Satellite Communications

Course Code: CT474

Structure: 3-0-0-3

Semester: B. Tech. Semesters 6 and 8, M. Tech. and Ph. D

Pre-Requisites: Electromagnetic Theory (SC217)

Category: U. G. Elective

Faculty: Deepak K. Ghodgaonkar (deepak.ghodgaonkar@daiict.ac.in) (Extn. 623)

Mechanisms/modalities for online delivery of Lectures: Lecture notes will be uploaded in Google Class Drive Folder on 10th January. These notes will be updated weekly. Audio and the screen share option of the Google Meet will be used to share the lectures with students. During lectures, important concepts will be presented by using figures, illustrations, tables and equations by pdf and ppt presentations. Also, graphic tablet will be used for writing on the screen to emphasize important points during lecture. Record of the lecture will be shared through Google Classroom. Students are encouraged to unmute microphone for asking questions. Also, students can send questions via posts on Google Classroom and e-mails.

Syllabus:

1. Introduction (6 hrs)
   1.1 A brief history of satellite communications.
   1.2 Description of satellite communications system: uplink, downlink, transponder and receiving earth stations. Satellite frequency bands.

2. Satellite Launching (6 hrs)
   2.1 Launching of objects into space, basic orbital mechanics, Kepler’s three basic laws, locating the satellite in orbit, locating the satellite with respect to earth, look angle determinations and geostationary satellites.
   2.2 The mechanics of launching a synchronous satellite, U. S. expendable launch vehicles and launch vehicles: Ariane and space Shuttle.

3. Satellite Link Design (8 hrs)
   3.1 Basic transmission theory
   3.2 System noise temperature and G/T ration
   3.3 Design of uplink and downlink
   3.4 Design of satellite links for specified carrier-to-noise ratio.

4. Modulation and Multiplexing Techniques for Satellite Links (6 hrs)
4.1 Analog telephone transmission
4.2 Digital modulation and demodulation. Bit and symbol error rates, binary phase shift keying and quadrature phase shift keying.
4.3 Digital transmission of voice and digital TV.

5. Multiple Access (7 hrs)

5.1 Frequency division multiple access (FDMA). Calculation of carrier-to-noise ratio, Effect of intermodulation noise and practical limitations of FDMA.
5.2 Time division multiple access (TDMA). TDMA frame structure and design. TDMA synchronization and timing.
5.3 Code division multiple access (CDMA). Spread spectrum transmission and reception.

6. Earth Station Technology (6 hrs)

6.1 Earth station design: for low system noise temperature and large earth station antenna.
6.2 Design of large antennas. Optimizing the gain of large antennas. Antenna noise temperature. Feed system for large antennas.
6.3 Tracking feeds. Tracking of geostationary antennas.
6.4 Small earth station antennas
6.5 Equipment for earth station. Low-noise amplifiers.

7. Satellite Services (6 hrs)

7.1 Direct broadcast satellite (DBS) services
7.2 MSAT and VSATs
7.3 Radarsat and Global Positioning Satellite System
7.4 Orbcomm and Iridium satellite services.

Text Books:


Evaluation:

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<thead>
<tr>
<th>Evaluation Type</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>In-Semester Examination (27 Feb. to 6 March)</td>
<td>45 %</td>
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<tr>
<td>End-Sem. Examination (26 April to 3 May)</td>
<td>45 %</td>
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<tr>
<td>Quizzes and Assignments</td>
<td>10 %</td>
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