Name of the Faculty: Dr. Vedatrayee Chakraborty

Course Name: Network Theory

Regulation: 2019

Course Code: EC304

Branch: Electronics and Communication Engineering

Year & Semester: II B.Tech- I Semester

Academic Year: 2022-23

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Academic Year: 2022-23

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INSTITUTE

VISION

To enrich knowledge in engineering and technology through practice of progressive teaching-learning process and to be recognised as a research based centre for grooming professionals with ethical values and providing creative engineering solutions commensurate to global changes.

MISSION

- To enhance quality of engineering education through accessible, comprehensive and research-oriented teaching-learning process.
- To create opportunities for students and faculty members in acquiring knowledge through research and developing progressive social attitude for mass awareness.
- To create effective interface with industry by strengthening industry-institution interaction and fostering entrepreneurial skills.
- To satisfy ever-changing needs of the nation through rational evolution towards sustainable and environment friendly technologies.

B. P. Poddar Institute of Management & Technology
Department of Electronics & Communication Engineering

Academic year: 2017-18

Vision of the Department

Emerge as one of the premier departments for Electronics and Communication Engineering studies in West Bengal.

Mission of the Department

1. Imparting innovative educational program through laboratory and project-based teachinglearning process for meeting the growing challenges of industry and research.
2. Providing an inspiring and conducive learning environment to prepare skilled and competent engineers and entrepreneurs for sustainable development of the society.
3. Creating a knowledge centre of advance technologies committed to societal growth using environment-friendly technologies.

Program Educational Objectives (PEOs)

1. Graduates of Electronics and Communication Engineering will be able to use latest tools and techniques to analyze, design and develop novel systems and products to solve real life problems.
2. Graduates of Electronics and Communication Engineering will have strong domain knowledge, skills and attitude toward employment in core and allied industries, higher studies and research or will become successful entrepreneurs.
3. Graduates of Electronics and Communication will exhibit ethical values, professionalism, leadership, communication and management skills, team work and multi-disciplinary approach to adapt current trends in technology through life-long learning.

Ivy Majumdar

Dr. Ivy Majumdar
HOD(ECE Department)

B. P. Poddar Institute of Management & Technology
Department of Electronics & Communication Engineering

Academic year: 2017-18

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Ivy Majumdar

Dr. Ivy Majumdar
HOD(ECE Department)

B. P. Poddar Institute of Management & Technology
Department of Electronics & Communication Engineering

Academic year: 2017-18

Program Specific Outcomes (PSO)

1. Students will acquire knowledge in Advance Communication Engineering, Signal and Image Processing, Embedded and VLSI System Design.
2. Students will qualify in various competitive examinations for successful employment, higher studies and research.

Ivy Majumdar
Dr. Ivy Majumdar
HOD(ECE Department)

ELECTRONICS AND COMMUNICATION ENGINEERING
II Year - I Semester

CIRCUIT THEORY & NETWORKS
Code: EC 301 **Contacts: 3L+1T=4 hrs** **Credits: 4**

Module I 8L
Node and mesh analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality; network theorem: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.

Module II 6L
Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

Module III 6L
Laplace transformation and their properties: Partial function, singularity function, waveform synthesis, analysis of RC, RL and RLC networks with or without initial conditions with Laplace transforms evaluation of initial conditions.

Module IV 12L
Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and two port networks and interconnections, Behavior of series and parallel resonant circuit, introduction of pass, low pass, high pass and band reject filters.
Basic idea of Circuit Synthesis, Cauer & foster forms, examples

Text Books:

1. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./Pearson Education
2. Hayt "Engg Circuit Analysis" 6/e Tata McGraw-Hill
3. D.A. Bell- Electrical Circuits- Oxford

Reference Books:

1. A.B. Carlson-Circuits- Cenage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.

5. Kuo F. F., “Network Analysis & Synthesis”, John Wiley & Sons.
6. R.A. DeCarlo & P.M. Lin- Linear Circuit Analysis- Oxford
7. P. Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: “Circuits & Networks:Analysis & Synthesis” 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- “Electric Circuits and Analysis”, Vikas
11. V.K. Chandna, “A Text Book of Network Theory & Circuit Analysis”,Cyber Tech
12. Reza F. M. and Seely S., “Modern Network Analysis”, Mc.Graw Hill .
13. M. H. Rashid: “Introduction to PSpice using OrCAD for circuits and electronics”, Pearson/PHI
14. Roy Choudhury D., “Networks and Systems”, New Age International Publishers.
15. D.Chattopadhyay and P.C.Rakshit: “Electrical Circuits” New Age

TEXT BOOKS:

1. Valkenburg M. E. Van, “Network Analysis”, Prentice Hall./Pearson Education
2. Hayt “Engg Circuit Analysis” 6/e Tata McGraw-Hill
3. D.A.Bell- Electrical Circuits- Oxford

REFERENCE BOOKS:

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5. Kuo F. F., “Network Analysis & Synthesis”, John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: “Circuits & Networks:Analysis & Synthesis” 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- “Electric Circuits and Analysis”, Vikas

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Course Outcomes and Their Mapping with POs/PSOs

Network Theory [EC 304]

COURSE DATA SHEET

PROGRAM: Electronics and Communication Engineering	DEGREE: B.Tech. (U .G)
COURSE: Network Theory	SEMESTER: Even CREDITS: 4
COURSE CODE: EC 304(C203) REGULATION: 2019	COURSE TYPE: ~~CORE~~ /ELECTIVE / ~~BREADTH/ S&H~~
COURSE AREA/DOMAIN: Electronics Engineering	CONTACT HOURS: 4 hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): NA	LAB COURSE NAME (IF ANY): NA

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
ES-EE101	Engineering Science Courses	DC network theorems, Electromagnetism, AC fundamentals	I
BS-M201	Basic Science courses	Ordinary differential equations, Basics of graph theory Laplace transform	II

COURSE OBJECTIVES:

1	Discuss the fundamental laws, approach of mesh and node analysis with electrical circuits.
2	Discuss various theorems for network problem simplification.
3	Discuss the different types of Fourier Series and Fourier Transformation along with their Spectrum
4	Provide students with mathematical tools for electrical circuit analysis.
5	Develop the concepts of network modeling of electrical and electronic circuits.

