UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lessons 1 to 3: Complex DC networks **Suggested Teaching Time:** 3.5 hours per session

Learning Outcome: Understanding complex DC networks

Topic	Suggested Teaching	Suggested Resources
• Introduction • Complex DC networks	**Introduction** to the unit: contents, aims and objectives and assessment structure. Adopt a practical approach wherever possible, to support and develop the learners understanding through linking theory to a substantial practice bias towards the recognition and analysis of circuit parameters. Computer simulation and analysis of circuits is a fundamental requirement of modern electronic design and should be encouraged. 1.1 Model an equivalent circuits, comprising of resistor-semi-conductors. Recap on learning outcomes at the end of the session.	**Books:** Hughes, T., *Electrical and Electronic Technology*, 10th Edn 2008, Revised by J. Hiley, K. Brown, I. MacKenzie-Smith. Pearson Prentice Hall. ISBN 978-0-13-206011-0 Bird, J., *Electrical and Electronic Principles and Technology*, 4th Ed 2010, Newnes. ISBN 978-0-08-089056-2 **Simulation software:** Multisim, Proteus Test equipment and components
	Start the session with a recap on previous session outcomes. 1.2 Evaluate the performance limits of **series**, **parallel**, and combined **series-parallel** networks for **current**, **power transfer** under design conditions, supported by simulated design package. Recap on learning outcomes at the end of the session.	
	Start the session with a recap on previous session outcomes. 1.3 Evaluate circuit performance, for the quality of its circuit components, power supply, signal input, circuit tolerance under variable conditions such as **temperature**, **voltage**, **power supply**, **current**, **ripple**, **step change**, through a series of practical observations. Recap on learning outcomes at the end of the session.	

UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lessons 4 to 7: RLC circuits and alternating wave forms **Suggested Teaching Time:** 3.5 hours/per session

Learning Outcome: Understanding the response of RLC circuits to alternating wave forms

Topic	Suggested Teaching	Suggested Resources
The response of RLC circuits to alternating wave forms	Start the session with a recap on previous session outcomes. 2.1 The RLC circuit forms the basis of filter design, allowing or rejecting a particular range of frequency. Therefore, it is essential for any engineer to be able to model dynamic **RLC circuits** for **series**, **parallel, series-parallel** combinations. Recap on learning outcomes at the end of the session.	**Book:** Bird, J., *Electrical Circuit Theory and Technology*, 4th Edn 2010, Newnes. ISBN 978-1-85617-770-2
	Start the session with a recap on previous session outcomes. 2.2 Analyse frequency responses of **tuned RLC** circuits, **harmonics**, **sub-harmonics**, **second harmonic**, **third harmonics** within **series**, **parallel**, **series-parallel** combinations. Recap on learning outcomes at the end of the session.	

UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lesson 8: RLC circuits and alternating wave forms

Suggested Teaching Time: 3.5 hours/per session

Learning Outcome: Understanding the response of RLC circuits to alternating wave forms

Topic	Suggested Teaching	Suggested Resources
The response of RLC circuits to alternating wave forms	Start the session with a recap on previous session outcomes and introduce the impact of power factor correction on AC electrical power systems; defined as the ratio of the real power flowing to the load, to the apparent power of a given circuit. 2.3 Analyse **power factor** correction requirements of given industrial applications. Recap on learning outcomes at the end of the session.	**Book:** Bird, J., *Electrical Circuit Theory and Technology*, 4th Edn 2010, Newnes. ISBN 978-1-85617-770-2 **Internet:** www04.abb.com/global/seitp/seitp202.nsf/0/.../$file/vol.8.pdf

UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lessons 9 to 11: Multi-port networks **Suggested Teaching Time:** 3.5 hours/per session

Learning Outcome: Understand performance of multi-port networks

Topic	Suggested Teaching	Suggested Resources
The response of RLC circuits to alternating wave forms	***Lessons: 9 and 10*** Start the session with a recap on previous session outcomes, and provide an overview of the impact of transients. 2.4 Evaluate the **transient** effect on **RLC circuits** through calculations and circuit simulation. Recap on learning outcomes at the end of the session.	**Book:** Bird, J., *Electrical Circuit Theory and Technology*, 4th Edn 2010, Newnes. ISBN 978-1-85617-770-2 **Simulation software:** Multisim, Proteus Test equipment and components **Internet:** www.nptel.ac.in/courses/.../pdf/L-11(GDR)(ET)%20((EE)NPTEL).pdf
	Lesson 11 Start the session with a recap on previous sessions involving transients, outlining the practical investigations to be covered within this lesson. 2.5 Evaluate the practical use of **transient effect** through practical investigations. Recap on learning outcomes at the end of the session.	

UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lesson 12 to 19: Multi-port networks **Suggested Teaching Time:** 3.5 hours/per session

Learning Outcome: Understand performance of multi-port networks

Topic	Suggested Teaching	Suggested Resources
Performance of multi-port networks	***Lessons 12 and 13*** Start the session with a recap on previous session outcomes on transients, outlining the outcomes of coming lessons on three port networks. 3.1 **Derive input and output equations** for **three port networks** Recap on learning outcomes at the end of the session.	Books: Bird, J., *Electrical Circuit Theory and Technology*, 4th Edn 2010, Newnes. ISBN 978-1-85617-770-2 Hughes, T., *Electrical and Electronic Technology*, 10th Edn 2008, Revised by J. Hiley, K. Brown, I. MacKenzie-Smith. Pearson Prentice Hall. ISBN 978-0-13-206011-0 **Simulation software:** Multisim, Proteus
	Lessons 14 and 15 Start the session with a recap on previous session outcomes 3.2 Analyse the output conditions of **three-port networks** in relation to the **inputs** for **waveforms**, **voltage**, **current, frequency** and **phase shift** Recap on learning outcomes at the end of the session.	
	Lessons 16 and 17 Start the session with a recap on previous session outcomes. 3.3 Convert circuit values of **three port networks** using different parameters comprising **Z (impedance model)**, **Y (admittance model)**, **h (hybrid model)** and **g (inverse hybrid model)** Recap on learning outcomes at the end of the session.	
	Lessons 18 and 19 Start the session with a recap on previous session outcomes. 3.4 Solve problems involving **attenuation** of **three-port networks**. Recap on learning outcomes at the end of the session.	

UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lessons 20 to 23: Electrical systems modelled as two-port networks **Suggested Teaching Time:** 3.5 hours/per session

Learning Outcome: Understand how to analyse electrical systems when modelled as two-port networks

Topic	Suggested Teaching	Suggested Resources
Analysing electrical systems when modelled as two-port networks	***Lessons 20 and 21*** Start the session with a recap on previous session outcomes. 4.1 Explain the parameters used in **two-port models** using **Z (impedance model)**; **Y (admittance model)** and **h (hybrid model)**; using elementary matrix algebra. Recap on learning outcomes at the end of the session.	**Books:** Hughes, T., *Electrical and Electronic Technology*, 10th Edn 2008, Revised by J. Hiley, K. Brown, I. MacKenzie-Smith. Pearson Prentice Hall. ISBN 978-0-13-206011-0 Bird, J., *Electrical and Electronic Principles and Technology*, 4th Ed 2010, Newnes. ISBN 978-0-08-089056-2
	Lessons 22 and 23 Start the session with a recap on previous session outcomes. 4.2 Explain the deriving of input and output equations for parameter models such as **Z (impedance model)**; **Y (admittance model)** and **h (hybrid model)**; elementary matrix algebra. Recap on learning outcomes at the end of the session.	

UNIT 502 ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

Lessons 24 and 25: Electrical systems modelled as two-port networks

Suggested Teaching Time: 3.5 hours/per session

Learning Outcome: To be able to analyse electrical systems when modelled as two-port networks

Topic	Suggested Teaching	Suggested Resources
Analysing electrical systems when modelled as two-port networks	***Lessons 24*** Start the session with a recap on previous session outcomes. 5.1 Convert circuit values using parameters such as **Z (impedance model); Y (admittance model)** and **h (hybrid model)**; **elementary matrix algebra from different models.** Recap on learning outcomes at the end of the session.	**Books:** Hughes, T., *Electrical and Electronic Technology*, 10th Edn 2008, Revised by J. Hiley, K. Brown, I. MacKenzie-Smith. Pearson Prentice Hall. ISBN 978-0-13-206011-0 **Simulation software:** Multisim, Proteus Test equipment and components
	Lessons 25 Start the session with a recap on previous session outcomes. 5.2 Solve problems involving **gain** at **low frequency**; **mid-band**; **high frequency** of **two-port model networks**. Recap on learning outcomes at the end of the session.	