NETWORK ANALYSIS AND TRANSMISSION LINES (EC302PC)

COURSE PLANNER

I. COURSE OVERVIEW:

Electrical energy occupies the top position in the energy hierarchy. It finds innumerable uses in home, industry, agriculture and even in transport. Electrical energy is a convenient form of energy due to following reasons cheapness, convenient and efficient transmission, easy control, cleanliness, greater flexibility and its versatile form. Hence, the students of engineering and technology should acquire enough knowledge over the subject as well as applications of electrical energy for equipping themselves to the on-going developments in this field. It also deals with the propagation of Electromagnetic (EM) waves through guided and unguided media.

AI. PREREQUISITE:

1. Basic knowledge of R, L and C elements and Electromagnetic wave.
2. Basic Electrical & Electronics Engineering

III. COURSE OBJECTIVE:

1.	To understand the basic concepts on RLC circuits
2.	To know the behaviour of the steady states and transients states in RLC circuits.
3.	To understand the two port network parameters
4.	To study the propagation, reflection and transmission of plane waves in bounded and unbounded media.

IV. COURSE OUTCOME:

S.No	Description	Bloom's Taxonomy Level
1.	Gain the knowledge on basic RLC circuits behaviour.	knowledge (Level 1)
2.	Analyze the Steady state and transient analysis of RLC Circuits.	Analyze (Level 4)
3.	Know the characteristics of two port network parameters.	Analyze (Level 4)
4.	Analyze the transmission line parameters and configurations..	Analyze (Level 4)

V HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems related to Electronics & Communication and Engineering.	2	Assignments
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems related to Electronics & Communication Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Exercises
PO3	**Design/development of solutions**: Design solutions for complex engineering problems related to Electronics & Communication Engineering 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.	3	Assignments, Discussions
PO4	**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.	2	Exercises
PO5	**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.	2	Discussions, Assignments, Seminars
PO6	**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 Electronics & Communication Engineering professional engineering practice.	2	Exercises
PO7	**Environment and sustainability**: Understand the impact of the Electronics & Communication Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2	Discussions, Seminars
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2	-

Program Outcomes		Level	Proficiency assessed by
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Discussions
PO10	**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.	3	-
PO11	**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.	2	Discussions , Seminars
PO12	**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.	2	Prototype, Discussions

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO 1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.	1	Lectures, Assignments
PSO 2	**Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.	2	Tutorials, Assignments
PSO 3	**Successful Career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	2	Seminars, Projects

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VII. SYLLABUS:

UNIT - I

Network Topology, Basic cutset and tie set matrices for planar networks, Magnetic Circuits, Self and Mutual inductances, dot convention, impedance, reactance concept, Impedance transformation and coupled circuits, co-efficient of coupling, equivalent T for Magnetically coupled circuits, Ideal Transformer.

UNIT - II

Transient and Steady state analysis of RC, RL and RLC Circuits, Sinusoidal, Step and Square responses. RC Circuits as integrator and differentiators. 2nd order series and parallel RLC Circuits, Root locus, damping factor, over damped, under damped, critically damped cases, quality factor and bandwidth for series and parallel resonance, resonance curves.

UNIT - III

Two port network parameters, Z, Y, ABCD, h and g parameters, Characteristic impedance, Image transfer constant, image and iterative impedance, network function, driving point and transfer functions – using transformed (S) variables, Poles and Zeros. Standard T, pie, L Sections, Characteristic impedance, image transfer constants, Design of Attenuators, impedance matching network.

UNIT – IV

Transmission Lines - I: Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Equivalent Circuit, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless / Low Loss Characterization, Types of Distortion, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.

UNIT – V

Transmission Lines – II: Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations, Smith Chart – Configuration and Applications, Single Stub Matching.

TEXT BOOKS:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rdEdition, 2000.
2. Networks, Lines and Fields - JD Ryder, PHI, 2nd Edition, 1999.

REFERENCE BOOKS:

1. Engineering Circuit Analysis – William Hayt and Jack E Kemmerly, MGH, 5th Edition, 1993.
2. Electric Circuits – J. Edminister and M.Nahvi – Schaum's Outlines, MCGRAW HILL EDUCATION, 1999.
3. Network Theory – Sudarshan and Shyam Mohan, Mc Graw Hill Education.
4. Electromagnetics with Applications – JD. Kraus, 5th Ed., TMH.
5. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan, 2001, (Tech. India Publications), New Delhi.

UGC-NET Syllabus

Superposition, Thevenin, Norton and Maxim Power transfer theorem, Network elements, Network graphs, Nodal and Mesh analysis, Zero and Poles, Laplace transforms, Time domain response, Image Impedance and Passive filters. Two port Network parameters, Transfer functions, Transient analysis.

GATE SYLLABUS: KCL, KVL, concept of ideal voltage and current sources. Sinusoidal steady state analysis, resonance in electrical circuit. Time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits & 2-port network parameters.

IES SYLLABUS: Circuit elements, KVL and KCL, Resonance circuit, Two-port network: Z, Y & H transmission parameters, Combination of two ports & analysis of two common ports.

VIII. COURSE PLAN (WEEK -WISE):

Session	Week	Unit	Topics	Link for PDF	Link For PPT	Course Learning Outcomes	Reference
1. .	1.	I.	Review of R, L,C	https://drive.google.com/drive/folders/1GNOsnMV3k7p8C0MeTKnD3 aeptCCTkPX-	https://drive.google.com/drive/folders/1GNOsnMV3k7p8C0MeTKnD3 aeptCCTkPX-	**Know** about electrical elements	T1,T2,R1
2.			Review of RC, RL, RLC circuits			**Analyse** RC, RL, RLC circuits	T1,T2,R1
3.			Network Topology,			**Understanding** Network	
			Terminology				
4.			Basic cut set matrix for planar networks			**Define** cut set matrix	T1,T2,R1
5.			Basic tie set matrix for planar networks			**Define tie set** matrix	T1,T2,R1
6.	2.		Magnetic Circuits			**Understanding** Magnetic Circuits	T1,T2,R1
7.			Self and Mutual inductances			**Understanding** mutual inductance	T1,T2,R1
8.			Dot convention			**Know** about Dot convention	T1,T2,R1
9.			Impedance			**Analyse** impedance	T1,T2,R1
10.			reactance concept			**Know** about reactance	T1,T2,R1
11.	3.		Impedance transformation and coupled circuits			**Understanding** coupled circuits	T1,T2,R1
12.			Co-efficient of coupling			**Know** about coupling	T1,T2,R1

