Course Information Sheet

Programme:UG	**Degree:** B.Tech (ECE)	
Course Code:	**Course Title: Electro Magnetic Waves and Tansmission Lines**	
Year: III **Sem:** I **A.Y. :2024-25**	**Regulation:** R20 **University:** JNTU Kakinada.	
L T/P/D C: 3/0/0/3	**Credits: 3**	**Contact Hrs: 4**
Mid Marks: 30	**External Marks: 70**	**Total Marks:** 100
Teaching Hrs: 64	**Exam Duration:** 3 hrs.	

Course Pre-Requisites: Electronic Circuit Analysis, AWP.

Course Code	Course Name	Description	Year-Sem
C312	**Electro Magnetic Waves and Transmission Lines**	At the end of this course the student can able to 1. Determine E and H using various laws and applications of electric & magnetic fields 2. Apply the Maxwell equations to analyze the time varying behavior of EM waves 3. Gain the knowledge in uniform plane wave concept and characteristics of uniform plane wave in various media 4. Calculate Brewster angle, critical angle and total internal reflection 5. Derive and Calculate the expressions for input impedance of transmission lines, reflection coefficient, VSWR etc. using smith chart	III ECE Semester -1

Course outcomes:

No.	Description	Skill /Bloom's Taxonomy Level
CO1	Ability to Determine E and H using various laws and applications of electric & magnetic fields	Applying BT3
CO 2	Ability to Apply the Maxwell equations to analyze the time varying behavior of EM waves	Applying/BT3
CO 3	Ability to Gain the knowledge in uniform plane wave concept and characteristics of uniform plane wave in various media	Analyzing / BT4
CO4	Ability to Calculate Brewster angle, critical angle and total internal reflection	Evaluating / BT5
CO5	Ability to Derive and Calculate the expressions for input impedance of transmission lines, reflection coefficient, VSWR etc. using smith chart	Evaluating / BT5

Course Articulation Matrix:

Mapping of Course Outcomes (CO) with Program Outcomes (PO) and Program Specific Outcomes (PSO's):

Course Outcomes (CO)	Program Outcomes (PO)												Program Specific Outcomes (PSO's)	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C312.1	2	1	-	-	-	-	-	-	-	-	-	-	2	-
C312.2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
C312.3	2	2	1	-	-	-	-	-	-	-	-	-	2	-
C312.4	2	2	1	-	-	-	-	-	-	-	-	-	2	-
C312.5	2	1	-	-	-	-	-	-	-	-	-	-	2	-
Overall	**2**	**1.4**	**0.4**										**2**	

Level: 1- Low correlation (Low), 2- Medium correlation (Medium), 3-High correlation (High)

JUSTIFICATIONS OF CO –PO MAPPING

C312.1		
C312.1-PO1	2	Understand the various laws and applications of electric & magnetic fields. Hence apply the same to solve engineering problems.
C312.1-PO2	1	Able to Determine E and H using various laws and applications of electric & magnetic fields.
C312.1-PO3	-	
C312.1-PO4	-	
C312.1-PO5	-	
C312.1-PO6	-	
C312.1-PO7	--	
C312.1-PO8		
C312.1-PO9	--	
C312.1-PO10	--	
C312.1-PO11	--	.
C312.1-PO12	-	

C312.2		
C312.2-PO1	2	Students get the knowledge on time varying behavior of EM waves.
C312.2-PO2	1	Ability to Apply the Maxwell equations to analyze the time varying behavior of EM waves.
C312.2-PO3	-	
C312.2-PO4	-	
C312.2-PO5	-	
C312.2-PO6	-	
C312.2-PO7	-	
C312.2-PO8	-	
C312.2-PO9	- -	
C312.2-PO10	- -	
C312.2-PO11	-	
C312.2 -PO12	-	

