COURSE MODULE

Faculty Name/s:			Academic Year: **2025-26 (Odd semester)**				
Department: **ECE**							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEC515D	Satellite and Optical Communication	**Elective**	**Knowledge about satellite orbits and principles of optical communication**	**3**	**-**	**-**	**50 (10 Hours / Module)**

Course objectives: This course will enable students to:

CLO1: Understand the basic principle of satellite orbits and trajectories.
CLO2: Study of electronic systems associated with a satellite and the earth station.
CLO3: Understand the various technologies associated with the satellite communication.
CLO4: Learn the basic principle of optical fiber communication with different modes of light propagation.
CLO5: Understand the transmission characteristics and losses, optical components and its applications in optical communication.

Topics Covered as per Syllabus

Module-1

Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle.
[Text 1: 2.1,2.2,2.3,2.4,2.5,3.3,3.4,3.5,3.6,3.7]

(RBT: L1 and L2)

Module-2

Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload.
Earth Station: Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking.
[Text 1: 4.1,4.5,4.6,4.7,4.8, 8.1,8.2,8.3,8.4,8.5,8.6,8.7]

(RBT: L1 and L2)

Module-3

Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems.

(RBT: L1, L2)

Module-4

Optical Fiber Structures: Optical Fiber Modes and Configurations, Mode theory for circular waveguides, Single mode fibers, Fiber materials. Attenuation and Dispersion: Attenuation, Absorption, Scattering Losses, Bending loss, Signal Dispersion: Modal delay, Group delay, Material dispersion.
[Text 2: 2.3[2.3.1 to 2.3.4], 2.4[2.4.1, 2.4.2],2.5, 2.7],3.1, 3.2

(RBT: L1, L2 and L3))

Module-5

Optical Sources and detectors: Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations, External quantum efficiency, Resonant frequencies, Photodetectors: The pin Photodetector, Avalanche Photodiodes.

WDM Concepts: Overview of WDM, Isolators and Circulators, Fiber grating filters (No derivation), Dielectric thin-film filters, Diffraction Gratings.
[Text 2: 4.2 ,4.3, 6.1, 10.1, 10.3, 10.4, 10.5, 10.7]

(RBT: L1, L2)

List of Text Books

1. Anil K. Maini, Varsha Agrawal, Satellite Communications, Wiley India Pvt. Ltd., 2015, ISBN: 978-81-265-2071-8.
2. Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw Hill Education (India) Private Limited, 2016. ISBN:1-25-900687-5.

List of Reference Books

1. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd 2017, ISBN: 978-81-265-0833-4
3. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3
4. Theodore Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0.

List of URLs, Text Books, Notes, Multimedia Content, etc

https://nptel.ac.in/courses/117105131
Basic Introduction To Satellite Communications | Satellite Communications - YouTube
How Satellite Works (Animation) - YouTube
Introduction video: Fiber Optic Communication Technology (youtube.com)
Introduction (youtube.com) (Introduction to Fiber optics)

Course Outcomes: Students will be able to

CO1: ***Describe*** the satellite orbits and its trajectories with the definition of parameters associated with it	**L2**
CO2: ***Describe*** the electronic hardware systems associated with the satellite subsystem and earth station	**L2**
CO3: ***Describe*** the communication satellites with the focus on national satellite system	**L2**
CO4: ***Classification*** and characterization of optical fibers with different modes of signal propagation.	**L3**
CO5: ***Describe*** the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and reception.	**L2**

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.

- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Subject Code:	BEC515D	**TITLE:** Satellite& Optical Communication							**Faculty Name:**				
List of Course Outcomes	**Program Outcomes**												Total
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
CO-1	3	2	2	-	-	-	-	-	-	-	-	2	09
CO-2	3	2	2	-	-	-	-	-	-	-	-	2	09
CO-3	3	2	2	-	-	-	-	-	-	-	-	2	09
CO-4	3	2	2	-	-	-	-	-	2	-	-	2	11
CO-5	3	2	2	-	-	-	-	-	2	-	-	2	11

The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

Subject Code:	BEC515D	**TITLE:** Satellite& Optical Communication	**Faculty Name:**
List of Course Outcomes	**Program Specific Outcomes**		
	PSO1	**PSO2**	**Total**
CO-1	3	2	05
CO-2	3	2	05
CO-3	3	2	05
CO-4	3	2	05
CO-5	3	2	05

Note: 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribute