 Marks)
 b. Enumerate the desirable environmental conditions for substations. (05 Marks)
 c. Describe how a redundant relay act as a backup for computer relays in a substation. (05 Marks)

OR

- 8 a. Articulate the general approach of weighted least square technique used in state estimation for real time operation of the bulk power system. (08 Marks)
 b. Explain with schematic diagram, the dynamic state estimation applied for phasor measurements. (08 Marks)

Module-5

- 9 a. Describe the phenomena of traveling waves with the help of Bewley lattice diagram. (08 Marks)
 b. Given the L and C matrices :

$$L = \begin{bmatrix} 2.1 & 0.8 & 0.8 \\ 0.8 & 2.1 & 0.8 \\ 0.8 & 0.8 & 2.1 \end{bmatrix}; C = \begin{bmatrix} 8.77 & -1.033 & -1.033 \\ -1.033 & 8.77 & -1.033 \\ -1.033 & -1.033 & 8.77 \end{bmatrix}$$

Where L in $\mu\text{H/m}$ and C in PF/m

Find : i) zero sequence mode parameters

ii) α and β sequence mode parameters. (08 Marks)

OR

- 10 a. What is adaptive protection? Illustrate the principle involved in transmission line protection using adaptive relaying. (08 Marks)
 b. With the neat schematic diagram, explain the principle of WAMS based out of step relaying. (08 Marks)

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