13.			Equivalent T for Magnetically coupled circuits			**Understanding** Equivalent T Circuit	T1,T2,R1
14.			Ideal Transformer			**Know** about Ideal Transformer	T1,T2,R1
15.			**Mock Test – 1**			**Know** about unit - 1	T1,T2,R1
16.	**4.**	II.	Steady state and transient analysis of RC Circuits			**Know** about Steady state and transient response	T1,T2,R1
17.			transient analysis of RL and RLC Circuits			**Analyse** transient analysis	T1,T2,R1
18.			transient analysis of RLC Circuits			**Analyse** transient analysis	T1,T2,R1
19.			Circuits with switches			**Understanding** switch circuit	T1,T2,R1
20.			***Tutorial / Bridge Class # 1***				T1,T2,R1
21.	**5.**		Step response			**Analyse** step response	T1,T2,R1
22.			2nd order series and parallel RLC Circuits			**Know** about 2nd order Circuits	T1,T2,R1
23.			Root locus			**Understanding** Root locus	T1,T2,R1
24.			damping factor, over damped, under damped			**Analyse** damped response	T1,T2,R1
25.			**Bridge class-2**				T1,T2,R1
26.	**6.**		Under damped, critically damped cases,			**Analyse** damped response	T1,T2,R1
27.			Resonance curves			**Know** about resonance	T1,T2,R1
28.			Quality factor and bandwidth for series			**Analyse** series resonance circuit	T1,T2,R1
29.			Quality factor and BW for parallel resonance			**Analyse** parallel resonance circuit	T1,T2,R1
30.			**Bridge class-3**				T1,T2,R1
31.	**7.**	III.	Two port network Z parameters			**Know about** Z parameters	T1,T2,R3
32.			Two port network using Y parameters			**Know about** Y parameters	T1,T2,R3
33.			Two port network using ABCD			**Know about** ABCD parameter	T1,T2,R3

			parameters				
34.			Two port network using h parameters			**Know about** h parameter	T1,T2,R3
35.			**Bridge class-4**				T1,T2,R3
36.			Two port network using g parameters			**Know about** g parameter	
37.			Characteristic impedance			**Define** Characteristic impedance	T1,T2,R3
38.	**8.**		Image transfer constant			**Define** Image transfer constant	T1,T2,R3
39.			Image impedance			**Define** Image impedance	T1,T2,R3
40.			***Tutorial / Bridge Class # 5***				T1,T2,R3
41.			iterative impedance			**Define** iterative impedance	T1,T2,R2
42.			network function			**Know about** network function	T1,T2,R2
43.	**9.**		Driving point transfer functions – using transformed (S) variables			**Know about** Driving point transfer functions	T1,T2,R2
44.			Poles and Zeros			**Define** Poles and Zeros	T1,T2,R2
45.			**MID-1**				T1,T2,R2
46.			Standard T, π Sections			**Know about** Standard T, π Sections	T1,T2,R2
47.			Standard L Section			**Know about** Standard L Sections	T1,T2,R2
48.	**10**		Characteristic impedance			**Understanding** impedance	T1,T2,R2
49.			image transfer constants			**Understanding** image constants	T1,T2,R2
50.			***Tutorial / Bridge Class # 9***				T1,T2,R2
51			Design of Attenuators			**Synthesis** Attenuators	T1,T2,R2
52	**11**		impedance matching network			**Synthesis** impedance matching n/w	T1,T2,R2
53			T and π Conversion,			**Understanding** T and π Conversion	T1,T2,R2

54			LC Networks and Filters			**Synthesis** filter	T1,T2,R2
55			***Tutorial / Bridge Class # 10***				T1,T2,R2
56	12		Constant K HP Filters			**Know about** constant K Filters	T1,T2,R2
57			Design constant K HP Filters			**Synthesis** HP Filters	T1,T2,R2
58			constant K BP Filters			**Know about** constant K Filters	T1,T2,R2
59			Design constant K BP Filters			**Synthesis** BP Filters	T1,T2,R2
60			Composite filter design.			**Synthesis** composite Filters	T1,T2,R2
I Mid Examinations (Week 9)							
61	**13.**	IV	**Transmission Lines - I** : Transmission line Types, Parameters, Transmission Line Equations	**https://drive.google.com/drive/folders/1GNOsnMV3k7p8C0MeTKnD3ae ptCCTkPX-**	**https://drive.google.com/drive/folders/1GNOsnMV3k7p8C0MeTKnD3ae ptCCTkPX-**	**Understanding**	T1,T2,R2
6 2 62			**Transmission Lines - I** : Transmission line Types, Parameters, Transmission Line Equations Primary & Secondary Constants			**Understanding**	T1,T2,R2
63			Primary & Secondary Constants			**Gathering** Knowledge	T1,T2,R2
64			Primary & Secondary Constants			**Gathering** Knowledge	T1,T2,R2
65			***Tutorial / Bridge Class # 6***				T1,T2,R2
66	**14.**		Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities			**Understanding of** Characteristic Impedance, Propagation Constant, Phase and Group Velocities	T1,T2,R2
67			Expressions for Characteristic			**Compose** the Knowledge	T1,T2,R2

			Impedance, Propagation Constant, Phase and Group Velocities.				
68			Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities,			**Compose** the Knowledge	T1,T2,R2
69			Infinite Line Concepts Losslessness /Low Loss Characterization		**https://drive.google.com/drive/folders/1GNOsnMV3k7p8C0MeTKnD3aeptCCTkPX-**	**Compose** the Knowledge	T1,T2,R2
70			***Tutorial / Bridge Class # 7***				T1,T2,R2
71	**15.**		Infinite Line Concepts Losslessness /Low Loss Characterization			**Gathering** Knowledge	T1,T2,R2
72			Distortion – Condition for Distortion lessness Minimum Attenuation, Loading - Types of Loading.			**Gathering** Knowledge	T1,T2,R2
73			Distortion – Condition for Distortion lessness Minimum Attenuation, Loading - Types of Loading.			**Compose** the Knowledge	T1,T2,R2
74			***Tutorial / Bridge Class # 8***				T1,T2,R2
75	**16**	**V**	**Transmission Lines – II:** Input Impedance Relations				T1,T2,R1
76			SC and OC Lines, Reflection Coefficient, VSWR	**ders/1GN OsnMV3k**		Knowledge of Reflection Coefficient, VSWR	T1,T2,R1
77			SC and OC Lines, Reflection			**Gathering** Knowledge	T1,T2,R1

			Coefficient, VSWR				
78			***Tutorial / Bridge Class # 9***			**Understanding**	T1,T2,R1
79			UHF Lines as Circuit Elements; λ /4, λ /2, λ /8 Lines			**Understanding**	T1,T2,R1
80			UHF Lines as Circuit Elements; λ /4, λ /2, λ /8 Lines			**Gathering** Knowledge	T1,T2,R1
81	**17**		Impedance Transformations			**Gathering** Knowledge	T1,T2,R1
82			Significance of Z_{min} and Z_{max}			**Compose** the Knowledge	T1,T2,R1
83			***Tutorial / Bridge Class # 10***			**Gathering** Knowledge	T1,T2,R1
84			Smith Chart – Configuration and Applications			**Understanding**	T1,T2,R1
85	**18**		Smith Chart – Configuration and Applications			**Gathering** Knowledge	T1,T2,R1
86			Single Stub Matching,			**Gathering** Knowledge	T1,T2,R1
II Mid Examinations (Week 18)							