C312.3		
C312.3-PO1	2	Use knowledge of the uniform plane wave concept and characteristics.
C312.3-PO2	2	Students can identify and formulate some applications in uniform plane wave in various media.
C312.3-PO3	1	Able to analyze the problem and identify the logic and parameter to solve problem related uniform plane waves.
C312.3-PO4	-	
C312.3-PO5	-	
C312.3-PO6	-	
C312.3-PO7	--	
C312.3-PO8	--	
C312.3-PO9	--	
C312.3-PO10	--	
C312.3-PO11		
C312.3-PO12	-	

C312.4		
C312.4-PO1	2	Able to understand Brewster angle, critical angle and total internal reflection
C312.4-PO2	2	Students will be able to calculate Brewster angle, critical angle and total internal reflection
C312.4-PO3	1	Students will be able to design and develop applications by using expressions of critical angle and total internal reflection.
C312.4-PO4	-	
C312.4-PO5	-	
C312.4-PO6	-	
C312.4-PO7	--	
C312.4-PO8	--	
C312.4-PO9	--	
C312.4-PO10	--	
C312.4-PO11	--	
C312.4-PO12	-	

C312.5

C312.5-P01	2	Understand the fundamentals input impedance of transmission lines.
C312.5-P02	1	Able to derive and calculate input impedance, reflection coefficient and VSWR.
C312.5-P03	-	
C312.5-P04	-	
C312.5-P05	-	
C312.5-P06	-	
C312.5-P07	-	
C312.5-P08	-	
C312.5-P09	--	
C312.5-P010	--	
C312.5-P011	--	
C312.5-PO12	-	

Justification for Avg CO-PO Mapping		
Mapping	**Level**	**Justification**
C411.PO1	2	Electromagnetic and transmission lines are used in designing engineering systems for solving engineering problems
C411.PO2	1.4	Electromagnetic components are used in designing engineering systems to analyze complex engineering problems
C411.PO3	0.4	Electromagnetic and transmission lines are used in designing engineering systems for solving engineering problems related to public health and safety and environmental systems
C411.PO4	--	
C411.PO5	--	
C411.PO6	--	
C411.PO7	--	
C411.PO8	--	
C411.PO9	--	
C411.PO10	--	
C411.PO11	--	
C411.PO12	--	

Justification for CO-PSO Mapping

Mapping	Level	Justification
C312.1-PSO1	2	Students get a sound knowledge of choosing electromagnetic theory used in designing
C312.2-PSO1	2	Students learn the programming skills required for designing
C312.3-PSO1	2	Knowledge of Electromagnetic theory and transmission lines which is used in automation industry
C312.4-PSO1	2	Students understand few of the modules required to design a product
C312.5-PSO1	2	Only overview of the basics of the electromagnetic waves and transmission lines.
C312.1-PSO2	-	
C312.2-PSO2	-	
C312.3-PSO2	-	
C312.4-PSO2	-	
C312.5-PSO2	-	

Topics beyond Syllabus

S.No.	Description	Proposed Actions
1	Cyclotron	Seminar

TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/PROJECTS/NPTEL ETC

Topic beyond Syllabus: Mapping with PO and PSO:

Topic beyond syllabus	Program Outcomes (PO)												Program Specific Outcomes (PSO's)	
1.	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
	3	3	2	-	-	-	-	-	-	-	-	-	3	2

Justification for Topic beyond the Syllabus (TBS) -PO Mapping.

Mapping	Level	Justification
TBS-PO1	3	Students could apply the acquired knowledge of Electronic components in designing
TBS-PO2	3	Able to analyze applications of Electronic circuits

TBS-PO3	2	Able to design various systems using electronic devices and circuits.

Justification for Topic Beyond the Syllabus (TBS) -PSO Mapping.

Mapping	Level	Justification
TBS-PSO1	3	Apply the acquired knowledge of design and development of electronic circuit based projects .
TBS-PSO2	2	Analyze the Conventional Methods for various applications .

