ELEC6222 Session Level LOs

This document briefly summarises the session level Learning Outcomes for ELEC6222. Students should consider whether they feel confident with each item and use this judgement to target their independent reading.

Session 2: Network Planning

- Identify the factors which need to be considered by network planners when designing either new or expanded distribution networks
- Be able to describe the impact of non-electrical factors on network planning
- Explain why there is a difference in security of supply requirements at transmission and distribution level

Session 3: Network Architecture

- Be able to explain the differences between radial, looped and meshed network layouts
- Justify the choice of network layout against the characteristics of the loads to be supplied
- List what non-electrical factors might influence the choice of network layout and explain why they need to be considered when designing networks

Session 4: Substation Bus Layouts

- Explain the difference between gas and air insulated substations and what factors influence the option selected
- Know the advantages and disadvantages of different substation bus layouts
- Link the bus layout to the overall security requirement of the network

Session 5: Substation Sizing

- Identify the factors which affect the sizing of substation components and explain why they must be considered during sizing
- Use simplified service area methods to estimate the necessary capacity of a distribution substation
- Calculate how the distribution of load on a feeder will affect voltage drop

Session 6: Overhead Line Design

- Know the function of the components of both transmission and distribution overhead line circuits
- Explain the factors affecting conductor selection and the impact of each on the resulting conductor choice
- Use the physical design of the line to select appropriate electrical models to represent its behaviour

Session 7: Overhead Line Ratings & Reactive Compensation

- Know the factors which limit the permissible current through an overhead line circuit
• Be able to explain the benefits to system operators and designers of using dynamic line ratings
• Explain the benefits of using reactive power compensation in overhead line networks

**Session 8: Underground Cable Design & Construction**

• Know the key types of cable technology available for transmission/distribution use
• List the key stages in cable manufacture
• Be able to explain how the environment into which a cable is to be installed will impact upon its design

**Session 9: Underground Cable Operating Constraints**

• Explain why the current rating of a cable is thermally limited
• Calculate thermal losses from high voltage cables according to international standards
• Discuss the impact of the way in which the cable is installed on its current rating

**Session 10: Transformers 1**

• Be able to relate the significance of transformer equivalent circuit parameters to design features
• Explain the reasons for restrictions on load currents and harmonic contents

**Session 11: Transformers 2**

• Discuss the advantages and disadvantages of different winding designs
• Know the effect of the transformer winding connections on its representation in a sequence network model
• Explain the operational principles of common tap changer designs

**Session 12: Reliability 1**

• Know the causes of outages and be able to differentiate between those which can be mitigated and those which can’t
• Apply simple statistical methods to characterise the reliability of a distribution system
• Explain the effect of asset health and maintenance strategies on reliability

**Session 13: Reliability 2**

• Use reliability block diagrams to determine the failure rate of simple series/parallel systems
• Explain the links between the topology of a distribution network and its reliability
• Provide justified options for improving the reliability of an existing network

**Session 14: Circuit Breakers**

• Know the operational principles of the key types of circuit breakers
• Discuss the factors which affect circuit breaker ratings and relate them to the operation of distribution networks
• Apply circuit breaker selection criteria to specify a circuit breaker for a specific location in a network

**Session 15: Reclosers & Sectionalisers**

• Explain the operational principles of reclosing circuit breakers and their application in distribution networks
• Coordinate sectionalisers and reclosers within distribution networks
• Describe the operational mechanisms of surge arrestors and explain how they should be specified

**Session 16: Fuses**

• Explain the operational principle of fuses commonly installed in distribution networks
• Analyse fuse operation using time current characteristics
• Coordinate fuses with other forms of network protection

**Session 17: Overcurrent Protection**

• Explain how protection schemes are specified and designed
• Describe the time-current characteristics of overcurrent relays and how they may be varied to achieve good coordination
• Coordinate overcurrent relays on circuit breakers across distribution networks to create a reliable protection system

**Session 18: Directional/Distance Protection**

• Explain the operational principles of directional relays and demonstrate how they are coordinated with overcurrent relays
• Apply the concept of zones of protection to simple network structures
• Coordinate distance protection in networks containing long transmission lines

**Session 19: Differential Protection**

• Coordinate differential relays for assets such as transformers and generators
• Design bus bar protection schemes with consideration to the reliability of the network overall
• Know the range of asset specific protection which may be required for transformers