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

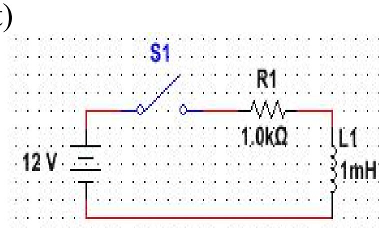
Course Objectives	**Program Outcomes**												**Program Specific Outcomes**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**		**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	2	2	2	2	-	2	-	2	1	1	1	2
CO2	3	1	2	2	1	1	1	-	2	-	2	2	1	1	1
CO3	2	2	3	1	2	2	3	-	1	-	1	1	1	3	3
CO4	2	3	2	2	2	2	2	2	3	3	2	3	2	1	2
Average	2	1.5	2.5	1.5	1.5	1.5	2	2	2	3	2	1.5	1.4	1.5	2
Average (Rounded)	2	2	3	2	2	2	2	2	2	3	2	2	1	2	2

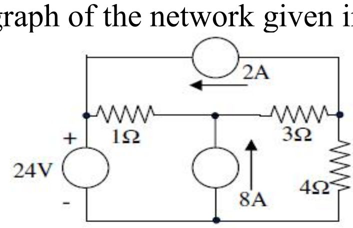
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

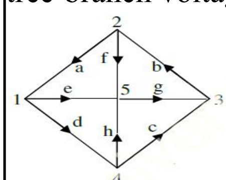
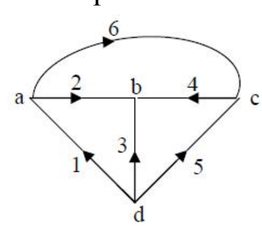
XI. QUESTION BANK (JNTUH)

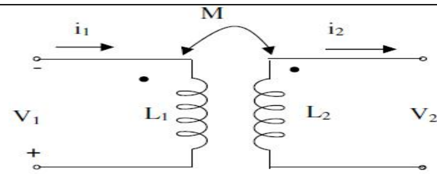
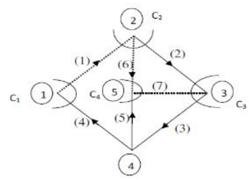
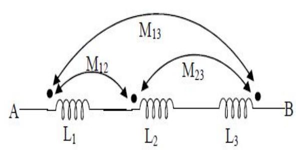
UNIT I

Long Answer Questions-

<table>
<tr><th>S.No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>1.</td><td>If the node-branch reduced incidence matrix is Draw the graph.
$$A = \begin{bmatrix} -1 & 1 & 0 & 0 & 1 & 0 \\ 0 & -1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & -1 & -1 \end{bmatrix}$$</td><td>Analysis</td><td>CO1</td></tr>
<tr><td>2.</td><td>Discuss the transient analysis of RLC series circuit excited by D.C. voltage.</td><td>Comprehension</td><td></td></tr>
<tr><td>3.</td><td>In the following circuit shown in fig-1, switch is closed at time t=0. Obtain the expression for the current i(t)


Discuss the transient analysis of RC series circuit excited by a sinusoidal source.</td><td>Comprehension</td><td>CO1</td></tr>
<tr><td>4.</td><td>Draw the graph of the network given in Figure

</td><td>Application</td><td>CO1</td></tr>
<tr><td>5.</td><td>Draw the oriented graph of a network with fundamental cut-set matrix as shown below:
<table>
<tr><th colspan="4">Twigs</th><th colspan="3">Links</th></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>-1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
</table>
Also find number</td><td>Analysis</td><td>CO1</td></tr>
</table>

	of cut-sets and draw them.		
6.	For a given impedance Z=R+jX , show that conductance $G = \frac{R}{Z^2}$ and suseptance, $B = \frac{X}{Z^2}$, where R and X are resistance and reactance.	Application	CO1
7.	For the network graph shown in figure:2, draw all possible trees. For any one of these trees, prepare a cut-set schedule and obtain the relation between tree-branch voltages and branch voltages. 	Analysis	CO1
8.	Define incidence matrix. For the graph shown in figure:3, find the complete incidence matrix. 	Comprehension	CO1
9.	Explain the procedure for obtaining fundamental cut-set matrix of given network.	Comprehension	CO1
10.	The current in a 15 mH inductor is $i_L = (2 - e^{-1000t})mA$. What is the voltage across inductor?	Application	CO1
11.	The two coupled inductors with L1=1H, L2 =3H and M=0.5H are connected in a circuit with voltages and currents as shown in Figure. If i1=30sin 80t Amp and i2=30 Cos (80t) Amp. Compute (a) V1 (b) V2	Application	CO1

			
12.	Formulate the fundamental cut set matrix for the graph shown in Figure 	Synthesis	CO1
13.	Write the expression for impedance of R-L-C series circuit. When does it have minimum impedance?	Application	CO1
14.	Write the expression for total inductance of the three series connected coupled coils connected between A and B as shown in figure: 1. 	Application	CO1
15.	Draw the graph corresponding to the following incidence matrix. $A = \begin{bmatrix} -1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 & -1 & 1 \\ 0 & 0 & -1 & -1 & 0 & -1 & 0 & -1 \\ 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \end{bmatrix}$	Analysis	CO1

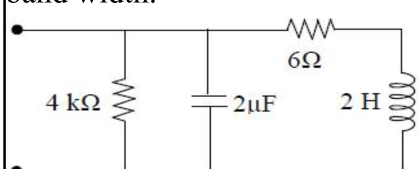
Short Answer Questions-

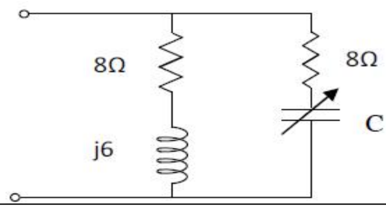
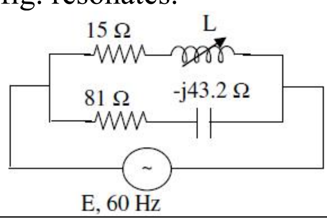
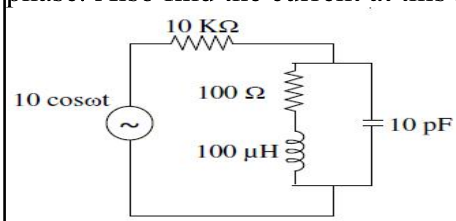
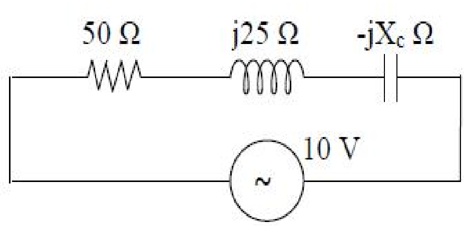
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain Active elements in detail.	Comprehension	CO1
2.	Explain Passive elements in detail.	Comprehension	CO1