ILO-TLO-CO

Un it.	H rs	Sub-Topic (from syllabus)	Instructional Learning Outcome(ILO) (Cognitive Process /Knowledge Dimension)	Topic Learning Outcome(TLO)	Course Outcome(CO)
1	4	Node and mesh analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality;	1.1 Explain Node and mesh analysis (1.2.1) (2.5.1) (9.1.1) (10.1.1) (12.1.1) 1.2 Explain matrix approach of network containing voltage (1.2.1) (2.5.1) 1.3 Explain matrix approach of network containing current sources, and reactance (1.2.1) (2.5.1) (4.4.1) (4.4.2) 1.4 Elaborate source transformation and duality (1.2.1)	TLO1.1 Calculate various parameters of the circuit with matrix approach TLO1.2 Apply source transformation and duality to the circuits.	**CO1: Calculate** circuit parameters by using mesh and node analysis including the matrix approach. (Apply) Assessment Tools: CT, OT, PS, Q
1	4	Network theorem: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.	2.1 Apply Superposition theorem and Reciprocity theorem to DC and AC. circuits. (1.2.1) (2.5.1) (9.1.1) (10.1.1) (12.1.1) 2.2 Apply Thevenin's and Norton's theorem to DC and AC. circuits. (1.2.1) (2.5.1) (3.6.1) 2.3 Apply Maximum Power Transfer theorem to DC and AC. circuits. (1.2.1) (2.5.1) 2.4 Apply compensation and Tallegen's theorem to DC and AC. Circuits (1.2.1)	TLO2.1 : Solve complex electrical problem in DC circuits with different theorem TLO2.2 Solve complex electrical problem in AC circuits with different theorem	**CO2: Solve** complex electrical circuit problems using network theorems. (Apply) Assessment Tools: CT, PS
2	6	Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power	3.1 Show Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform. (1.2.1) (2.5.1) (3.6.1) (9.1.1) (10.1.1) (12.1.1) 3.2 Explain steady state response of a network to non-sinusoidal periodic inputs. (1.2.1) (2.5.1) (3.6.1) 3.3 Explain the relation of power factor, effective values (1.2.1) (2.5.1) 3.4 Show Fourier transform and continuous spectra. (1.2.1)	TLO3.1 Explain Fourier series of different waves and spectrum TLO3.2 Explain different types fourier transformatio	**CO3: Explain** the different types of Fourier Series and Fourier Transformation along with the Spectrum L2 (Understand) Assessment Tools: CT, PS

		factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation	3.5 Calculate three phase balanced circuit and power calculation (1.2.1) 3.6 Calculate three phase unbalanced circuit and power calculation (1.2.1)	n and spectrum	
4	6	Laplace transformation and their properties: Partial function, singularity function, waveform synthesis, analysis of RC, RL and RLC networks with or without initial conditions with Laplace transforms evaluation of initial conditions.	1.1 Explain Laplace transformation and their properties (1.2.1) (2.5.1) (3.6.1) (9.1.1) (10.1.1) (12.1.1) 1.2 Explain Partial function, singularity function (1.2.1) (2.5.1) (3.6.1) 4.1 Explain waveform Analysis (1.2.1) (2.5.1) 4.2 Explain waveform synthesis (1.2.1) (2.5.1) 4.3 Solve the analysis of RC, RL and RLC networks without initial conditions (1.2.1) 4.4 Solve the analysis of RC, RL and RLC networks with initial conditions (1.2.1)	TLO4.1 Explain the Laplace transformation, their properties with waveform analysis and synthesis TLO4.2 Solve different RC,RL,RLC network with Laplace transformation	**CO4: Solve** electrical network problems using differential equation and Laplace transform. (Apply)L3 Assessment Tools: CT, PS, TP, P
5	12	Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations,	5.1 Explain Transient behavior, concept of complex frequency (1.2.1) (2.5.1) (3.6.1) (9.1.1) (10.1.1) (12.1.1) 5.2 Calculate Driving points and transfer functions (1.2.1) (2.5.1) (3.6.1) 5.3 Explain poles and zeros of immittance function (1.2.1) (2.5.1) 5.4 Explain their properties (1.2.1) (2.5.1) (9.1.1) (10.1.1) (12.1.1) 5.5 Show sinusoidal response from pole-zero locations 1.1 (1.2.1) (2.5.1) 5.6 Explain convolution theorem and two port networks (1.2.1) (2.5.1) 5.7 Show their interconnections (1.2.1) (2.5.1)	TLO5.1 Explain transient behavior, pole zero function and their properties TLO5.2 Solve driving points and transfer functions	**CO5: Solve** the electrical problems with two port network representation with pole zero concept and transient responses (Apply) Assessment Tools: CT, PS

		convolution theorem and two port networks and interconnections, Behavior of series and parallel resonant circuit, introduction of pass, low pass, high pass and band reject filters. Basic idea of Circuit Synthesis, Cauer & foster forms, examples	5.8 Explain the Behavior of series and parallel resonant circuit (1.2.1) (3.6.1) 5.9 Introduce pass, low pass, high pass and band reject filters. (1.2.1) (2.5.1) 5.10 Explain Basic idea of Circuit Synthesis (1.2.1) (2.5.1) (3.6.1) 5.11 Represent the networks in Cauer & foster forms (1.2.1) 5.12 Calculate with some examples (1.2.1)	TLO5.3 Solve different problems related to two port network and series and parallel circuits	

SNO	DESCRIPTION	Blooms Level	PO(1..12) MAPPING	PSO(1..2) MAPPING
	Students will be able to:			
C203.1	**Calculate** circuit parameters by using mesh and node analysis including the matrix approach.	L3 (Apply)	PO1, PO2, PO12	PSO1, PSO2
C203.2	**Solve** complex electrical circuit problems using network theorems.	L3 (Apply)	PO1, PO2, PO3, PO4, PO12	PSO1, PSO2
C203.4	**Explain** the different types of Fourier Series and Fourier Transformation along with the Spectrum	L2(Understand)	PO1, PO2, PO3, PO4, PO12	PSO1, PSO2
C203.3	**Solve** electrical network problems using differential equation and Laplace transform.	L3(Apply)	PO1, PO2, PO3, PO4, PO12	PSO1, PSO2
C203.5	**Solve** the electrical problems with two port network representation and transient responses	L3(Apply)	PO1, PO2, PO3, PO4, PO12	PSO1, PSO2
COURSE OVERALL PO/PSO MAPPING: PO1, PO2, PO3, PO5, PO12, PSO1, PSO2				

