Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC503TRANSMISSION LINES, NETWORKSAND WAVEGUIDES

Fifth Semester, 2017-18 (Odd Semester)

Course (catalog) description

The course introduces the various types of transmission lines and to discuss the losses associated. This course give thorough understanding about impedance transformation and matching. It imparts knowledge on filter theories and waveguide theories.

Compulsory/Elective course: Elective for ECE students

Credit & contact hours **:** 3 & 45

Course Coordinator **:** Ms.Raji Pandurangan, Assoc Professor.

Instructor(s)

Name of the Instructor	**Class handling**	**Office location**	**Office Phone**	**Email(Domain:@bharathuniv.ac.in)**	**Consultation**
Ms.Raji Pandurangan	Third Year	SA006		Rajipandurangan.ece @bharathuniv.ac.in	12.45-1.15 PM
MS.D.PRASANNA	Third Year	SA006		Prasanna.ece @bharathuniv.ac.in	9.00-9.50 AM

Relationship to other courses

Pre-requisites : Electromagnetic Fields and waves.

Assumed knowledge : The students will have a physics and mathematics background obtained at a high school (or equivalent) level. In particular, working knowledge of basic mathematics including differentiation, integration and probability theories are assumed.

Following courses : Nil

UNIT I TIME VARRYING FIELDSAND MAXWELL'S EQUTIONS 9

Motional Electromotive Force, General Expression for motional EMF, Faraday's Law of Induction, Displacement current, Maxwell's equation in the point or differential form, Maxwell's equations in Integral form, Maxwell's equations from Gauss's Law, Maxwell's equations and Boundary conditions, Poynting's theorem, Time harmonic (sinusoidal) fields, Maxwell's equations in phasor form.

UNITII TRANSMISSION LINES 9

Need for Transmission Lines, Types of Transmission lines, Characterization in terms of primary and secondary constants, Characteristic impedance, General wave equation, Loss less propagation, Propagation constant, Wave reflection at discontinuities, Voltage standing wave ratio, Transmission line of finite length, The Smith Chart, Smith Chart calculations for lossy lines, Impedance matching by Quarter wave transformer, Single and double stub matching.

UNIT III THE UNIFORM PLANE WAVE 9

Wave propagation in free space, Wave propagation in dielectrics, Forward and Backward Travelling Wave, Poynting Theorem and Wave Power, Energy of the Radiated wave, Propagation in good conductors and good dielectrics, Skin effect, Wave polarization, Linearly, Elliptically and Circularly polarized waves,

UNIT IV TRANSMISSION AND REFLECTION OF PLANE WAVES AT BOUNDARIES 9

Normal incidence of Uniform Plane waves: Conductor-Conductor interface, Dielectric-Dielectric interface, Dielectric-perfect Conductor interface, Dielectric-Conductor interface. Oblique incidence on a plane boundary for perpendicular polarization, Dielectric-Dielectric interface, Dielectric-Conductor interface.

UNIT V WAVE GUIDES AND CAVITY RESONATORS 9

General Wave behaviors along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel"s differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

Total : 45 Periods

TextBook:

T1. John D Ryder, "Networks lines and fields", Prentice Hall of India, New Delhi, 2005

T2. GSN Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 2005

References:

R1.William H HaytandJrJohnABuck, "Engineering Electro magnetics "Tata McGraw-HillPublishing Company Ltd, New Delhi, 2008

R2. David KCheng, "Field and Wave Electromagnetics", Pearson Education Inc,Delhi,2004

R3. John D KrausandDaniel A Fleisch,"Electromagnetic swithApplications",McGrawHill BookCo,2005

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Engineering Physics, Electromagnetic Fields and waves

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
5	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems. This course emphasizes:	Correlates to program outcome	
	H	M
1. Discuss the fundamental concepts of wave propagation in Transmission Lines and Wave Guides	a,d	c,e,f,g,l
2. Analyze the line parameters and various losses in transmission lines.	-	a,g,i
3. Apply smith chart for line parameter and impedance calculations	d	a,b,e,i
4. Evaluate the characteristics of parallel plane and rectangular wave guides.	e	a,b,c,g,l
5. Evaluate the characteristics of Circular waveguides.	-	b,j,l
6. Evaluate the characteristics of resonators.	-	d

H: high correlation, M: medium correlation

Draft Lecture Schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**TIME VARRYING FIELDSAND MAXWELL'S EQUTIONS**		
1.	Motional Electromotive Force	Yes	[T1] Chapter -9
2.	General Expression for motional EMF, Displacement current	Yes	
3.	Maxwell‟s equation in the point or differential form	Yes	
4.	Maxwell‟s equations in Integral form	Yes	
5.	Maxwell‟s equations from Gauss‟s Law	Yes	
6.	Maxwell‟s equations and Boundary conditions	Yes	
7.	Poynting‟s theorem	Yes	
8.	Time harmonic (sinusoidal) fields	Yes	
9.	Maxwell‟s equations in phasor form	Yes	
UNIT II	**TRANSMISSION LINES**		
10.	Need for Transmission Lines, Types of Transmission lines	Yes	[T1] Chapter -7
11.	Characterization in terms of primary and secondary constants	Yes	
12.	Characteristic impedance	Yes	
13.	General wave equation	Yes	
14.	Wave reflection at discontinuities	Yes	
15.	Voltage standing wave ratio, Transmission line of finite length	Yes	
16.	The Smith Chart, Smith Chart calculations for lossy lines	Yes	
17.	Impedance matching by Quarter wave transformer	Yes	
18.	Single and double stub matching	No	
UNIT III	**THE UNIFORM PLANE WAVE**		
19.	Wave propagation in free space	Yes	[T1] Chapter -9,10
20.	Wave propagation in dielectrics	Yes	
21.	Forward and Backward Travelling Wave	Yes	
22.	Poynting Theorem and Wave Power	Yes	
23.	Energy of the Radiated wave	Yes	
24.	Propagation in good conductors and good dielectrics	Yes	
25.	Skin effect	No	
26.	Wave polarization	Yes	
27.	Linearly, Elliptically and Circularly polarized waves	Yes	
UNIT IV	**TRANSMISSION AND REFLECTION OF PLANE WAVES AT BOUNDARIES**		
28.	Normal incidence of Uniform Plane waves	Yes	[T1] Chapter -10
29.	Conductor interface	Yes	
30.	Dielectric interface	Yes	
31.	Dielectric-Conductor interface	Yes	
32.			
33.	Oblique incidence on a plane boundary for perpendicular polarization	Yes	
34.		Yes	
35.	Dielectric-Conductor interface	Yes	
36.		Yes	

UNIT V	WAVE GUIDES AND CAVITY RESONATORS		
37.	General Wave behavior along uniform Guiding structures	Yes	[T1] Chapter -11, 12
38.	Transverse Electromagnetic waves	Yes	
39.	Transverse Magnetic waves	Yes	
40.	Transverse Electric waves	Yes	
41.	TM and TE waves between parallel plates	Yes	
42.	TM and TE waves in Rectangular wave guides	Yes	
43.	Bessel's differential equation and Bessel function	Yes	
44.	TM and TE waves in Circular wave guides	Yes	
45.	Rectangular and circular cavity Resonators.	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Attendance	-	5%
Assignment /Seminar/online test/quiz	-	5%
Final exam	-	70%

Prepared by: Ms.Raji Pandurangan, Assoc Professor **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate*:*

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal impro

Course Teacher	Signature
Ms Raji pandurangan	

Course Coordinator **HOD/ECE**