3.	List the properties of incidence matrix.	Application	CO1
4.	Write the volt-ampere relations of R, L, C parameters.	Comprehension	CO1
5.	Define graph, node and degree of a node.	Knowledge	CO1
6.	Why the coefficient of coupling in a magnetic circuit is not more than unity.	Knowledge	CO1
7.	Explain the elementary theory of Ideal Transformer?	Comprehension	CO1
8.	Define Tie-set and cut-set.	Knowledge	CO1
9.	Define self and mutual inductance	Knowledge	CO1
10.	Define the following terms a) Tree b) Node c) graph	Knowledge	CO1
11.	A connected graph has 9 branches and 4 branch currents which are independent. Find the number of nodes.	Application	CO1
12.	A sinusoidal voltage $v(t)$ = 20 sin(75t) is applied suddenly to a series RL circuit with R = 20Ω and L = 4 H. Find the instant at which transient current becomes zero.	Application	CO1
13.	Define the quality factor. What is its significance?	Knowledge	CO1
14.	Two identical coupled coils have an equivalent inductance of 80 mH when connected series aiding and 35 mH in series opposing. Find L1, L2, M and K.	Application	CO1
15.	Two coupled coils with respect to self inductances L1 = 0.6 H, L2 = 0.4 H having a K = 0.4. Coil 2 has 100 turns. The current in coil 1 is I1 = 10 sin200t Amperes. Determine the voltage at coil 2 and maximum flux set up by coil 1.	Application	CO1
16.	Explain why current lags the voltage by 900 in case of ideal inductor.	Comprehension	CO1
17.	What is time constant? Explain time constant in case of series RL and series RC .	Comprehension	CO1
18.	For an RC series circuit, a sinusoidal voltage $v(t)$ = Vm sin(ωt+θ) is applied at t = 0. Find the condition for transient free response.	Application	CO1
19.	For an RL series circuit, a sinusoidal voltage $v(t)$ = Vm sinωt is applied at t = 0. Find the expression for transient current.	Application	CO1
20.	A sinusoidal voltage $v(t)$ = 20 sin(75t) is applied suddenly to a series RL circuit with R = 20Ω and L = 4 H. Find the instant at which transient current becomes zero.	Application	CO1

UNIT II

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain the terms bandwidth, Quality factor, and selectivity curve in a series resonant circuit.	Comprehension	CO2
2.	A coil of inductance 10H and 10Ω resistance is connected in parallel with 100pF capacitor. The combination is applied with a voltage of 100. Find the resonant frequency and current at resonance.	Application	CO2
3.	For the network shown in the figure:4, determine (i) Resonance frequency (ii) input admittance at resonance (iii) quality factor (iv) band width. 	Application	CO2
4.	Show that the resonant frequency ω_0 of an RLC series circuit is the geometric mean of ω_1 and ω_2, the lower and upper half-power frequencies respectively.	Application	CO2
5.	For an RC series circuit, a sinusoidal voltage $v(t)$ = Vm sin (wt) *is* applied at t=0. Find the expression for transient current using both differential equation approach and Laplace transforms approach.	Application	CO2
6.	A series RL circuit with R=200 ohms and L= 3H has a sinusoidal voltage source 100 sin (600t +f) applied at time when f = 0. (i) Find the expression for current (ii) At what value of f must the switch is closed so that the current directly enter steady state.	Application	CO2
7.	Find C which results in resonance in the circuit shown in Figure when ω=5000rad/s.	Application	CO2

			
8.	Find the value of L so that the circuit shown in fig. resonates. 	Application	CO2
9.	For the circuit shown in below Figure 4, find the value of ω so that current and source emf are in phase. Also find the current at this frequency. 	Application	CO2
10.	For the circuit shown in figure:1, determine the value of capacitive reactance, impedance and current at resonance. 	Application	CO2
11.	For a series resonant circuit with constant voltage and variable frequency, obtain the frequency at which voltage across the inductor is maximum. Calculate this maximum voltage when R=50 ohms, L=0.05H, C=20μF and V=100 volts.	Application	CO2
12.	In a series RLC circuit, with R = 2 Ω, L = 2 mH, and C = 10 μF. Find the resonant frequency, half power frequencies, bandwidth, quality factor.	Application	CO2
13.	A coil having a resistance of 20 ohms and an inductance of 0.2 H is connected in series with a 50 μF capacitor across a 250 V, 50 Hz supply. Calculate (i) the current (ii) the power (iii) the	Application	CO2

	power factor (iv) the voltage across the coil and capacitor. Draw the phasor diagram showing the current and various voltages.		
14.	Impedances Z2 and Z3 in parallel are in series with impedance Z1 across a 100V, 50 Hz AC supply. Z1=(0.25+j1.25) ohms, Z2=(5+j0) ohms, and Z3=(5-jXC) ohms. Determine the value of the capacitance of XC such that the total current of the circuit will be in phase with the supply voltage. What is then the circuit current and power?	Application	CO2
15.	A series RLC resonant circuit includes 1µF capacitor, a resistance of 16Ω. If the bandwidth is 500 rad/se. Determine: i) wr ii) Q iii) L	Application	CO2
16.	In case of a series resonant circuit with frequency variation, obtain expressions for ω_C at which maximum voltage occurs across C ω_L at which maximum voltage occurs across L and show that $\omega_L > \omega_C$	Application	CO2
17.	A series RLC circuit consists of a resistance of 25Ω, inductance 0.4 H, capacitance of 250 µF is connected a supply of 230V, 50 Hz. Find the total impedance, current, power, power factor, voltage across coil and capacitance.	Application	CO2
18.	Show that the resonant **frequency i**s the geometric mean of two half power frequencies.	Application	CO2

Short Answer Questions-

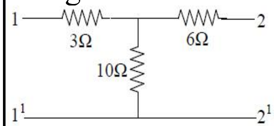
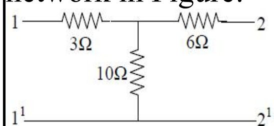
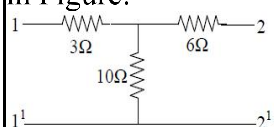
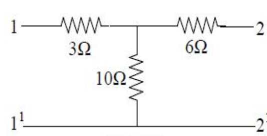
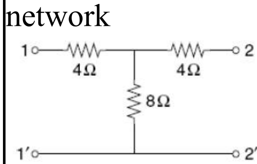
S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	In a parallel RLC circuit, with R = 2 Ω, L = 2 mH, and C = 10 µF. Find the resonant frequency, half power frequencies, bandwidth, quality factor.	Application	CO2 CO2
2.	Explain the procedure to draw the root locus diagram of RLC series circuit when R is	Application	CO2

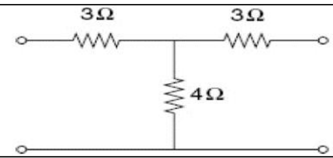
	varying?		CO2
3.	Explain the procedure to draw the root locus diagram of parallel RLC circuit when R is varying?	Application	CO2 CO2
4.	A series RLC circuit with R=100Ω, L = 0.5H, C=40μF has an applied voltage of $100\angle 0^0$ with variable frequency. Calculate the resonance frequency, current at resonance and voltage across R, L, and C. Also calculate the Q-factor, upper and lower cutoff frequencies.	Application	CO2 CO2
5.	Explain the importance of dot convention in coupled circuits.	Application	CO2 CO2
6.	With respect to series resonant circuit, prove that bandwidth is inversely proportional to the Q-factor at resonance.	Application	CO2 CO2
7.	Define resonance and bandwidth.	Knowledge	CO2 CO2
8.	Give the detailed comparison of series and parallel circuits.	Comprehension	CO2

UNIT III

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Derive the relationship between Z parameters and H parameters.	Application	CO3