MAPPING OF CO WITH PO/PSO (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**):**

S.NO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C203.1	3	2	-	1	-	-	-	-	1	1	-	1	1	1
C203.2	3	2	1	1	-	-	-	-	1	1	-	1	1	1
C203.3	3	2	1	1	-	-	-	-	1	1	-	1	1	1
C203.4	3	2	1	1	-	-	-	-	1	1	-	1	1	1
C203.5	3	2	1	1	-	-	-	-	1	1	-	1	1	1
C203*	3	2	1	1	-	-	-	-	1	1	-	1	1	1

** For Entire Course, PO /PSO Mapping; 1 (Low); 2(Medium); 3(High) Contribution to PO/PSO*

JUSTIFICATION FOR MAPPING

S. NO.	PO/PSO MAPPED	LEVEL OF MAPPING	JUSTIFICATION
C314.1	PO1, PO2, PO4, PO12, PSO1, PSO2	3, 2, 2, 1,1,1	**Students can calculate** circuit parameters by using mesh and node analysis including the matrix approach..
C314.2	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	3, 2, 1,1,1,1,1	**Students can solve** complex electrical circuit problems using network theorems.
C314.3	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	3, 2, 1,1,1,1,1	**Students can explain** the different types of Fourier Series and Fourier Transformation along with the Spectrum
C314.4	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	3, 2, 1,1,1,1,1	**Students can solve** electrical network problems using differential equation and Laplace transform.
C314.5	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	3, 2, 1,1,1,1,1	**Students can solve** the electrical problems with two port network representation and transient responses

Dr. Vedatrayee Chakraborty

GAP WITHIN THE SYLLABUS AND MAPPING TO CO, PO/PSO

Sl. No.	Topic	Proposed Actions	CO	PO/ PSO	Level of Mapping
1	Graph theory Magnetic coupling	Guest lecture/NPTEL/ Assignment/ Web resources	5	PO1, PO2, PO12, PSO1, PSO2	3, 2, 1, 3, 2

WEB SOURCE REFERENCES:

1	https://chemiitm.files.wordpress.com/2012/09/electrical-circuit-theory-and-technology-second-edition-revised-edition-john-bird-by-censored.pdf
2	https://upload.wikimedia.org/wikipedia/commons/f/f8/Circuit_Theory.pdf
3	http://bank.engzenon.com/download/54d9982d-b904-4b3e-8c06-79f7c0feb99b/Fundamentals_Of_Electric_Circuits-5th-Edition.pdf
4	http://fmcet.in/SH/EE6201_sq.pdf

JOURNAL REFERENCES:

S.NO.	JOURNAL NAME	ISSN
1	International Journal of Circuit Theory & Applications	0098-9886, 1097-007X
2	IEEE Transactions on Circuits and Systems I	1549-8328

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK AND TALK, CLASS ROOM DISCUSSION	☑ STUD. ASSIGNMENT	☐ WEB RESOURCES	☐ NPTEL/OTHERS
☑ LCD/SMART BOARD /PROJECTOR	☐ STUD. SEMINARS	☐ ADD-ON COURSES	☐ WEBNIARS

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

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Prepared by **Approved by**

Dr. Vedatrayee Chakraborty **Dr. Ivy Majumdar, HOD (ECE)**

COURSE OUTCOMES – ASSESSMENT METHODOLOGY/PLAN SHEET

COURSE OUTCOMES – ASSESSMENT METHODOLOGY/PLAN SHEET

Course Outcome C203.1 Students can calculate circuit parameters by using mesh and node analysis including the matrix approach.

Supporting Student Activities:
- Class Discussion

Assessment Methodology:
- Questions asked on facts based on fundamental laws.
- Questions asked to explain electrical circuits based on network laws.

Course Outcome C203.2: Students can solve complex electrical circuit problems using network theorems

Supporting Student Activities:
- Class Discussion
- Modeling of problem solving in class
- Practice problem solving in groups
- Practice problem solving at home

Assessment Methodology:
- Questions given asking to simply complex electrical circuits using network theorems
- Questions given asking to solve problems on electrical circuits with dc, ac and dependent sources

Course Outcome C203.3: Students can explain the different types of Fourier Series and Fourier Transformation along with the Spectrum

Supporting Student Activities:
- Class Discussion
- Practice problem solving in class
- Practice problem solving in groups
- Practice problem solving at home
- Demonstration of application to real world situations

Assessment Methodology:
- Questions given asking to solve electrical circuits using Fourier transform
- Questions given asking to solve electrical networks using Fourier Series

<u>Course Outcome C203.4:</u> Students can solve electrical network problems using differential equation and Laplace transform.
<u>Supporting Student Activities:</u> • Class Discussion • Modeling of problem solving in class • Practice problem solving in groups • Practice problem solving at home • Demonstration of application to real world situations **<u>Assessment Methodology:</u>** • Questions given asking to represent complex circuits using two-port network • Questions given asking to design an appropriate circuit for a given problem
<u>Course Outcome C203.5:</u> Students can solve the electrical problems with two port network representation and transient responses
<u>Supporting Student Activities:</u> • Class Discussion • Modeling of problem solving in class • Practice problem solving in groups • Practice problem solving at home • Demonstration of application to real world situations **<u>Assessment Methodology:</u>** • Questions given asking to represent complex circuits using two-port network • Questions given asking to design an appropriate circuit for a given problem

Prepared by
Dr. Vedatrayee Chakraborty

Institute calendar

LESSON PLAN

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Lesson Plan for Network Theory (EC 304)

Academic Year: 2022-23

Lecture/ Tutorial No.	Topics to be Covered	Text/ References	TA	Teaching Methodology
L1	Familiarization of the students with Institute and Department Vision, Mission, PEOs, POs, PSOs, COs and Course Overview	------------	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L2	Fundamentals of AC	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L3	Kirchhoff's Current law, Formulation of Node equations and solutions, driving point admittance, transfer Admittance	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L4	Supernode analysis	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L5	Nodal analysis by Cramer's rule	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L6	Kirchhoff's Voltage law, Formulation of mesh equations, Solution of mesh equations by Cramer's rule and matrix method, Driving point impedance, Transfer impedance	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L7	Solution to mesh equations	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L8	Supermesh analysis	T1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L9	Mesh analysis by Cramer's rule	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L10	Network theorems: Superposition theorem and related problems	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L11	Thevenin's theorem, Norton's theorem and related problems	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**

