PVP-19

TRANSMISSION LINES AND WAVEGUIDES

Course Code	19EC4501D	**Year**	III	**Semester**	I
Course Category	Programme Elective-I	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Interpret the parameters of different transmission lines for various applications (L2)
CO2	Develop transmission lines for applications in different frequency ranges (L3)
CO3	Analyse transmission line parameters using different tools (L4)
CO4	Analyse rectangular waveguides and cavity resonators for EM wave propagation (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	1								1	2
CO2	2	3	3	2	1								2	2
CO3	3	3	1	2	2								2	2
CO4	2	2	2	3	2								3	2
Average* (Rounded to nearest integer)	3	3	2	3	2								2	2

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Basics of Transmission Lines**: Concept and definition, Different kinds of transmission lines, Applications, Equivalent circuit, Primary constants- R, L, C and G, Secondary constants – Propagation constant and Characteristic Impedance, General transmission line equations. Attenuation and phase constant. Wavelength, phase velocity and group velocity. Time domain transmission line equations. The lossless transmission line, The infinite long transmission line, The distortion less transmission line and condition for distortion less ness and minimum attenuation, The low resistance transmission line. Loading, Types of loading, Losses.	CO1
II	**Finite Transmission Lines**: The load reflection coefficient, Standing Wave Ratio, Line impedance, Generalized reflection coefficient, The lossless terminated transmission line, The lossless matched transmission line, The lossless shorted transmission line, The lossless open transmission line, The lossless resistively loaded transmission line. Power relations on a general transmission line.	CO2

III	**UHF Lines**: UHF lines as circuit elements: λ/4, λ/2, λ/8 lines, **Smith Chart**: Construction of smith chart, Smith chart as impedance chart, smith chart as admittance chart, Problems using smith chart. Impedance matching- Single stub with applications, Quarter wave transformer.	**CO2, CO3**
IV	**Waveguides:** Introduction, Rectangular Waveguides-Transverse Electric (TE) and Transverse Magnetic (TM) mode analysis – Field expressions, Characteristic equation, Cut-off frequency, Phase velocity, Group velocity, Attenuation and Phase constants, Wavelength and Impedance. Filter characteristics, Dominant and degenerate modes, Mode dispersion, Power transmission and Power loss expressions. **Cavities:** Rectangular Cavity Resonators-Dominant modes and Resonant Frequencies, Q factor, Types of coupling and Coupling coefficients.	**CO4**
V	**Strip Lines**: Introduction, Microstrip Lines- characteristic impedance, Losses and Quality factor. Parallel Strip Lines- distributed parameters, characteristic impedance, attenuation losses. Coplanar Strip Lines, Shielded Strip Lines.	**CO1**

Learning Resources

Text Books

1. Engineering Electromagnetics, Nathan Ida, Springer International, 2nd Edition 2008.
2. Microwave Devices and Circuits – Samuel Y. Liao, Pearson Education, 3rd Edition, 2003.

Reference Books

1. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2009
2. 2. Annapurna Das, Sisir K Das, "Microwave Engineering", 2nd edition, 2006, Tata McGraw Hill.

e- Resources & other digital material

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
2. http://nptel.iitm.ac.in/video.php?subjectId=117101056
3. http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Transmission %20Lines %20and%20EM%20Waves/TOC.htm
4. http://www.mike-willis.com/Tutorial/PF2.htm