2.	Write the Z-parameters of the following network in Figure:1  Figure:1	Application	CO3
3.	Derive the relationship between Z parameters and Y parameters.	Application	CO3
4.	Write the Y-parameters of the following network in Figure:  Figure:1	Application	CO3
5.	Derive the relationship between Z parameters and h parameters.	Application	CO3
6.	Write the h-parameters of the following network in Figure:  Figure:1	Application	CO3
7.	Derive the relationship between y parameters and g parameters.	Application	CO3
8.	Write the g-parameters of the following network in Figure:  Figure:1	Application	CO3
9.	What are poles and zeros? What is their significance? Draw the pole-zero plot for the following transfer $T(s)=\frac{s^2+3s+2}{s\left(s^2+2s+2\right)\left(s^2+4s+3\right)}$ function.	Application	CO3
10.	Find the Y & h-parameters of the following network 	Application	CO3
11.	Find Z & Y -parameters	Application	CO3

			
12.	Two two-port networks are connected in series. Prove that the overall impedance parameter matrix is the sum of individual impedance parameters matrices.	Application	CO3
13.	Two two-port networks are connected in parallel. Prove that the overall Admittance parameter matrix is the sum of individual Admittance parameters matrices.	Application	CO3
14.	Draw the standard-T section. Show that standard-T section characteristic impedance $Z_{OT} = \sqrt{\frac{Z_1^2}{4} + Z_1 Z_2}$	Application	CO3
15.	Draw the standard π-Section. Show that standard π-Section characteristic impedance $Z_0 = \frac{Z_1 Z_2}{\sqrt{\frac{Z_1^2}{4} + Z_1 Z_2}}$	Application	CO3
16.	Design an *m*-derived *T*-section (low-pass) filter with a cut-off frequency f_c= 20 kHz, f_∞ = 16 kHz and a design impedance *R* =600 Ω.	Synthesis	CO3
17.	Design a constant *K*-type LPF having a cut-off frequency of 2000 Hz and a zero-frequency characteristic impedance of 200 Ω. Draw *T*- and π-Section of the filter.	Synthesis	CO3
18.	Design a constant *K*-type HPF having a cut-off frequency of 5500 Hz and a design impedance of 750Ω. Draw *T*-section filter and π-Section filter.	Synthesis	CO3
19.	Design an *m*-derived LPF (*T*- and π-Section) having a design impedance of 500Ω and cut-off frequency 1500 Hz and an infinite attenuation frequency of 2000 Hz.	Synthesis	CO3
20.	Design a proto type section on band pass filter having cut-off frequencies of 12kHz and 16 kHz and a design impedance of 600 Ω.	Synthesis	CO3

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	**Write** the Z-parameter equations	Application	CO3
2.	**Write** the Y- parameter equations	Application	CO3
3.	**Write** the H- parameter equations	Application	CO3
4.	**Write** the G- parameter equations	Application	CO3
5.	**Write** the ABCD parameter equations	Application	CO3
6.	**Write** the Z & Y parameters relation	Application	CO3
7.	**Write** the Z & h parameters relation	Application	CO3
8.	**Write** the Z & g parameters relation	Application	CO3
9.	**Write** the Z & ABCD parameters relation	Application	CO3
10.	**Define** network function	Knowledge	CO3
11.	**Define** a filter	Knowledge	CO3
12.	**Define** a Attenuator	Knowledge	CO3
13.	**Define** low pass filter	Knowledge	CO3
14.	**Define** high pass filter	Knowledge	CO3
15.	**Define** band pass filter	Knowledge	CO3
16.	**Define** characteristic impedance	Knowledge	CO3
17.	**Define** image impedance	Knowledge	CO3
18.	**Explain** image transfer constant	Comprehension	CO3
19.	**Compare** the filter characteristics	Analysis	CO3

20.	**Explain** composite filter	Comprehension	CO3

UNIT IV

Long Answer Questions-

S.N	Question	Blooms Taxonomy Level	Course Outcome
1	Obtain the general solution of Transmission line?	Understand	CO4
2	Explain about waveform distortion and distortion less line condition?	Apply	CO4
3	Explain about reflection loss?	Understand	CO4
4	Discuss in details about inductance loading of telephone cables and derive the attenuation constant and phase constant andvelocity of signal transmission (v) for the uniformly loaded cable?	Knowledge	CO4
5	Derive the equation of attenuation constant and phase constant of TL in terms of R,L, C, G?	Understand	CO4
6	Explain in details about the reflection on a line not terminated in its characteristic impedance (z0)?	Knowledge	CO4
7	Explain in following terms (i) Reflection factor (ii) Reflection loss (iii) Return loss	Knowledge	CO4
8	Explain about physical significance of TL?	Understand	CO4
9	Derive the equation for transfer impedance?	Understand	CO4
10	Derive the expression for input impedance of lossless line?	Knowledge	CO4
11	Explain about telephone cable?	Understand	CO4

Short Answer Questions

Sl.. No.	Question	Blooms Taxonomy Level	Course Outcome
1	What is group velocity?	Understand	CO4
2	What is patch loading?	Understand	CO4
3	What do you understand by loading of transmission lines?	Understand	CO4
4	Define Characteristic impedance?	Understand	CO4
5	What is frequency distortion?	Knowledge	CO4
6	Calculate the load reflection coefficient of open and short circuited lines?	Knowledge	CO4
7	Calculate the characteristic impedance for the following line arameters R = 10.4 ohms /km L = 0.00367 H/km C = 0.00835µf /km G = 10.8x10-6 mhos /km	Apply	CO4
8	Define phase distortion?	Understand	CO4
9	Write the equation for the input impedance of a TL?	Knowledge	CO4
10	Define propagation constant?	Knowledge	CO4
11	Write the condition for a distortion less line?	Understand	CO4
12	When does reflection take place on a TL?	Understand	CO4
13	What is transfer impedance? State its expression?	Understand	CO4
14	What is difference between lumped and distributed parameters?	Understand	CO4
15	Draw the equivalent circuit of a TL?	Knowledge	CO4

16	Write the Campbell's formula for propagation constant of a loaded line?	Understand	CO4
17	What is the need for loading?	Understand	CO4
18	Define reflection factor?	Understand	CO4
19	Define reflection loss?	Knowledge	CO4
20	What is meant by reflection co – efficient?	Knowledge	CO4
21	State the properties of infinite line?	Knowledge	CO4

UNIT V

Long Answer Questions

Sl. No.	Question	Blooms Taxonomy Level	Course Outcome
1	Explain about half wave transformer?	Understand	CO4
2	Application of smith chart?		CO4
3	Explain about voltage and current waveform of dissipation less line?	Understand	CO4
4	Derive the expression for the input impedance of the dissipation less line and the expression for the input impedance of a quarter wave line. Also discuss the application of quarter wave line?	Analyse	CO4
5	Explain single stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line?	Understand	CO4
6	Design a single stub match for a load of 150+j225 ohms for a 75 ohms line at 500 MHz using smith chart?	Apply	CO4
7	A 30 m long lossless transmission line with characteristic impedance (zo) of 50 ohm is terminated by a load impedance (ZL) = 60 + j40 ohm. The operating wavelength is 90m. find the input impedance and SWR using smith chart?	Apply	CO4
8	Explain double stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line?	Understand	CO4

