



B.P. PODDAR INSTITUTE OF MANAGEMENT AND TECHNOLOGY
Department of Electrical Engineering
Academic Year: 2025-2026 (Odd Semester)
LESSON PLAN

Program: Electrical Engineering
Paper : Electric Circuit Theory

Credit: 4

Contact: 3L+1T
Paper Code: PC-EE301`

Module	Sl. No.	Topics to be Covered	Text Books / Reference/ Web References	Teaching Pedagogies
Introduction	L1	Different types of systems & networks: Continuous & Discrete, Fixed and Time varying, Linear and nonlinear, lumped and distributed, passive & active networks and systems	T1, R2, W8	a. Lecture b. Chalk c. Green board d. Quiz
	L2	Different signals: Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth	T1, T2, R1, W9	a. Lecture b. Power Point Presentation c. Chalk d. Green Board e. Projector f. Quiz
	T1	Numerical Problems on different systems & signals	T2, T3, R2, W9, W12	a. Lecture b. Chalk c. Green board
Graph theory and Networks equations	L3	Vertex & Edge: Nodes & branches, definition of graph, drawing of graph from any electric circuit, Concept of Tree, Branch, twig, link	T1, T2, R1, W1	a. Lecture b. Chalk c. Green board
	L4	Different Matrices of Graph theory: Introduction of different matrices of Graph theory, to create an incidence matrix from graph, to construct graph from incidence matrix, properties of incidence matrix.	T1, T2, R1	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector
	L5	Tie-set matrix: Generation of tie-set matrix from graph drawn from an electric circuit and loop currents, discussion on the problems on incidence matrix. Cut set matrix and node pair potentials	T2, R1, W1	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector
	T2	Reduced incidence matrix: To draw a graph from reduced incidence matrix, calculation of no. of trees from reduced incidence matrix	T2, R1, W13	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector

Module	Sl. No.	Topics to be Covered	Text Books / Reference/ Web References	Teaching Pedagogies
Coupled circuits	L6	Magnetic coupling: Idea of magnetic coupling, concept of Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance	T1,R1	a. Lecture b. Power Point Presentation c. Projector
	L7	Coefficient of coupling: Modelling of coupled circuits, Solution of problems. Relationship between Self-inductance and Mutual inductance.	T2,W14	a. Lecture b. Chalk c. Green board
	T3	Numerical problems discussion on Coefficient of coupling	T2,R2,W14	a. Lecture b. Chalk c. Green board
Laplace transforms	L8	Introduction: Advantages of Laplace transform i.e. t domain vs s domain. Idea regarding Impulse, Step & Sinusoidal signals. Definition of Laplace Transform. LT of some basic functions	T1, T2, R1,W2	a. Lecture b. Chalk c. Green board
	L9	Transient response of RL circuit with and without initial conditions for step and sinusoidal inputs in t domain	T2, R2	a. Lecture b. Chalk c. Green board
	L10	Transient response of RC and RLC circuits with and without initial conditions for step and sinusoidal inputs in t domain	T1,T2, R1	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector
	L11	Step Response of RL and RC circuit using LT and numerical problems	T1,R1,W2	a. Lecture b. Chalk c. Green board
	L12	Step Response of RLC circuit using LT and numerical problems	T1,R1,7	a. Lecture b. Chalk c. Green board
	L13	Solution of current in switching circuit LT of repetitive functions	T2,R2,W15	a. Lecture b. Chalk c. Green board
	L14	Concept of Convolution theorem and its application	T1,T2	a. Lecture b. Chalk c. Green board
	T4	Solutions of Numerical problems on LT from Semester question papers	T2,R2	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector

Module	Sl. No.	Topics to be Covered	Text Books / Reference/ Web References	Teaching Pedagogies
Fourier method of waveform analysis	L15	Introduction: Idea regarding Fourier series, idea of ODD and EVEN functions	T2, T3, R2, W11	a. Lecture b. Power Point Presentation c. Chalk d. Green board Projector
	L16	Problem analysis of Fourier series, idea regarding Dirichlet conditions	T2, T3, R2, W11	a. Lecture b. Power Point Presentation c. Chalk d. Green Board e. Projector f. Moodle
	L17	Fourier Transform (FT): Definition of FT (in continuous domain only), example of FT of different functions.	T2, T3, R2	a. Lecture b. Power Point Presentation c. Chalk d. Green Board e. Projector
	L18	Problems on ODD and EVEN functions	T2,R2	a. Lecture b. Chalk, c. Green board
	L19	Application of FT in circuit analysis, Solution of Problems.	T1,R1	a. Lecture b. Power Point Presentation c. Projector
	T5	Solutions of Numerical problems on Fourier Series and FT from Semester question papers	T3,R3	a. Lecture b. Chalk c. Green Board
Network equations	L20	Kirchhoff's Current Law(KCL) & Kirchhoff's Voltage Law (KVL): Formulation of network equations from electric circuits solution of problems using KCL and KVL, Loop variable analysis.	T1, R2	a. Lecture b. Chalk c. Green board d. Quiz
	L21	Idea regarding source transformation solutions of problems using source transformation, Node variable analysis, Necessity of different Network theorems.	T1, R2,W5	a. Lecture b. Chalk c. Green board
	L22	Network theorems: Superposition theorem statement and problems using AC and DC.	T1, R2,W10	a. Lecture b. Chalk c. Green board
	L23	Thevenin's and Norton's theorem : statement and problems	T2, T3, R2, W17	a. Lecture b. Chalk c. Green board

Module	Sl. No.	Topics to be Covered	Text Books / Reference/ Web References	Teaching Pedagogies
	L24	Maximum power transfer theorem: statement and proof in DC and AC source	T1,R1	a. Lecture b. Chalk c. Green board
	L25	Millman's theorem and its application in three phase unbalanced circuit analysis.	T1, T2, R1	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector
	L26	Solution of Problems with DC & AC sources.	T1,R1	a. Lecture b. Chalk c. Green board
	T6	Solution of Problems from semester questions.	T2,R2	a. Lecture b. Chalk c. Green board
Two port networks analysis	L27	Two-Port Networks: Definition, Open circuit Impedance parameters(Z parameters) condition of symmetry in Z parameters	T2, R1,W4	a. Lecture b. Chalk c. Green board
	L28	Short circuit Admittance parameter(Y): Definition, Determination of the Y-parameter matrix (admittance matrix) condition of symmetry in Y parameters	T2, R1, W3	a. Lecture b. Chalk c. Green board
	L29	Transmission parameters(ABCD) parameters: Definition, determination of A, B, C, D parameters in two port network, Condition of symmetry in ABCD parameters. Idea of Hybrid parameters(h parameters). Inverse hybrid parameters (g- parameters)	T2, R1,W4	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector
	T7	Numerical problems solutions of two port networks from semester questions.	T2, T3, R2, W18	a. Lecture b. Chalk c. Green board
Filter Circuits	L30	Op-amp: Op-amp characteristic, op amp as an integrator and differentiator, Classification of filters (Analog filters, Digital filters, Active filters, Passive filters) Analysis and synthesis: Low pass filter and design of it	T2, R1, W6	a. Lecture b. Power Point Presentation c. Chalk d. Green board e. Projector
	L31	High pass and Band pass filter definition and derivation,.	T2, R1, W6,W16	a. Lecture b. Power Point c. Projector
	L32	Band reject filter (first and second order only) using operational amplifier.	T2,R2,W16	a. Lecture b. Chalk, board

Module	Sl. No.	Topics to be Covered	Text Books / Reference/ Web References	Teaching Pedagogies
	T8	Numerical problems solutions of filters from semester questions.	T2, T3, R2, W19	a. Lecture b. Chalk c. Green board
	*L33	Concept of transfer function, poles and zeros , Z-transforms, its properties and applications	T1,R1	a. Lecture b. Chalk c. Green board
	*L34	Active filter is included in this module. But passive filter is beyond syllabus which will be required for different filter design.	T2,R2	a. Lecture b. Chalk c. Green board

* Gap within Syllabus

Total No. of Classes (34(L) +T (8)): 42
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N.B. Lecture notes and PPTs are uploaded in the Moodle of Institute in EE section

(<http://moodlebppimt.ddns.net/course/index.php?categoryid=4>)

Text Books:

T1 - Networks and Systems, D. Roy Chowdhury, New Age International Publishers

T2 - Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

T3 - Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli 4th edition. Tata Mc Graw Hill Education Pvt. Ltd.