L12	Reciprocity theorem, Compensation theorem and related problems	T1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L13	Maximum power transfer theorem, Millman's theorem, Star delta transformation and related problems	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L14	Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform,	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L15	Waveform analysis by Fourier Series, Fourier transform	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L16	Laplace transform: Concept of complex frequency, Transform of f(t) into F(s), Transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L17	Properties of Laplace transform: Linearity, real differentiation, real integration, initial value theorem and final value theorem	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L18	Inverse Laplace transform: Partial fraction expansion, Heaviside's expansion theorem	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L19	Applications of Laplace transform in circuit analysis, Problems and solutions	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L20	Applications of Laplace transform in circuit analysis, Problems and solutions	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L21	Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L22	h-parameters, Relationship between parameter sets, Network functions for ladder network and general network	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L23	Series resonant circuits: impedance and admittance characteristics, Selectivity curve, Quality factor, Half power points, Bandwidth,	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L24	Phasor diagrams, Transform diagrams	T1, T2, R1	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**

L25	Parallel resonant circuits: impedance and admittance characteristics, Quality factor, Half power points, Bandwidth, Phasor diagrams, Transform diagrams	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L26	Driving points and transfer functions poles and zeros of immittance function, their properties	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L27	sinusoidal response from pole-zero locations, Stability analysis, Routh-Hurwitz	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L28	introduction of pass, low pass, high pass and band reject filters.	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L29	Basic idea of Circuit Synthesis,	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L30	Cauer & foster forms, examples	T1, T2	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L31	Discussions on previous year questions and model questions	University questions	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L32	Discussions on model questions and model questions	University questions	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**
L33	Discussions on model questions and model questions	University questions	**GGB, LCD Projector, Chalk, Duster**	**Lecture, PPT**

Text Books:

1. A. Sudhakar & S. S. Palli, Circuits & Networks: Analysis & Synthesis, 5/e, Tata Mc-Graw Hill
2. A. Chakrabarti and S,P Ghosh , Circuit Theory (Analysis & Synthesis), 6/e, Dhanpat Rai & Co.

Reference Books:

1. C. K. Alexander & M. N. O. Sadiku, Fundamentals of Electric Circuit, 5/e, Mc-Graw Hill
2. J. Bird, Electrical Circuit Theory and Technology, 2/e, Newnes
3. W. H. Hayt Jr., J. E. Kemerly & S. M. Durbin, Engg Circuit Analysis, 8/e, Tata McGraw-Hill

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Dr. Vedatrayee Chakraborty

LIST OF POWER POINT PRESENTATIONS

INTERNAL QUESTION PAPERS WITH KEY

B. P. PODDAR INSTITUTE OF MANAGEMENT & TECHNOLOGY

Class Test / B.TECH/ ECE(NEW)/ SEM 3/ EC304/ 2022

Network Theory

Time Allotted: 45 minutes **Full Marks: 25**

OUTCOME BASED EDUCATION (OBE)			
Question No.	**Knowledge Domain**	**Allotted Marks**	**COs**
1	Understand	5	4 , 5
2 , 3 , 4	Apply	10	4
5 , 6 , 7	Apply	10	5

GROUP–A: Answer of the following.(**any five**) 5 X 1= 5

1.(i) . Find the Laplace transform of ramp function r (t) = t.

(a) $1/s$ (b) $1/s^2$ (c) $1/s^3$ (d) $1/s^4$

(ii) Which among the following represents the precise condition of reciprocity for transmission parameters?

(a) AB - CD = 1 (b) AD – BC = 1 (c) AC – BD = 1 (d) None of the above

(iii) Inductor does not allow sudden change of ________________________

(a) voltage (b) power (c) current (d) none of these

(iv) Poles of the transfer function given as $Z(s) = \frac{(s+4)(s+1)}{(s+2)(s+3)(s+5)}$

(a) 4 and 1 (b) − 4 and −1 (c) 2, 3 and 5 (d) − 2, −3 and − 5

(v) The parameters Y_{11}, Y_{12}, Y_{21}, Y_{22} are called?

(a) Open circuit impedance parameters (b) Short circuit admittance parameters

(c) Inverse transmission parameters (d) Transmission parameters

(vi) If the poles or zeros are not repeated, then the function is said to be having ___________ poles or ________ zeros.

(a) simple, multiple (b) multiple, simple (c) simple, simple (d) multiple, multiple

Group-B

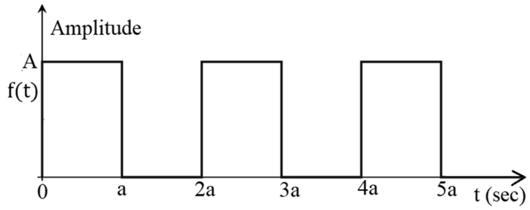
(Short Answer Type Questions)

Answer **any four** the following: 4 X 5=20

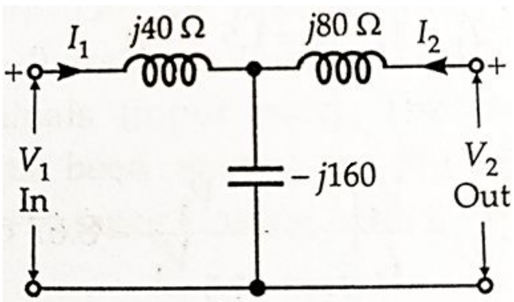
2. A function in Laplace domain is given by, $M(s) = \frac{2s+1}{(s+1)(s+2)(s+3)}$. Find M(t) .

3. An RC (R=1 Ω, C=5 µF) series circuit connected to a dc voltage source (10 V) is switched on by closing a key at t=0. Apply Laplace transform to find i(t). Assume initial charge on the capacitor, Q_0= -250 µC.

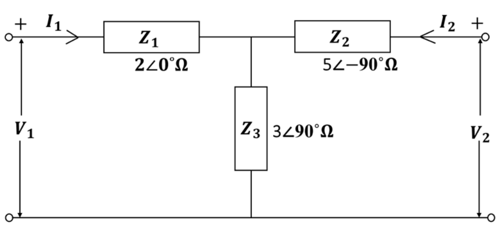
4. Obtain the Laplace Transform of the following wave.



