NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B.Tech. in Electrical Engineering**
Semester:	**VI**
Course Code:	**3EE213ME26**
Course Title:	**Electrical Distribution Systems Analysis**
Course Type:	**Department Elective-II**
Year of Introduction:	**2025 – 26**

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. comprehend distribution system structure and modelling of various components (BL2)
2. determine the operating state of distribution system through load flow analysis (BL4)
3. assess the short circuit level for various faults and reliability in distribution system (BL5)
4. apply appropriate automation technique for system performance enhancement (BL3)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Distribution Systems: Introduction and Layout** Introduction to electrical distribution system, difference between power transmission and distribution network, distribution system substation and bus-bar layouts, feeder configurations, application of distribution system analysis	**05**
Unit-II	**Modelling of Distribution System Components** Modelling of distribution lines, cables, single-phase transformer, three-phase transformer, voltage regulator, load, capacitor bank, distributed generation (DG)	**10**
Unit-III	**Load Flow Analysis for Distribution Systems** Backward/forward sweep load flow (balance/unbalance conditions), direct approach based load flow for balance, unbalance, and weekly meshed system, load flow analysis of DG integrated distribution network, load flow considering various load models	**08**
Unit-IV	**Short Circuit Analysis for Distribution Systems** Sequence component based short circuit analysis, Thevenin's equivalent and phase variable based short circuit analysis, direct approach for short circuit analysis, impact of DG integration on short circuit current	**07**
Unit-V	**Reliability Analysis of Distribution Systems** Reliability modelling concept, different reliability indices, network technique-based reliability assessment, reliability analysis with DG, reliability enhancement techniques	**07**

Unit-VI **Distribution System Automation** **08**

Distribution system voltage control, volt-var control through traditional, SCADA-based and advance technologies, service restoration, feeder reconfiguration for loss reduction and load balancing

Self-Study: The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- James A. Momoh., *Electric Power Distribution, Automation*, Protection and Control, CRC Press.
- Turan Gonen., *Electric Power Distribution System Engineering*, BSP Books Pvt. Ltd.
- William Kersting., *Distribution Modelling and Analysis*, CRC Press.
- Biswarup Das., *Power Distribution Automation*, The Institution of Engineering and Technology
- Juan M. Gers, *Distribution System Analysis and Automation*, The Institution of Engineering and Technology
- Relevant recent literature, journal articles, standards and codes

Tutorial: Tutorial work will be based on above syllabus with minimum 08 tutorials.