

- 1  INTRO
- 2  COURSE GOALS
- 3  COURSE OVERVIEW
- 4  HIGH VOLTAGE GROUNDING TOPIC AREAS
- 5  DEFINITIONS
- 6  IMPORTANCE OF INDUCTIVE AND CAPACITIVE REACTANCE
- 7  OHM'S LAW
- 8  GROUNDING GOALS
- 9  WHAT and WHY DO WE GROUND?
- 10  ELECTRICAL THEORY KNOWLEDGE BASE
- 11  GROUNDING AND BONDING - SHOCK HAZARDS AND INSULATION STRESS
- 12  GENERAL GROUNDING - SHOCK SAFETY
- 13  DESIGNING FOR SHOCK SAFETY
- 14  EFFECTS OF CURRENT ON HUMAN BODY
- 15  ELECTRICAL SYSTEM GROUNDING
- 16  EQUIPMENT GROUNDING CONDUCTORS
- 17  CONDUCTOR SHIELD GROUNDING
- 18  NESC Rule 94A - GROUNDING ELECTRODES
- 19  GROUNDING ELECTRODES
- 20  NESC GROUNDING CONDUCTORS
- 21  NESC MINIMUM GROUNDING CONDUCTOR SIZES
- 22  GROUND CONDUCTOR IN A MAGNETIC ENCLOSURE
- 23  SEPARATION OF GROUNDING CONDUCTORS – RULE 97
- 24  SEPARATION OF GROUNDING CONDUCTORS – RULE 97 MULTI-GROUNDED NEUTRAL
- 25  SEPARATION OF GROUNDING CONDUCTORS – RULE 97 UNI-GROUNDED NEUTRAL
- 26  NESC RULE 97- SEPARATE GROUNDS, 3-W, 3-PH, GROUNDED SYSTEM
- 27  RULE 97- ANALYSIS, SEPARATE GROUNDS , 3-PH,3-W, GROUNDED SYSTEM
- 28  NESC RULE 97- SEPARATE GROUNDS, MULTI-GROUNDED NEUTRAL SYSTEM
- 29  RULE 97- ANALYSIS, SEPARATE GROUNDS , MULTI-GROUNDED NEUTRAL SYSTEM
- 30  NESC RULE 97- IMPROVED DESIGN
- 31  GROUNDING REQUIREMENTS UNDERGROUND
- 32  RISER POLE GROUNDING
- 33  RISER POLE GROUNDING
- 34  MANHOLE AND VAULT GROUNDING
- 35  MESSENGER GROUNDING
- 36  GUY GROUNDING AND GUARDING
- 37  OBJECTIONABLE CURRENTS
- 38  OBJECTIONABLE CURRENTS
- 39  OBJECTIONABLE CURRENT SOURCES

- 40  OBJECTIONABLE CURRENT SOLUTIONS
- 41  GROUND FAULT CURRENTS
- 42  GROUND FAULT CURRENT MGN SYSTEM - NO NEUTRAL CIRCUIT DIAGRAM
- 43  GROUND FAULT CURRENT MGN SYSTEM - NO NEUTRAL EQUIVALENT CIRCUIT
- 44  MULTI-GROUNDED SYSTEM - NO NEUTRAL RUN TO TRANSFORMER
- 45  GROUND ELECTRODE RESISTANCE CALCULATIONS
- 46  GROUND ELECTRODE RESISTANCE CALCS
- 47  CURRENT FLOW AND VOLTAGE DROP IN SOIL OR WATER FROM AN ELECTRODE
- 48  REMOTE EARTH
- 49  TOUCH VOLTAGES – VERTICAL GROUND ROD – NO EQUIPMENT GROUNDING CONDUCTOR
- 50  TOUCH VOLTAGES – HORIZONTAL BURIED WIRE OR ROD
- 51  SUMMARY OF EARTH SURFACE VOLTAGES AROUND A GROUNDING ELECTRODE
- 52  SUBSTATION STEP AND TOUCH POTENTIALS “Why my grounding system is not safe”
- 53  SUBSTATION GROUND GRID DESIGN
- 54  IEEE 80 GROUND GRID CALCS
- 55  DETERMINATION OF ( $k_m$   $k_i$ ) AND ( $k_s$   $k_i$ ) FACTORS AND  $E_{mesh}$
- 56  EFFECT OF GRID DEPTH ON  $E_{TOUCH}$  AND  $E_{STEP}$
- 57  CONTROLLING  $E_{TOUCH}$
- 58  CONTROLLING  $E_{STEP}$
- 59  SOME NEC vs NESC DIFFERENCES
- 60  FENCES AROUND SWITCHYARDS, SUBSTATIONS, AND EQUIPMENT
- 61  FENCES – TO BOND OR NOT TO BOND
- 62  TRANSFER POTENTIALS FROM GROUNDING SYSTEMS
- 63  TRANSFER POTENTIAL MITIGATION
- 64  TRANSFER VOLTAGES – STATION SERVICE POWER
- 65  GROUND GRID DESIGN PROCEDURES
- 66  GROUNDING AND LIGHTNING PROTECTION
- 67  GROUNDING OF STEEP WAVE FRONT TRANSIENTS
- 68  TRANSIENTS AND GROUNDING CONDUCTORS
- 69  CONDUCTOR VOLTAGE DROPS DURING LIGHTNING CURRENT DISCHARGE
- 70  SURGE ARRESTERS
- 71  SURGE ARRESTER SELECTION
- 72  INSULATION RATING FOR TRANSIENTS
- 73  GROUNDING ELECTRODE TRANSIENT CIRCUIT MODELS
- 74  LIGHTNING PROTECTION FOR SUBSTATIONS
- 75  SURGE PROTECTION – SUBSTATION CONTROL AND INSTRUMENTATION
- 76  SOARES GROUNDING BOOK – CHAPTER 21
- 77  SCALE MODELING OF GROUNDING SYSTEMS
- 78  SUMMARY
- 79  REFERENCES