5. Open Circuit Impedance parameter of the circuit is



6. Find Z parameters for the network shown in figure.



7. Check whether the following polynomial is Hurwitz or not.

$$s^4 + s^3 + 2s^2 + 3s + 2 = 0$$

Solution of Class Test

1.(i) **Find the Laplace transform of ramp function r (t) = t.**
(a) $1/s$ (b) $1/s^2$ (c) $1/s^3$ (d) $1/s^4$
(ii)**Which among the following represents the precise condition of reciprocity for transmission parameters?**
(a) AB - CD = 1 (b) AD – BC = 1 (c) AC – BD = 1 (d) None of the above
(iii) **Inductor does not allow sudden change of ________________________**
(a) voltage (b) power (c) current (d) none of these
(iv) **Poles of the transfer function given as Z(s) =** $\frac{(s+4)(s+1)}{(s+2)(s+3)(s+5)}$
(a) 4 and 1 (b) -4 and -1 (c) 2, 3 and 5 (d) $-2, -3$ and -5
(v) **The parameters Y_{11}, Y_{12}, Y_{21}, Y_{22} are called?**
(a) Open circuit impedance parameters (b) Short circuit admittance parameters
(c) Inverse transmission parameters (d) Transmission parameters
(vi) **If the poles or zeros are not repeated, then the function is said to be having __________ poles or _________ zeros.**
(a) simple, multiple (b) multiple, simple (c) simple, simple (d) multiple, multiple

Group-B
(Short Answer Type Questions)

Answer **any four** the following: 4 X 5=20

2. A function in Laplace domain is given by, $F(s) = \frac{2s+1}{(s+1)(s+2)(s+3)}$. Find Laplace inverse F(t) .

Sol: $F(s) = \frac{2s+1}{(s+1)(s+2)(s+3)}$

$$= \frac{k_1}{(s+1))} + \frac{k_1}{(s+2)} + \frac{k_1}{(s+3)}$$

$$k_1 = (s+1)F(s)|_{s=-1}$$

$$= \frac{(s+1)(2s+1)}{(s+1)(s+2)(s+3)}|_{s=-1}$$

$$= \frac{(2s+1)}{(s+2)(s+3)}|_{s=-1}$$

$$= -\frac{1}{2}$$

$$k_2 = (s+2)F(s)|_{s=-2}$$

$$= \frac{(s+2)(2s+1)}{(s+1)(s+2)(s+3)}|_{s=-2}$$

$$= \frac{(2s+1)}{(s+1)(s+3)}\Big|_{s=-2}$$

$$= 3$$

$$k_3 = (s+3)F(s)|_{s=-3}$$

$$= \frac{(s+1)(2s+1)}{(s+1)(s+2)(s+3)}\Big|_{s=-3}$$

$$= \frac{(2s+1)}{(s+1)(s+2)}\Big|_{s=-3}$$

$$= -\frac{5}{2}$$

$$F(s) = \frac{2s+1}{(s+1)(s+2)(s+3)}$$

$$= \frac{\left(-\frac{1}{2}\right)}{(s+1)} + \frac{3}{(s+2)} + \frac{\left(-\frac{5}{2}\right)}{(s+3)}$$

$$= -\frac{1}{2}\frac{1}{(s+1)} + 3\frac{1}{(s+2)} - \frac{5}{2}\frac{1}{(s+3)}$$

F(t)= $-\frac{1}{2}e^{-t} + 3e^{-2t} - \frac{5}{2}e^{-3t}$

3. An RC (R=1 Ω, C=5 µF) series circuit connected to a dc voltage source (10 V) is switched on by closing a key at t=0. Apply Laplace transform to find i(t). Assume initial charge on the capacitor, Q_0= -250 µC.

Sol: $i(t)\times 1 + \frac{1}{5\times 10^{-6}}\int i(t)dt = 10$

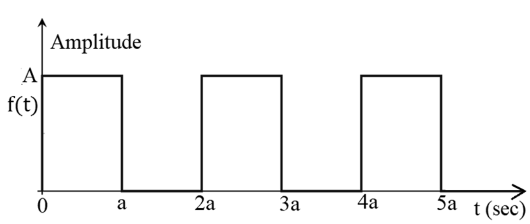
Taking Laplace transform,

$$I(s) + \frac{I(s)}{5\times 10^{-6}s} - \frac{250\times 10^{-6}}{5\times 10^{-6}s} = \frac{10}{s}$$

or, $I(s) = \frac{60}{s+2\times 10^5}$

or, $i(t) = 60e^{-2\times 10^5 t}$ A

4. Obtain the Laplace Transform of the following wave.



Sol:

$f(t) = \{Au(t) - Au(t-a)\} + \{Au(t-2a) - Au(t-3a)\} + \{Au(t-4a) - Au(t-5a)\}$

$F(s) = \frac{A}{s} - \frac{A}{s}e^{-as} + \frac{A}{s}e^{-2as} - \frac{A}{s}e^{-3as} + \frac{A}{s}e^{-4as} - \frac{A}{s}e^{-5as} + \ldots$

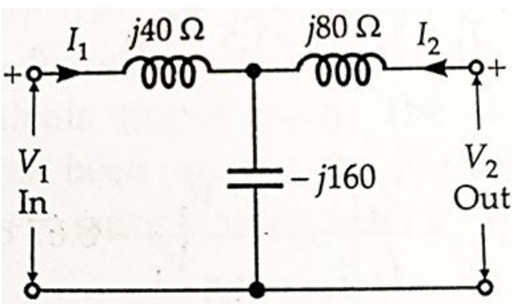
$= \frac{A}{s}(1 - \quad e^{-as}(1 - \ e^{-as}(1 - e^{-as} + e^{-2as} - e^{-3as} + \cdots)) \quad)$

$= \frac{A}{s}\left(1 - \quad e^{-as}\left(\frac{1}{1+e^{-as}}\right)\right)$

$= \frac{A}{s}\left(\frac{1+e^{-as} - e^{-as}}{1+e^{-as}}\right)$

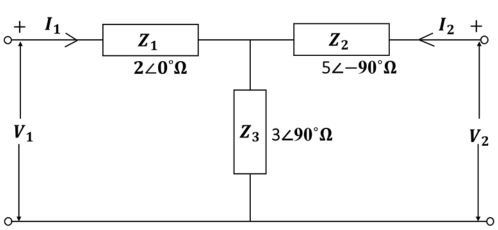
$= \frac{A}{s}\left(\frac{1}{1+e^{-as}}\right)$

5. Open Circuit Impedance parameter of the circuit is



Sol: $z_{11} = -j\,120 \;\; ohms\,, z_{21} = -j160\; ohms, \;\; z_{12} = -j160\; ohms, \;\; z_{22} = -j\,80\; ohms$

6. Find Z parameters for the network shown in figure.



Sol: $z_{11} = 2\angle 0^\circ + 3\angle 90^\circ = 2 + 3j = 3.605\angle 56^\circ \quad \Omega$

$z_{12} = 3j = 3\angle 90^\circ \quad \Omega$

$z_{21} = 3j = 3\angle 90^\circ \quad \Omega$

$z_{22} = -5j + 3j = -2j = 2\angle -90^\circ \quad \Omega$

7. Check whether the following polynomial is Hurwitz or not.

$$s^4 + s^3 + 2s^2 + 3s + 2 = 0$$

Sol: Since the continued fraction contains negative quotients, hence the polynomial is not Hurwitz.