9	Explain about Lamda/ 8 wave transformer?	Understand	CO4
10	Explain about properties of smith chart?	Understand	CO4

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Name few applications of half – wave line?	Understand	CO4
2	Find the VSWR and reflection co – efficient of a perfectly matched line with no Reflection from load?	Understand	CO4
3	Explain the use of quarter wave line for impedance matching?	Understand	CO4
4	What is the need for stub matching in transmission lines?	Understand	CO4
5	Why do standing waves exist on TL?	Knowledge	CO4
6	Define Node and antinodes?	Knowledge	CO4
7	What are constant S circles?	Knowledge	CO4
9	What are the advantages of double stub matching over single stub matching?	Knowledge	CO4
11	Derive the relationship between standing wave ratio and reflection co – efficient?	Knowledge	CO4
12	Explain the use of quarter wave line for impedance matching?	Knowledge	CO4
13	Write the expression for the characteristic impedance Ro' of the matching quarter –wave section of the line?	Knowledge	CO4
14	Give the applications of smith chart?	Understand	CO4
15	Define standing wave ratio?	Knowledge	CO4
16	Give the analytical expression for input impedance of dissipation less line?	Understand	CO4

17	Design a quarter wave transformers to match a load of 200 to a source resistance of 500. The operating frequency is 200 MHz?	Understand and apply	CO4
18	Define skin effect?	Understand	CO4

XI. OBJECTIVE QUESTIONS:
JNTUH:
UNIT-1

1. Transient behavior occurs in any circuit when
   a) There are sudden changes of applied voltage b) the voltage source is shorted
   b) The circuit is connected or disconnected from the supply d) all of the above happen
2. The parameter that cannot change instantaneously in a capacitor is
   a) current b) power c) Energy d) voltage
3. When a series RL circuit is connected to a voltage V at t=0,the current passing through the inductor L at $t=0^+$ is
   a) V/R b) infinite c) zero D)V/L
4. A ramp voltage, v (t) =100 volts, is applied to an RC series circuit with R=5kΩ and C=4µF. The maximum output voltage across capacitor is
   a) 0.2 volts b) 2.0 volts c) 10.0 volts d) 50.0 volts
5. The final value theorem is used to find the
   a) Steady state value of system output b) initial value of the system output
   b) Transient behavior of the system output d) none of these
6. The time constant of RL circuit is
   a) L/R b) LR c) L-R D d) L+R
7. Transient behavior occurs in any circuit when
   i. there are sudden changes of applied voltage (b)the voltage source is shorted
   ii. the circuit is connected or disconnected from the supply (d)all of the above happen A capacitor does not allow sudden changes in (a)currents (b)voltages (c)both a and b (d)power
8. The time constant of a series RC circuit is

(a)1/RC (b)R/C (c)RC (d)C/R

9. The transient response occurs

(a)only in R circuits (b) only in L circuits (c) only in C circuits (d)both b and c

10. The final value theorem is used to find the
    i. steady state value of system output (b) initial value of the system output
    ii. transient behavior of the system output (d) none of these
11. Capacitor acts like for the a.c. signal in the steady state

a) openb)closed c) not open not close d) none.

<u>Fill in the blanks:</u>

1. The derivative of a step function is _______________
2. The Laplace transform of a unit step function is _____________

3. The time constant of a series RL circuit is _____________.
4. When a series RL circuit is connected to a voltage v at t=0, the current passing through the L at t=0+is _____________.
5. The time constant of a series RC circuit is

UNIT II:

1. In a series RLC circuit with output taken across C, the poles of the transfer function are located at -a ± jb . The frequency of maximum response is given by

(A) $\sqrt{\beta^2 - \alpha^2}$. (B) $\sqrt{\alpha^2 - \beta^2}$.

(C) $\sqrt{\beta^2 + \alpha^2}$. (D) $\sqrt{\alpha\beta}$.

2. A network function can be completely specified by:

(A) Real parts of zeros **(B)** Poles and zeros
(C) Real parts of poles **(D)** Poles, zeros and a scale factor

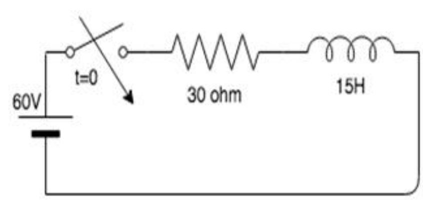
3. In the complex frequency s = s + jw, w has the units of rad/s and s has the units of:

(A) Hz **(B)** neper/s
(C) rad/s **(D)** rad

4. If all the elements in a particular network are linear, then the superposition theorem would hold, when the excitation is

(a) DC only (b) AC only (c) Either Ac or DC (d) An impulse

5. If the switch is opened at t=0, what is the current in the circuit?

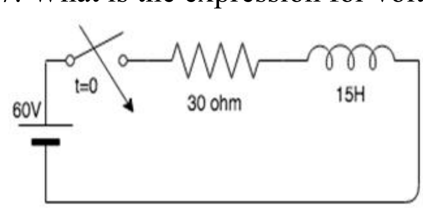


(a) 0A (b) 1A (c) 2A (d) 3A

6. In an RL series circuit, when the switch is closed and the circuit is complete, what is the response?

(a) Response does not vary with time (b) Decays with time (c) Increases with time (d) First increases, then decrease

7. What is the expression for voltage in the given circuit?



(a) $V=60e^{-0.5t}$ (b) $V=30e^{-0.5t}$ (c) $V=60e^{-2t}$ (d) $V=30e^{-2t}$

8. An RL network is one which consists of

(a) Resistor and capacitor in parallel (b) Resistor and capacitor in series (c) Resistor and inductor in parallel (d) Resistor and inductor in series

9. What happens to the MMF when the magnetic flux decreases?

(a) Increases (b) Decreases (c) Remains constant (d) Becomes zero

10. Can we apply Kirchhoff's law to magnetic circuits?

(a) Yes (b) No (c) Depends on the circuit (d) Insufficient information provided

11. The equivalent of the current I in magnetic ohm's law is?

(a) Flux (b) Reluctance (c) MMF (d) Resistance

12. Electric field terminates at

(a) Positive charge (b) Negative charge (c) Neither positive nor negative (d) Both positive and negative

Fill in the blanks:

1. The Steady state value can be calculated using.............
2. Sudden change in voltage is not occurred in which component……………..
3. The transient response occurs in……………………..
4. In…………circuit the admittance and impedance have the same properties.
5. The Q-factor (or figure of merit) for an inductor in parallel with a resistance R is given by……..
6. A field that spreads outwards in all directions is __________
7. Electric field originates at __________
8. The conventional direction of electric field is ________
9. Magnetic field is strong when____________
10. Magnetic field lines form _________ loops from pole to pole.
11. Magnetic field lines seek the path of __________ resistance.

UNIT-3

1. For a two port network to be reciprocal

a)$z_{11}=z_{22}$ b) $y_{21}=y_{22}$ c) $h_{21}= -h_{12}$ d) AD-BC=0

2) The parameter that cannot change instantaneously in a capacitor is

a) current b)power c)energy d)voltage

3) For a two port network to be reciprocal

a)$Z_{11}=Z_{22}$ b)$y_{21}=y_{22}$ c)$h_{21}= -h_{12}$ d)AD-BC=0

4. The condition for a network with Z_1 series impedance and Z_2shunt impedance to have a pass band is

a) $0<Z_1/4Z_2<1$ b) $-1<Z_1/4Z_2<0$ c)Z1-Z2 = 0 d) both a and c

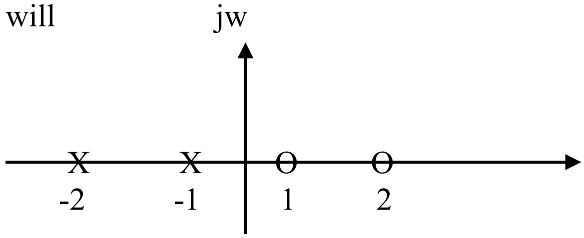
5. A two port network is simply a network inside a black box, and the network has only

a) two terminals b)two pairs of accessible terminals c)two pairs of ports (d)all above

6. As the poles of a network shift away from the axis, the response

a) Remain constant b) becomes less oscillating c) becomes more oscillating d) none of these

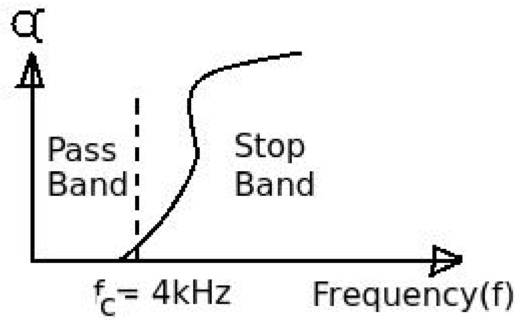
7. The pole-zero configuration of a network function is shown. The magnitude of the transfer function will



8. What is an ideal value of attenuation for the frequencies in pass band especially for a cascade configuration?

a. Zero b. Unity c. Infinity d. Unpredictable

9. Referring to the characteristics of π-section low pass filter given below, what would be the phase shift at 2 kHz in the pass band?



a. 0.7731 radian **b.**1.0471 radian **c.** 2.551 radian **d.** 3.991 radian

10. For a constant k type LPF with T- section, with the cut-off frequency of about 4kHz, what will be the value of stop-band attenuation at 8 kHz?

a. 10.03 dB b. 22.87 dB c. 35.04 dB d. 50.02 dB

11. While designing a constant-k low pass filter (T-section), what would be the value of capacitor if L/2 = 20mH, R_0 = 500 Ω and f_c = 5 kHz?

a. 0.0635 µF **b.** 0.10 µF **c.** 0.1273 µF **d.** 0.20 µF

Fill in the blanks:

1. The ABCD parameters of a passive two port network are related as _____________
2. For a two port bilateral network, the three transmission parameters are given by A=6/5; B=17/5 and C=1/5, what is the value of D? _________________
3. If Z_{11}=2Ω; Z_{12}=1Ω; Z_{21}=1Ω and Z_{22}=3Ω, what is the determinant of admittance matrix ____ _
4. The characteristic impedance (Z_{0T}) of a T-section filter having total series and shunt impedances as Z_1 and Z_2 respectively is given by ____________.
5. In the m-derived HPF, the resonant frequency is to be chosen so that it is………………
6. In a symmetrical p attenuator with attenuation N and characteristic impedance Ro, the resistance of each shunt arm is equal to………………
7. For a prototype low pass filter, the phase constant b in the attenuation band is…………

UNIT 4

1. Ex = cos(ωt +βz) represents a wave travelling in the __________________

(a)-ve x-direction (b)+ve x-direction (c)+ve z-direction (d)-ve z-direction

2.An electromagnetic wave is to pass through an interface separating two media having dielectric constants ε_1 and ε_2 respectively. If $\varepsilon_1 = 4\varepsilon_2$, the wave will be totally reflected if angle of incidence is

(a) 0^0 (b) 30^0 (c) 45^0 (d) 60^0

3. The Snell's law of refraction gives -------------

4. The instantaneous rate of energy flow per unit area at a point is

(a) E x H (b) $B \bullet \nabla D$ (c) $B \bullet \nabla D \bullet \nabla$ (d)) (2 $EHx\nabla\nabla$

5. When electromagnetic waves are reflected at an angle from a wall, their wavelength along the wall is

(a) shortened because of the Doppler effect (b) the same as in free space
(c) greater than in the actual direction of propagation
(d) same as the wavelength perpendicular to the wall

6. At the cut-off wave length, the wave between the walls of parallel plane guide

(a) is travel almost parallel to the axis of the guide
(b) is travel perpendicular to the axis of the guide
(c) is travel in zig-zag path (d) has no wave motion

7. If the time dependence of voltage is given as e^{-jwt}, then $V_o e^{-\gamma z}$ will represent

(a) forward travelling wave (b) backward travelling wave (c) standing wave
(d) refracted wave

8. A lossless line of length 500m has L=10μH/m and C=0.1pF/m at 1 MHz. The electrical length of the line is

(a) 360^0 (b) 270^0 (c) 180^0 (d) 90^0

9. For an open circuited line which is not true

(a) Zin = -jZo cotβl (b) 1 = Γ (c) 1 = Γ l 1 = Γ l (d) S = ∞

10. Short-circuited stubs are preferred to open-circuited stubs because the latter are

(a) more difficult to make and connect
(b) made of a transmission line with a different characteristic impedance
(c) liable to radiate (d) incapable of giving a full range of reactances

11. For transmission-line load matching over a range of frequencies, it is best to use a

(a) balun (b) broadband directional coupler
(c) double stub (d) single stub of adjustable position

UNIT -5

1. (Nov 1998) What determines the velocity factor in transmission line ?

a) The termination impedance b) The center conductor resistivity
c) Dielectrics in the line d) The termination impedance

2. A transmission line has a capacitance of 25 pF / ft. and an inductance of 0.15 mH / ft. Determine the characteristic impedance of the line.

a) 100 W b) 75 W c) 77.5 W d) 50 W

3. What is the impedance of most waveguide?

a) 300 ohms b) 75 ohms c) 600 ohms **d) 50 ohms**

4. Who developed the Smith Chart?

a) James N. Smith b) Philip S. Char **c) Philip H. Smith** d) Gunn Chart

5. The ratio of incident and reflected voltage waves representing transmission and reflection coefficients used to characterize a linear microwave device.

a) Z Parameter b) Y Parameter **c) S Parameter** d) H Parameter

6. An open circuit line greater than wavelength L/4 but less than wavelength L/2 in length will exhibit ______ reactance.

a) capacitive b) minimum **c) inductive** d) maximum

7. How can SWR be minimized?
a) using filters b) using limiter c) using Smith Chart **d) using stubs**
8. What is a short (< l/4) length of transmission line, shorted at one end and attached at the appropriate distance from the load for the purpose of matching a complex load to the transmission line?
a) quarter-wave transformer **b) stub** c) balun d) network
9. A type of transmission line consisting of an inner conductor surrounded by, but insulated from an outer conductor.
a) strip line b) Micro strip line **c) Coaxial cable** d) balanced line
10. For a parallel-resonant circuit, a l / 4 stub must be _____ at the ends.
a) shorted b) open c) complex d) loaded

XI. GATE QUESTIONS / UGC - NET:

1. $Z_L = 200\ \Omega$ and it is desired that $Z_i = 50\ \Omega$ The quarter wave transformer should have a characteristic impedance of

   A. 100 Ω

   B. 40 Ω

   C. 10000 Ω

   D. 4 Ω

2. A broadside array consisting of 200 cm wavelength with 10 half-wave dipole spacing 10 cm. And if each array element feeding with 1 amp. current and operating at same frequency then find the half power beamwidth

   A. 4°

   B. 2°

   C. 10°

   D. 15°

3. The input impedance of short-circuited line of length l where $\lambda/4 < l < \lambda/2$, is

   A. Resistive

   B. Inductive

   C. Capacitive

   D. none of the above

4. A wave is propagated in a waveguide at frequency of 9 GHz and separation is 2 cm

between walls find cut off wavelength for dominant mode.