Reference Books:

R1 – Network Analysis, M.E. Valkenburg, Pearson Education

R2 – Fundamental of Electric circuit theory, D. Chattopadhyay & P.C. Rakshit, S. Chand.

R3 – Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The Mc Graw Hill Company

Web References

YouTubeLinks:

W1. <https://www.youtube.com/watch?v=C9Tv4DusUgc&t=442s> (Graph Theory)

W2. <https://www.youtube.com/watch?v=o5ZtYmCX2m4&t=28s> (LT)

W3. <https://www.youtube.com/watch?v=kJAjpgAbGqU&t=231s> (Two port Network)

W4. <https://www.youtube.com/watch?v=AbrgPxWC6xQ&t=140s> (Two port Network)

W5. <https://www.youtube.com/watch?v=T-cAO5CkP4Q&t=224s> (Theorems)

W6. https://www.youtube.com/watch?v=JAR3H_VYVZQ&t=194s (Filters)

W7. <https://www.youtube.com/watch?v=v3ThyxFD2c8&t=204s> (LT)

W8. <https://www.youtube.com/watch?v=TYmSEQY4EyE&t=348s> (Different Systems)

W9. <https://www.youtube.com/watch?v=nYVd7WQO84I&t=193s> (Different Signals)

W10. <https://www.youtube.com/watch?v=kAIYOhPgYiU&t=5s> (Different Theorems)

W11. <https://www.youtube.com/watch?v=pMwbVFq-TOI&t=253s> (Fourier Series)

NPTEL video links

W12. <https://nptel.ac.in/courses/108102042> (Signals & Systems)

W13. https://onlinecourses.nptel.ac.in/noc24_ma23/preview (Graph theory and Networks equations)

- W14. https://onlinecourses.nptel.ac.in/noc25_ee158/preview (Coupled circuits)
W15. https://onlinecourses.nptel.ac.in/noc23_ma54/preview (Laplace transforms)
W16. https://onlinecourses.nptel.ac.in/noc24_ma90/preview (Fourier method of waveform analysis)
W17. <https://nptel.ac.in/courses/108105159> (Network equations)
W18. https://onlinecourses.nptel.ac.in/noc20_ee46/preview (Two port networks analysis)
W19. <https://nptel.ac.in/courses/108103378> (Filter Circuits)

Research Papers Linked with Different Modules:

- W20. K.J.P. Reddy, K. Vinil Kumar and J. Mohan Satish, “A review on applications of laplace transformations in various fields”, Journal of Advanced Research in Dynamical and Control Systems, vol. 9, no. 14, pp. 14–24, January 2017.
W21. Abhimanyu Sah, Gourang Sangrulkar , “Circuit Analysis Using Network Theorems”, https://www.researchgate.net/publication/397600645_Circuit_Analysis_Using_Network_Theorems, November, 2025
W22. Lobna A. Said , A. G. Radwan , A. H. Madian , A. M. Soliman , “Two port network analysis for three impedance based oscillators”, IEEE, DOI: [10.1109/ICM.2011.6177421](https://doi.org/10.1109/ICM.2011.6177421), December, 2011.
W23. Hongze Fu, Yunting Li and Qingyang Zhuo, “Research on the Passive and Active Low Pass Filters”, vol. 46, pp. 260-265, DOI: 10.54097/hset. v46i.7712, April 2023.

Assessment Methodologies:

- Presentation
- Report writing
- Tests
- Assignment
- University examination

Innovations in Teaching/Learning/Assessment Processes:

- E-Learning material, demonstrations, field visits are extensively used.
- Incentive based class room interaction.
- Need based online sessions beyond class hours.
- Assessment process promotes self-learning, written and oral communication skills.

Sutapa Mukherjee

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