Scheme of Evaluation

Solution of Group A : b, b, c ,d ,b, c

2.

Description	**Marks awarded**	**Knowledge level attained**
If conversation formulae is correct	1	Remember
If by parts are correct	1+1+1	Understand
If final result is correct	1	Apply

3.

Description	**Marks awarded**	**Knowledge level attained**
If KVL formulae is correct	1	Understand
If application of Laplace is correct	1	Apply
If solution of algebraic equation is correct	1	Understand
If inverse Laplace is correct	1	Apply
If final result is correct	1	Apply

4.

Description	**Marks awarded**	**Knowledge level attained**
If expression of waveform is correct	1	Understand
If application of Laplace is correct	3	Apply
If final result is correct	1	Apply

5.

Description	**Marks awarded**	**Knowledge level attained**
If KVL formulae is correct	1	Understand
If calculation of the z parameters are correct	3	Apply
If final result is correct	1	Apply

6.

Description	**Marks awarded**	**Knowledge level attained**
If KVL formulae is correct	1	Understand
If calculation of the z parameters are correct	3	Apply
If final result is correct	1	Apply

7.

Description	**Marks awarded**	**Knowledge level attained**
If the array formation is correct	2	Understand
If the sign change is correctly observed	1.5	Apply
If the comment is correct	1.5	Apply

PROBLEM SHEET WITH KEY

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Problem Sheet / B.TECH/ ECE(NEW)/ SEM 3/ EC304/ 2022

Last Date of Submission: 25/08/2022

Course Name: Network Theory (EC 304)

Total marks: 25

1. Find the current through the 5 Ω resistor is shown in Fig 1.

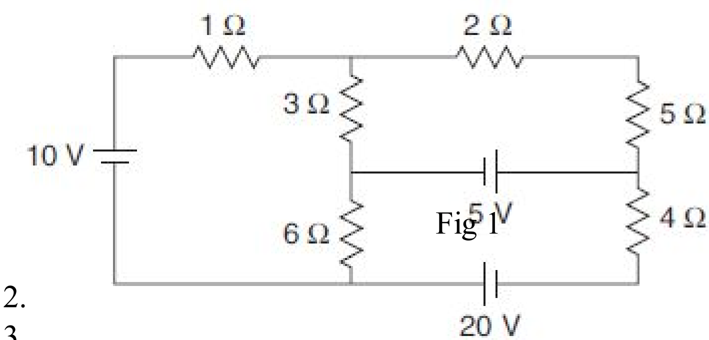


Fig 1

2.
3.
4.
5.
6. Find Thevenin's equivalent network of Fig. 2

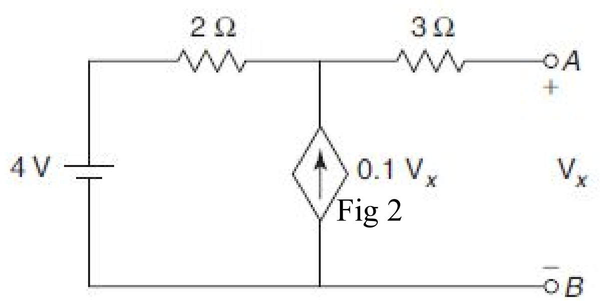


Fig 2

7. For the network shown in the fig3, find the value of Z_L to which the maximum power is delivered. Hence find the value of the maximum power.

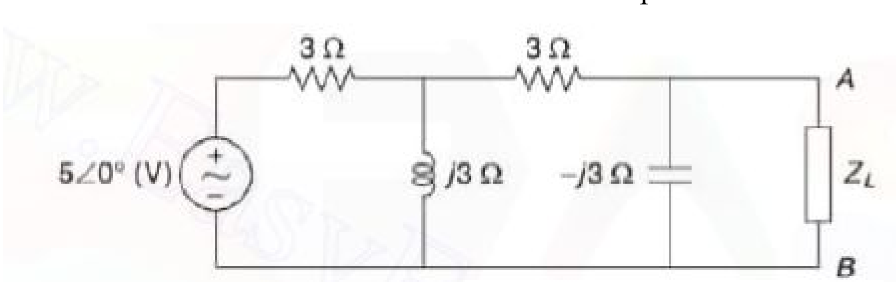


Fig 3

8. Resolve the waveform shown in the fig4 into odd and even components and plot two components.

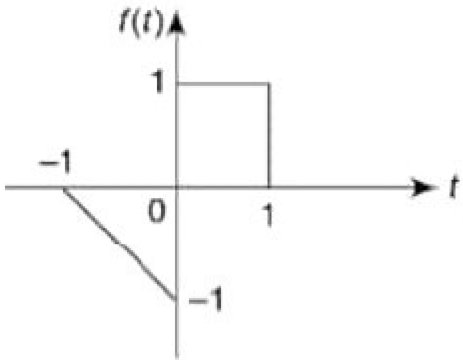


Fig 4

9. Find the Fourier transform of a single triangular pulse shown in the fig5 and draw the continuous spectra.

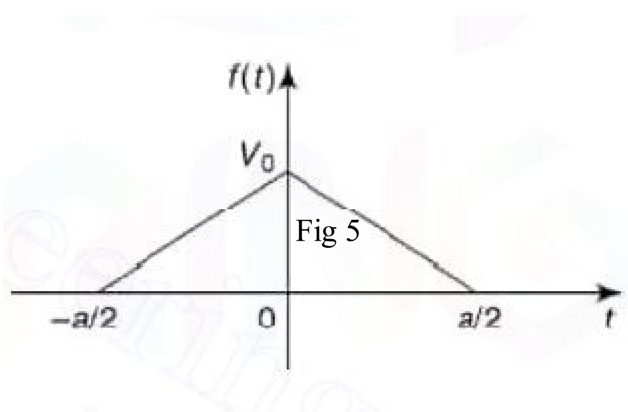
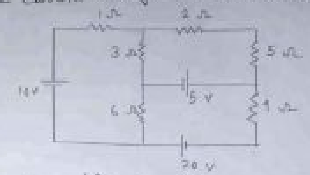