A. 4 cm

B. 1 cm

C. 2 cm

D. 8 cm

4. Charge needed within a unit sphere centred at the origin for producing a potential field,

$V = -\frac{6r^5}{\varepsilon_0}$ for $r \leq 1$ is

A. 12

B. 60

C. 120

D. 180

5. A rectangular metal waveguide filled with a dielectric of relative permittivity $\varepsilon_r = 4$, has the inside dimensions 3 x 1.2 cm, the cut off frequency for the dominant mode is

A. 2.5 GHz

B. 5 GHz

C. 10 GHz

D. 12.5 GHz

6. A wave is propagated in a waveguide at frequency of 9 GHz and separation is 2 cm between walls Calculate group velocity for dominant mode.

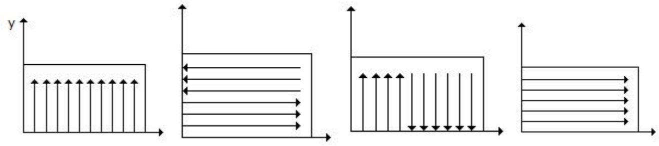
A. 1.8 x 10^8 m/sec

B. 5 x 10^8 m/sec

C. 3 x 10^8 m/sec

D. 1.5 x 10^8 m/sec

7. Which one of the following does represents the electric field lines for the TE_{02} mode in the cross section of a hollow rectangular metallic waveguide?

A. 

8. The velocity of electromagnetic wave in a good conductor is

   A. 3×10^8 m/s

   B. more than 3×10^8 m/s

   C. very low

   D. High

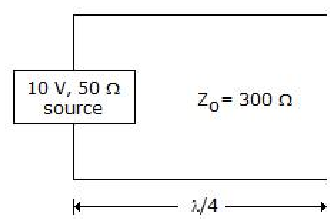
1. Consider a 300 Ω, quarter wave long at 1 GHz transmission line as shown in figure. It is connected to a 10 V, 50 Ω source at one end is left open circuited at the other end. The magnitude of the voltage at the open circuit end of the line is

   A. 10 V

   B. 5 V

   C. 60 V

   D. 60/7 volt



2. Which of the following laws of electromagnetic theory is associated with the force experienced by two loops of a wire carrying currents?

   A. Maxwell's law

   B. Coulomb's law

   C. Ampere's law

   D. Laplace's law

3. The shunt admittance of a transmission line is given by

   A. $\gamma = R + j\omega L$

   B. $\gamma = R - j\omega L$

   C. $\gamma = G + j\omega C$

   D. $\gamma = j\omega GC$

4. The force in a magnetic field is given by $F = qvB$

A. F and q are perpendicular and v and B are perpendicular

B. F and q only are perpendicular to each other

C. F and v, F and B are mutually perpendicular to each other and v and B at any angle between them

D. All the four components are perpendicular to each other

5. An electromagnetic wave is incident normally on a dielectric boundary. It is

A. totally reflected

B. partially reflected and partially refracted

C. totally absorbed

D. none of the above

14. Two co-axial cylindrical sheets of charge are present in free space f_s = 5 c/m^2 at r = 2 m and $_s$ = -2 c/m^2 at r = 4 m, The displacement flux density $\vec{D}$ at r = 3 m is

A. $\vec{D} = 5\,\vec{a}_r$ c/m^2

B. $\vec{D} = \frac{2}{3}\,\vec{a}_r$ c/m^2

C. $\vec{D} = \frac{10}{3}\,\vec{a}_r$ c/m^2

D. $\vec{D} = \frac{8}{3}\,\vec{a}_r$ c/m^2

15. When the phase velocity of an EM wave depends on frequency in any medium, the phenomenon is called

A. Scattering

B. Polarization

C. Absorption

D. Dispersion

16. Circular polarized waves result when

A. magnitudes are the same

B. phases are the same

C. magnitudes are same and phase difference is 90°

D. magnitudes are same and phase difference is zero

17. For a distortionless line, the parameters are related as

A. R/G = L/C

B. R/L = 1

C. R/G = C/L

D. RG = LC

18. A field $\vec{A} = 3x^2yz\ \hat{a}_x + x^3z\ \hat{a}_y + (x^3y - 2z)\hat{a}_z$ can be

A. harmonic

B. divergence less

C. solenoidal

D. rotational

19. Phase velocity of waves propagating in a hollow metal waveguide is

A. greater than the group velocity

B. less than the velocity of light in free space

C. equal to the velocity of light in free space

D. equal to group velocity

20. If a plane electromagnetic wave satisfies the equation $\frac{\partial^2 E_x}{\partial z^2} = c^2 \frac{\partial^2 E_x}{\partial t^2}$, the wave propagates in the (at an angle of 45° between the *x* and *z* direction)

A. *x*-direction

B. *z*-direction

C. *y* direction

D. *xy* plane

21. Radiowaves are electromagnetic waves having frequency range

A. 0.001 to 50 H

B. 0.001 to 50 kHz

C. 0.002 to 50 MHz

D. 0.001 to 10^{16} Hz

XII Gate paper

1. A source V(t) = cos 100πt has an internal impedance of (4+j3). If a purely resistive load connected to this source has to extract the maximum power out of the source, its value in W should be?
2. Calculate the average power delivered to an impedance (4- 3j)Ω by a current 5cos (100πt+ 100)A.

XIII WEBSITES:

1. www.elecrical4u.com
2. www.pezzelelectrcal.com

XIV EXPERT DETAILS:

1. Prof G.D Roy http://nptel.iitm.ac.in/video.php?subjectId=108108076
2. Dr. Christopher Rose http://www.winlab.rutgers.edu/~crose/index221.html

XV JOURNALS:

1. http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=1283651&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D1283651
2. http://www.researchgate.net/publication/2977315_A_Si_1.8_GHz_RLC_filter_with_tunable_center_frequency_and_qualityfactor

XVI LIST OF TOPICS FOR STUDENT SEMINARS:

1. Differential equations of first order and second order
2. Filters utilization in general electrical and electronic circuits

XVII. CASE STUDIES / SMALL PROJECTS

1. Construction of simple filter circuit
2. Construction of charger circuit.
3. Implementation of wideband pass filter.