WEB SOURCE REFERENCES :

1	**http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/cyclot.html**
2	https://www.britannica.com/technology/cyclotron

Syllabus / Lesson Plan:

S.No.	SYLLABUS	Periods	Methodology	Text book/references /web references and additional text book reference
	UNIT – I			
1	Transmission Lines-I: Types, Parameters	**2**	**Chalk & Talk**	**R1, R3**
2	T&π Equivalent Circuits	**2**	**Chalk & Talk,**	**R1, R3**
3	Transmission Line Equations	**1**	**Chalk & Talk,**	**R1, R3**
4	Primary & Secondary Constants	**1**	**Chalk & Talk,**	**R1, R3**
5	Expressions for Characteristic Impedance	**1**	**Chalk & Talk**	**R1, R3**
6	Propagation Constant, Phase and Group Velocities	**2**	**Chalk & Talk Demo of mechanisms.**	**R1, R3**
7	Infinite Line, Lossless lines	**1**	**Chalk &Talk Demo of mechanisms.**	**R1, R3**
8	distortion less lines	**1**	**Chalk & Talk**	**R1, R3**
9	Illustrative Problems	**1**	**Chalk & Talk**	**R1, R3**
	Total	**12**		
	Unit 2			

10	Transmission Lines – II: Input Impedance Relations, , ,.,;,–., , ,.	**1**	**Chalk & Talk**	**R1, R3**
11	SC and OC Lines	**1**	**Chalk & Talk**	**R1, R3**
12	Reflection Coefficient VSWR	**1**	**Chalk & Talk**	**R1, R3**
13	Low loss radio frequency lines and UHF Transmission lines	**2**	**Chalk & Talk**	**R1, R3**
14	UHF Lines as Circuit Elements	**1**	**Chalk & Talk**	**R1, R3**
15	Impedance Transformations	**1**	**Chalk & Talk**	**R1, R3**
16	λ/8,λ/4 and λ /2 Lines	**1**	**Chalk & Talk**	**R1, R3**
17	Smith Chart – Construction and Applications	**2**	**Chalk & Talk**	**R1, R3**
18	Quarter wave transformer	**1**	**Chalk & Talk**	**R1, R3**
19	Single Stub Matching	**1**	**Chalk & Talk**	**R1, R3**
20	Illustrative Problems	**1**	**Chalk & Talk**	**R1, R3**
	Total	**13**		
	Unit 3			
21	Review of Co-ordinate Systems	**2**	**Chalk & Talk**	**T1, T2, R2**
22	Electrostatics: Coulomb's Law	**1**	**Chalk & Talk**	**T1, T2, R2**
23	Electric Field Intensity, Electric Flux Density	**1**	**Chalk & Talk**	**T1, T2, R2**
24	Gauss Law and Applications	**1**	**Chalk & Talk**	**T1, T2, R2**
25	Electric Potential	**1**	**Chalk & Talk**	**T1, T2, R2**
26	Maxwell's Two Equations for Electrostatic Fields	**1**	**Chalk & Talk**	**T1, T2, R2**
27	Energy Density, Illustrative Problems	**1**	**Chalk & Talk**	**T1, T2, R2**
28	Convection and Conduction Currents	**1**	**Chalk & Talk**	**T1, T2, R2**
29	Dielectric Constant	**1**	**Chalk & Talk**	**T1, T2, R2**
30	Poisson's and Laplace's Equations	**1**	**Chalk & Talk**	**T1, T2, R2**
31	Capacitance – Parallel Plate, Coaxial Capacitors	**1**	**Chalk & Talk**	**T1, T2, R2**
32	Illustrative Problems	**1**	**Chalk & Talk**	**T1, T2, R2**
	Total	**13**		
	Unit 4			
33	Magneto Statics: Biot-Savart Law	**1**	**Chalk & Talk**	**T1, T2, R2**
34	Ampere's Circuital Law and Applications	**1**	**Chalk & Talk**	**T1, T2, R2**
35	Magnetic Flux Density	**1**	**Chalk & Talk**	**T1, T2, R2**
36	Maxwell's Two Equations for Magneto static Fields	**1**	**Chalk & Talk**	**T1, T2, R2**
37	Magnetic Scalar and Vector Potentials	**2**	**Chalk & Talk**	**T1, T2, R2**
38	Forces due to Magnetic Fields, Ampere's Force Law	**2**	**Chalk & Talk**	**T1, T2, R2**
39	Inductances and Magnetic Energy, Illustrative Problems	**1**	**Chalk & Talk**	**T1, T2, R2**