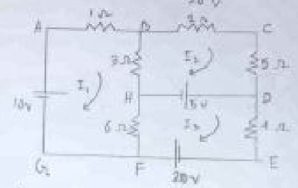
Fig 5

Solution

1. Find the current through the 5Ω resistor in shown fig 1



Sol –



For mesh ABHFGA, By applying KVL we get

$10 - I_1 - 3(I_1 - I_2) - 6(I_1 - I_3) = 0$

$\Rightarrow -10I_1 + 3I_2 + 6I_3 = -10$ —— (i)

For mesh BCDHB, By applying KVL we get

$-5 - 3(I_2 - I_1) - 2I_2 - 5I_2 = 0$

$\Rightarrow 3I_1 - 10I_2 = 5$ —— (ii)

For mesh HDEFH, By applying KVL we get

$20 - 6(I_3 - I_1) + 5 - 4I_3 = 0$

$\Rightarrow 6I_1 - 10I_3 = -25$ —— (iii)

Now, we solve (i), (ii), (iii) equation

$-10I_1 + 3I_2 + 6I_3 = -10$

$3I_1 - 10I_2 = 5$

$6I_1 - 10I_3 = -25$

$3I_1 - 10I_2 = 5$

$\Rightarrow 3I_1 - 5 = 10I_2$

$\Rightarrow I_2 = \frac{1}{10}(3I_1 - 5)$

$6I_1 - 10I_3 = -25$

$\Rightarrow 6I_1 + 25 = 10I_3$

$\Rightarrow I_3 = \frac{1}{10}(6I_1 + 25)$

Substituting the value of I_2 and I_3 we get,

$-10I_1 + \frac{3}{10}(3I_1 - 5) + \frac{6}{10}(6I_1 + 25) = -10$

$\Rightarrow \frac{-100I_1 + 9I_1 - 15 + 36I_1 + 150}{10} = -10$

$\Rightarrow -55I_1 + 135 = -100$

$\Rightarrow -55I_1 = -235$

$\therefore I_1 = \frac{235}{55}$

$= 4.27\ A$

$I_2 = \frac{1}{10}(3 \times 4.27 - 5)$

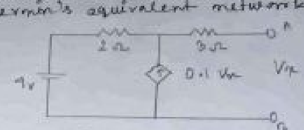
$= 0.78\ A$

$I_3 = \frac{1}{10}(6 \times 4.27 + 25)$

$= 5.06\ A$

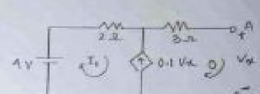
Current through 5Ω resistor is 0.78 A

2. Find Thevenin's equivalent network of fig 2.



Sol – To determine V_{oc},

$V_{oc} = V_x$, Applying KVL,



$+V_x - 4 + 2I_1 + 0 \times 3 = 0$

$\Rightarrow V_x - 4 + 2(-0.1V_x) = 0$

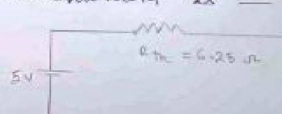
$\Rightarrow V_x(1 - 0.2) = 4$

$\Rightarrow V_x = \frac{4}{0.8} = 5\ V = V_{oc}$

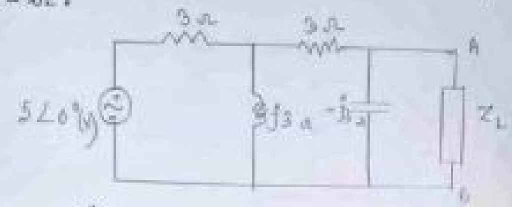
To determine i_{sc}, $i_{sc} = \frac{4V}{5\Omega} = 0.8A$

$R_{th} = \frac{V_{oc}}{i_{sc}} = \frac{5\ V}{0.8\ A} = 6.25\ \Omega$

Thevenin equivalent is —



3. For the network shown in the fig 3, find the value of Z_L to which the maximum power is delivered. Hence find the value of the maximum power.



Sol — with respect to terminals A and B, the Thevenin voltage is

$$V_{th} = \frac{5\angle 0^\circ}{3 + \frac{j3(3-j3)}{3-j3+j3}} \times \left(\frac{j3}{3+j3-j3}\right)$$

$$= \frac{15\angle 0^\circ}{18+j9} = 2.236\angle -26.56^\circ \,(V)$$

and thevenin impedance,

$$Z_{th} = \frac{\left(3+\frac{3\times j3}{3+j3}\right)\times(-j3)}{3+\frac{3\times j3}{3+j3}-j3} = 3\angle -53.12^\circ \,\Omega$$

$$= (1.8 - j2.4)\,\Omega$$

For maximum power transfer, $Z_L = Z_{th}^{*}$

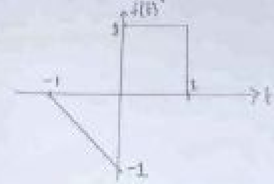
$$= (1.8 + j2.4)\,\Omega$$

∴ Current, $I = \frac{2.236\angle -26.56^\circ}{1.8\times 2} = 0.621\angle -26.56^\circ A$

The value of the maximum power is,

$$P_{max} = \frac{(V_{th})^2}{4R} = \frac{(2.236)^2}{4\times 1.8} = 0.694\,W$$

4. Resolve the waveform shown in the fig. 4 into odd and even components and plot two components.



Sol — Let $f_o(t)$ and $f_e(t)$ be respectively the odd and even parts of $f(t)$.

