INSTRUCTION DIVISION
FIRST SEMESTER 2015-2016
Course Handout Part II **Date: 03.08.2015**

Course No.: EEE F472

Course Title: Satellite Communication.
Instructor-in-Charge: Sainath Bitragunta

1. Scope and Objective:

This course gives an introduction to Satellite Communication Systems which combines diverse topics like radio-wave propagation, antennas, modulation, demodulation, coding, orbital mechanics etc. The spacecraft link analysis and link design will be dealt in detail. The various satellite access techniques like FDMA, TDMA and CDMA will be analyzed from bandwidth utilization and through put capability. The Indian National Satellite System (INSAT) will be covered in detail giving its specifications, features and services provided. The INTELSAT and other programmes will also be covered. The VSAT, Mobile satellite communication and Personal Satellite communication will be discussed. The principles of Global Positioning System (GPS) principles, GPS receivers and its applications would be covered. The regulatory and interference issues will also be covered.

2. Text Book (TB):
Pratt, Bostian, and Allnutt, *Satellite Communication Systems*, 2nd edition, John Wiley& Sons, 2003.

3. Reference Book (RB):
Robert M. Gagliardi, *Satellite Communications, 2nd edition, Springer, 2012.*
Dennis. Roddy, *Satellite Communications*, McGraw- Hill Professional, 2001.
G. Maral and M. Bousquet, *Satellite Communications Systems*, 5th edition, John Wiley & Sons, 2009.

4. Course Plan

Lecture No.	Topic	Learning Objectives	Ref. To Text & Ref. Book.
1	Introduction.	The history and the essential components of a satellite communication system.	Ch-1---TB
2	Radio wave propagation.	The radio wave propagation effects and how it influences the choice of frequencies for satellite communication.	Ch-8---TB
3-6	Satellite Orbits.	LEO, MEO & GEO, their merits and demerits. The different types of launch vehicles and their features.	Ch-2 & 10---TB Ch-2 & 11---RB.
7	Space environment.	The outer space and its impact on the design of spacecraft subsystems.	Ch-3---TB Ch-12---RB.
8-10	Spacecraft sub-systems.	The various sub-systems of the satellite like, Power, Telemetry, AOCS, Sensors, thermal systems, propulsion etc.	Ch-3---TB Ch-10---RB.
11-13	The communication	Communication channel and its	Ch-3---TB

	Transponder	components like antenna, LNA, wideband receiver, demultiplexer, HPA like SSPA/ TWTA, transponder etc. INSAT-II transponder and its specifications.	Ch-9---RB
14	Reliability	Design of satellite systems for unattended operation and incorporation of reliability into system design.	Ch-3---TB Ch-13---RB.
15-18	Satellite RF link analysis.	Introduction of terms like EIRP, G/T, uplink C/N, downlink C/N, overall C/N, C/N_o and illustration with a typical link design.	Ch-4---TB Ch-5---RB
19-20	Intermodulation(IM)	Two-tone third order IM, IM noise and its effect on overall link design.	Ch-6---TB.
21-22	Link design with IM	Apportionment of various noise budgets and methods to obtain a desired C/N in presence of IM.	Ch-6---TB.
23-26	Analog & Digital signals.	The modulation and error correction techniques employed.	Ch-5 & 7---TB Ch-3 & 4---RB.
27-32	Satellite Multiple Access.	FDMA, TDMA and CDMA and their merits and demerits will be highlighted. On board processing or regenerative transponders will be discussed.	Ch-6---TB Ch- 6---RB.
33-35	Earth Segment.	Earth station engineering aspects: transmitters, receivers, antenna and feed systems, INTELSAT earth station standards.	Ch-8---RB. Supp. References
36	INSAT Program. INTELSAT, EUTELSAT etc.	The Indian National Satellite Programme, & its services and the salient features of the satellites.	Supp. References
37-38	Very Small Aperture Terminal (VSAT) systems.	VSAT system planning, implementation and VSAT earth station engineering.	Ch-9---TB
39-40	Mobile Satellite Comm. and non-geostationary satellite systems.	The third generation satellite communication and the need for mobile and personal communication.	Supp. References Ch-10---TB.
41-42	Global Positioning System (GPS) and Future trends.	GPS principles, receivers and its application. Emerging trends in both the payloads and spacecraft.	Ch-12---TB Supp. References

Evaluation scheme:

Component	Duration	Weightage (%)	Date & Time	Room No.	Remarks
Quiz(s)	50 mins	20	Details will be announced in the class		
Assignment(s)		10	Details will be announced in the class		

Mid-sem Test	90 mins	30	8/10 10:00 - 11:30 AM	CB
Comprehensive	3 hours	40	8/12 AN	CB+OB

5. **Chamber Consultation Hours:** To be announced in the class.

6. Notice(s) regarding the course will be displayed on the EEE group notice board only.

Instructor-in-charge
EEE F472