

# ADVANCED SATELLITE AND FIBRE OPTIC COMMUNICATIONS

(Elective Subject)

<b>Course Code:</b>	<b>10M11EC112</b>	<b>Semester:</b>	<b>8<sup>th</sup> Semester, B. Tech (ECE)</b>
<b>Credits:</b>	<b>3</b>	<b>Contact Hours:</b>	<b>L-3</b>

## Course Objectives

1. To introduce the concept of optical fiber communication system starting from the basics of electromagnetic engineering.
2. To make the students learn the basic characteristics of optical fibers and satellite communication systems.
3. Design a satellite communication system for given parameters.

## Course Outcomes

After studying the course, the student would gain enough knowledge of

1. The working of optical and satellite communication systems.
2. The practical issues concerning the launch of satellites.
3. The modulation and multiplexing schemes involved in satellite communication systems.
4. The types of interference in launching the satellites.
5. The design of satellite communication system.

S.No	Unit	Content	Lecture
1	Introduction to optical communication system	Review of Maxell's Equations, wave propagation, boundary conditions, optical communication system, need of optical communication system, Advantage of optical fibre system, attenuation windows.	3
	Propagation in Dielectric Waveguides	Wave propagation in an inhomogeneous medium, planar and cylindrical optical waveguide, TE-mode of a symmetric step-index planar waveguide, power distribution and confinement factor,	5
2	Optical Fibre	Introduction, Step-index Fibres, Graded Index Fibres, Modes & Rays, Slab Wave Guide, Ray propagation in optical fibre, Ray propagation in step-index fibre, ray propagation in graded index fibre, modal analysis of an ideal step-index fibre, fractional modal power distribution, limitation of multimode fibre, effects of material dispersion, combine effects of multipath and material dispersion.	8
3	Characteristics, of optical fibre	Characteristic parameters of single mode fibre, dispersion in single mode fibre, attenuation in single-mode fibre, design of single mode fibre, signal degradation in optical fibre, attenuation, scattering losses, bending losses, dispersion.	6
4	Satellite Communication	Introduction to the satellite communication system, earth satellite geometry, orbits of the satellite communication, Geo-stationary and non-geostationary orbits, ground segment and space segment.	2
5	Launch vehicles	Principle of rocket propulsion, powered flight, injection into final orbit, propulsion system	2
6	Spacecraft	Design of spacecraft, primary power, thermal subsystem, telemetry, tracking and command, altitude control, system	3

		reliability, estimation of mass of communication satellite	
7	RF Link	General consideration of RF link, noise, limits of the link performance, satellite links: uplink and down link, composite performance, optimization of RF links, noise temperature, antenna temperature, overall system temperature and propagation factors	5
8	Modulation and multiplexing	System engineering consideration, FDMA, TDMA system, beam switching and satellite switched TDMA, comparisons of multiple access techniques	2
9	Satellite transponder	Function of the transponder, transponder implementation and its technical issues.	2
10	Earth station	Transmitters, receivers, antennas, tracking systems, terrestrial interface	2
11	Interference	Calculation of C/I for single interfering satellite, calculation of C/i for multiple interfering satellite, interference specifications and protection ratio, special problems of satellite communication: delay and data communication	4

### Text books:

- J M senior, "Optical Fiber Communications: Principles and Practice", 3<sup>rd</sup> Edition Prentice Hall.
- Dennis Roddy, "Satellite Communications", 4<sup>th</sup> Edition, McGraw-Hill.

### Reference Books:

- G E Keiser, "Optical Fiber Communication", McGraw-Hill.
- M Richharia, "Satellite Communication System", Macmillian.
- W L Pritchard et al, "Satellite Communication Systems Engineering", Pearson Education.

### Evaluation Scheme

Test 1 - 15

Test 2 – 25

Test 3 - 35

Continuous Evaluation-25 (Att.-5, Assignments -10, Quiz/Presentation-10)

Total-100

### Text Books

1. Fiber Optics and Optoelectronics, R.P. Khare Oxford University Press.
2. Fiber Optic Communication Systems, G. P. Agarwal, Third Edition, Wiley.