$$\therefore f(t) = f_e(t) + f_o(t) \quad \text{---(i)}$$

$$f(-t) = f_e(-t) + f_o(-t) = f_e(t) - f_o(t) \quad \text{---(ii)}$$

Solving (i) and (ii); $f_e(t) = \frac{1}{2}[f(t) + f(-t)]$

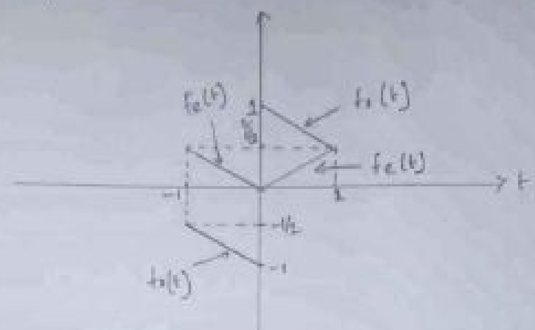
and $f_o(t) = \frac{1}{2}[f(t) - f(-t)]$

For the given waveform,

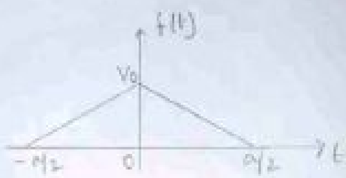
$f(t) = 1;\ 0 < t < 1$ $\therefore f_e(t) = \frac{1}{2}$

and $f(-t) = (t-1);\ 0 < t < 1$ and $f_o(t) = (1-t/2)$

Thus, the components are,



5. Find the Fourier transform of a single triangular pulse shown in the fig 5 and draw the continuous spectra.



Sol — The wave is, $f(t) = V_0\left[1 - \frac{2}{a}|t|\right]$

i.e. $f(t) = V_0\left[1 - \frac{2}{a}t\right]$; for $t > 0$

and $f(t) = V_0\left[1 + \frac{2}{a}t\right]$; for $t < 0$

$$\therefore F(j\omega) = \int_{-\infty}^{\infty} f(t)\, e^{-j\omega t}\, dt = \int_{-\infty}^{\infty} V_0\left[1 - \frac{2}{a}|t|\right] e^{-j\omega t}\, dt$$

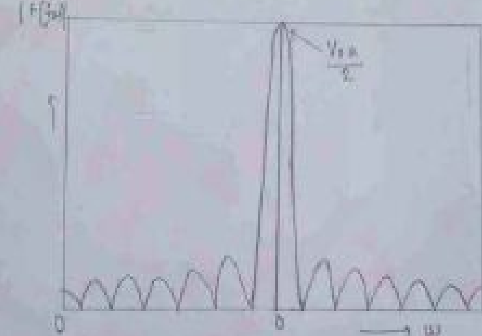
$$= V_0 \int_{-a/2}^{a/2} e^{-j\omega t}\, dt - \frac{2V_0}{a} \int_{-a/2}^{a/2} |t|\, e^{-j\omega t}\, dt$$

Bringing it into standard form,

$$F(j\omega) = \frac{V_0 a}{2} \frac{\sin^2\left(\frac{\omega a}{4}\right)}{\left(\frac{\omega a}{4}\right)^2}$$

Its continuous amplitude spectrum is shown. The first zero occurs when, $\frac{\omega a}{4} = \pi$ i.e. $\omega = \frac{4\pi}{a}$

Spectra



Scheme of Evaluation (Problem Sheet)

1.

Description	**Marks to be awarded**	**Knowledge level attained**
If the correct formulae is applied	2	Understand
If the correct calculation is done	2	Apply
If final result is obtained	1	Apply

2.

Description	**Marks to be awarded**	**Knowledge level attained**
If the correct formulae is applied	2	Understand
If the correct calculation is done	2	Apply
If final result is obtained	1	Apply

3.

Description	**Marks to be awarded**	**Knowledge level attained**
If the correct formulae is applied	2	Understand
If the correct calculation is done	2	Apply
If final result is obtained	1	Apply

4

Description	**Marks to be awarded**	**Knowledge level attained**
If the correct formulae for the waveform is applied	2	Understand
If the correct derivation is done	2	Apply
If final result is obtained	1	Apply

5.

Description	**Marks to be awarded**	**Knowledge level attained**
If the correct formulae for the waveform is applied	2	Understand
If the correct derivation is done	2	Apply
If final result is obtained	1	Apply

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Course Name: Network Theory (EC 304)

Weak Students based on marks of CA1

University Roll No.	Name	Surname
11500321024	SOURAB	GUPTA
11500321083	RITAM	SANTRA

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Course Name: Network Theory (EC 304)

Bright Students based on marks of CA1

University Roll no.	First name	Surname
11500321007	SAGAR	KEWAT
11500321051	RITAM	SAHA
11500321056	RITAMA	ROY
11500321066	SOUMADEEP	GHOSH
11500321070	SHRESTHA	DAS

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Course Name: Network Theory (EC 304)

Weak Students based on average marks of CA2 & CA3

University Roll	Name	Surname
11500321014	SHIRSHO	MAITY
11500321067	SOUMYAJIT	DEY

B. P. Poddar Institute of Management & Technology

Department of Electronics & Communication Engineering

Course Name: Network Theory (EC 304)

Bright Students based on average marks of CA2 & CA3

University roll	Name	Surname
11500321003	SHASWATI	BISWAS
11500321004	SIDDHARTH	CHATTERJEE
11500321005	SNEHAL	GUPTA
11500321007	SAGAR	KEWAT
11500321010	SUBHANKAR	KOLAY
11500321011	SUBHAJIT	GHOSH
11500321019	SHREYA	DUTTA
11500321020	SRIJA	BHATTACHARYA
11500321023	SOUMI	PAUL
11500321040	UDDIPAN	GHOSH
11500321041	SURAJ	TRIBEDY
11500321042	SANTANU	BANIK
11500321043	USNISHA	PODDAR
11500321050	PRIYANSU	CHATTERJEE
11500321052	RITAM	SAHA
11500321053	SAFALYA	PAN
11500321054	SOUMYABRATA	BANIK
11500321057	RITAMA	ROY
11500321070	SOUMADEEP	GHOSH
11500321072	SOUMYADIP	SINHA RAY
11500321078	SHRESTHA	DAS
11500321079	RIDDHI	AGARWAL
11500321080	SOUMI	DEY
11500321084	SNEHASHIS	PAUL
11500321086	PRIYANSHU	MANDAL
11500321092	ROHIT KUMAR	SHARMA
11500321094	SOHEL	AKTAR
11500321095	SRISTI	CHOWDHURY
11500321101	SNEHA	GHOSH
11500321106	SOHAM	NANDI
11500321108	SHRISTY	KESHRI
11500321123	RAJARSHI	SARKAR
11501621010	RUDRANIL	BISWAS