40	Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF	**1**	**Chalk & Talk**	**T1, T2, R2**
41	Inconsistency of Ampere's Law and Displacement Current Density	**1**	**Chalk & Talk**	**T1, T2, R2**
42	Maxwell's Equations in Different Final Forms and Word Statements	**1**	**Chalk & Talk**	**T1, T2, R2**
43	Conditions at a Boundary Surface, Illustrative Problems.	**1**	**Chalk & Talk**	**T1, T2, R2**
	TOTAL	**13**		
	UNIT - V			
44	EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media	**2**	**Chalk & Talk**	**T1, T2, R2**
45	Uniform Plane Waves – Definition, All Relations Between E & H	**1**	**Chalk & Talk**	**T1, T2, R2**
46	Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space	**2**	**Chalk & Talk**	**T1, T2, R2**
47	wave propagation in good conductors, skin depth	**1**	**Chalk & Talk**	**T1, T2, R2**
48	Polarization & Types, Illustrative Problems	**1**	**Chalk & Talk**	**T1, T2, R2**
49	Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics	**2**	**Chalk & Talk**	**T1, T2, R2**
50	Brewster Angle, Critical Angle and Total Internal Reflection	**1**	**Chalk & Talk**	**T1, T2, R2**
51	Surface Impedance, Poynting Vector and Poynting Theorem	**2**	**Chalk & Talk**	**T1, T2, R2**
52	Illustrative Problems	**1**	**Chalk & Talk**	**T1, T2, R2**
	TOTAL	**13**		
	GRAND TOTAL	**64**		

Topic Beyond Syllabus:

S.No.	Topic Beyond Syllabus Planning	PERIODS	Methodology	Text book/references/web references and additional text book reference
1	Cyclotron	**1**	**Seminar / Assignment**	**http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/cyclot.html**

Note: Bloom's Taxonomy Levels

BTL1-Remember	**BTL2 – Understand**	**BTL3 –Apply**

BTL4-Analyze	BT56 –Evaluate	BTL6–Create

Text books (T) / Reference books (R)/Additional text books (A):

T/R/A	Book Title/Author/Publication
T1	Elements of Electromagnetic–Matthew N.O.Sadiku, Oxford Univ. Press,3rded.,2001. Electromagnetic Waves and Radiating Systems–E.C.Jordan and K.G.Balmain, PHI,2ndEdition,2000.
T2	Electromagnetic Waves and Radiating Systems–E.C.Jordan and K.G.Balmain, PHI,2ndEdition,2000.
R1	Electromagnetic Field Theory and Transmission Lines–SNRaju, Pearson Education 2006.
R2	Engineering Electromagnetic –William H. Hayt Jr. and John A.Buck, TMH, 7th ed., 2006
R3	Electromagnetic Field Theory and Transmission Lines : G Sasi Bhushana Rao, WileyIndia2013.

Web References:

W	Web References
W1	https://www.physics-and-radio-electronics.com/electronic-devices-and-circuits.html
W2	https://www.indiabix.com/electronics-and-communication-engineering/electronic-devices-and-circuits/
W3	https://www.electronics-tutorials.ws/
W4	https://www.sanfoundry.com/1000-electronic-devices-circuits-questions-answers/
W5	https://mcqslearn.com/electronics/electronic-devices/electronic-devices-and-circuits-mcqs.php
W6	https://www.indiabix.com/electronic-devices/questions-and-answers/

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 (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**