Academic Course Description

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

BEC003 SATELLITE COMMUNICATION

Seventh Semester, 2017-18 (Odd Semester)

Course (catalog) description

The course helps the students to become familiar with satellites and satellite services. This course gives thorough understanding about the satellite orbits and launching. It imparts knowledge on earth segment and space segment components. It explains the satellite access by various users.

Compulsory/Elective course : Elective for ECE students

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

Course Coordinator **:** Mr.Sethupriyan, Assistant Professor.
Instructor(s)

Name of the Instructor		Office location	Office Phone	Email(Domain:@bharathuniv.ac.in) Class handling	Consultation
Mr.Sethupriyan	Final Year	SA006		meenakumari.ece@bharathuniv.ac.in	12.45-1.15 PM

Relationship to other courses

Pre-requisites : Communication Engineering – I & II

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 INTRODUCTION **9**

Introduction, Types – Active and Passive Satellite, Frequency allocation, Satellite orbits, Kepler's laws, Definitions of terms for earth-orbiting Satellites, Apogee and Perigee heights, Orbit Perturbations, Geo stationary orbit, Antenna look angles, Limits of visibility, Earth Eclipse of Satellite, Sun transit outage, launching orbits.

UNIT II THE SPACE SEGMENT **9**

Introduction, The Power supply, Attitude control, Spinning satellite stabilization, Momentum Wheel Stabilization, Station keeping, Thermal control, TT&C subsystem, Transponders, The Wide Band receiver, The Input De-multiplexer, The Power Amplifier, The Antenna subsystem.

UNIT III THE EARTH SEGMENT AND ANTENNAS **9**

Transmit receive earth station subsystems, up-converters-High Power Amplifier-Receive chain-LNA&LNB.TVRO earth station, The isotropic radiator and antenna gain, Horn antenna, The Parabolic reflector, Double reflector antenna-Cassie grain antenna-Gregorian antenna.

UNIT IV THE SPACE LINK & SATELLITE ACCESS **9**

EIRP, Transmission losses The Link budget equation, System noise, Effects of rain, up link and down link C/N ratio. Multiple access techniques-Concepts and types of TDMA, FDMA and CDMA-Comparison and contrast of TDMA, FDMA and CDMA.

UNIT V SATELLITE APPPLICATIONS **9**

Satellite Mobile services, DBS, VSAT, Remote sensing, GPS, INTELSAT, INMARSAT, SARSAT, Video Conferencing and Internet connectivity

Total : 45 Periods

TextBook:

T1. Dennis Roddy, "Satellite Communication", 4th Edition, McGraw Hill International, 2006.

T2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.

References:

R1.N.Agarwal,"Designof GeosynchronousSpace Craft",Prentice Hall,1986.

R2. BruceR.Elbert,"TheSatelliteCommunicationApplications",HandBook,ArtechHouseBostanLondon,1997.

R3. TriT. Ha, "Digital Satellite Communication", 2nd edition,1990.

R4. Emanuel Fthenakis, "Manual ofSatellite Communications", McGrawHill BookCo.,1984.

Computer usage: Nil

Professional component

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

Broad area : Engineering Physics, Communication Engineering.

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
4	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	L
1. Define orbital mechanics and launch methodologies	a,h	c,e,f,g,i	k
2. Describe satellite subsystems	c,g,j	a	b,i
3. Design link power budget for satellites	b,k,l	a,c,g,h,i	-
4. Compare competitive satellite services	b,c	a,e,i,k,l	-
5. Explain satellite access techniques	-	e,f,g,k,l	b,i
6. DTH and compression standards	F	d,e,g	-

H: high correlation, M: medium correlation-

Draft Lecture Schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I INTRODUCTION			
1.	Introduction, Types Active and Passive Satellite	No	[T1] Chapter -1,2,3
2.	Frequency allocation, Satellite orbits, Kepler's laws	No	
3.	Definitions of terms for earth-orbiting Satellites	No	
4.	Apogee and Perigee heights	No	
5.	Orbit Perturbations, Geo stationary orbit	No	
6.	Antenna look angles	No	
7.	Limits of visibility	No	
8.	Earth Eclipse of Satellite	No	
9.	Sun transit outage, launching orbits	No	
UNIT II THE SPACE SEGMENT			
10.	Introduction, The Power supply	No	[T1] Chapter -7
11.	Attitude control	No	
12.	Spinning satellite stabilization	No	
13.	Momentum Wheel Stabilization	No	

14.	Station keeping, Thermal control	No	
15.	TT&C subsustem, Transponders	No	
16.	The Wide Band receiver	No	
17.	The Input Demultiplexer	No	
18.	The Power Amplifier, The Antenna subsystem.	No	
UNIT III	**THE EARTH SEGMENT AND ANTENNAS**		
19.	Introduction, Transmit receive earth station subsystems	No	[T1] Chapter -6
20.	up-converters-High Power Amplifier	No	
21.	Receive chain-LNA&LNB	No	
22.	TVRO earth station	No	
23.	The isotropic radiator and antenna gain	No	
24.	Horn antenna	No	
25.	TheParabolic reflector	No	
26.	Cassie grain antenna	No	
27.	Gregorian antenna, Double reflector antenna	No	
UNIT IV	**THE SPACE LINK & SATELLITE ACCESS**		
28.	Introduction, EIRP, Transmission losses	No	[T1] Chapter -4,12,14
29.	System noise, Effects of rain	No	
30.	up link and down link C/N ratio	No	
31.	Multiple access techniques	No	
32.	The Link budget equation	No	
33.	Concepts and types of TDMA, FDMA and CDMA	No	
34.	TDMA	No	
35.	FDMA	No	
36.	CDMA	No	
UNIT V	**SATELLITE APPPLICATIONS**		
37.	Introduction, Satellite Mobile services	No	[T1] Chapter -17
38.	DBS	No	
39.	VSAT	No	
40.	Remote sensing, GPS	No	
41.	INTELSAT	No	
42.	INMARSAT	No	
43.	SARSAT	No	
44.	Video Conferencing	No	
45.	Internet connectivity	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%
Assignment /Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Mr.Sethupriyan, Assistant 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 i

Course Teacher	Signature
Mr.Sethupriyan	

Course Coordinator **HOD/ECE**