**Program: B.Tech- Electronics & Communication Engineering Semester: VII**

**Subject: Satellite Communication Subject Code: EC0723**

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| **Teaching Scheme** | | | | | **Examination Scheme** | | | |
| **Class Room Contact Hrs** | **Practical** | **Activity Based Learning** | **Credits** | **Total hours/**  **Semester** | **University Examination** | **Mid Sem Examination** | **Continuous Evaluation** | **Total Marks** |
| 2hrs/week | 2hrs/week |  | 3 | 45 | 40 | 40 | 40+20 | 100 |

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| **Subject learning outcome** | | | | After competing this course the student will be able to Define the working principle and operation of various satellite systemsExplain the space segment and earth segment system with their controlsDetermine the various communication techniques for satellite applicationsAnalyze the various methods of satellite access systems and illustrate the satellite broadcast standards and servicesApply the state of the art in new research areas such as speech and video coding, satellite networking and satellite personal communicationsDesign satellite communication link and prepare the satellite communication budget. | | | | |
| **Subject Content** | | | | | | | | |
| **Unit No.** | **Topics** | | | | | **Learning outcome** | **Book Reference** | |
| 1 | **Introduction to Satellite Communication**  Benefits of satellite communication, Historical evolution of communication satellites, Satellite communication in India, Elements of satellite communication, Types of satellites, Satellite services, Satellite network configurations, Satellite frequency bands | | | | | * Student will know the need and evolution of satellite communication in India and world * Student will be able to differentiate between various types of satellites and services | [1] Ch.1, [2]Ch.1 | |
| **Satellite Orbits and Orbital Parameters**  Introduction, Types of orbits, Kepler’s laws, Orbital Elements, Solar Time and Sidereal Time, Satellite Orbits, Orbital Perturbations, Satellite position determination, Limits of visibility, earth eclipse of satellite, Eclipse of satellite, Satellite Launching, Geolaunching Methods | | | | | * Student will be able compute the altitude of satellite orbits * Student will be able to find the location of satellites * Student will know how satellites are launched | [1]Ch.2  [2]Ch.2, Ch.3 | |
| 2 | **Space Segment**  Introduction to Satellite System, Transponder Subsystem, Antenna Subsystem, Altitude and Orbit Control (AOC) Subsystem, Telemetry, Tracking and Command Subsystem, Power Subsystem, Thermal Subsystem, Structural Subsystem, Reliability and Quality Assurance | | | | | * Student will know the subsystems of satellite * Students will be able to compute the power generated by solar panels * Students will be able to compute the transmitted power and EIRP of satellite | [1] Ch.3, [2]Ch.7 | |
| **Ground Segment**  Introduction, Elements of an Earth Station, Types of earth stations, Earth Station transmitter, Earth Station Receiver, Antenna and Feed Systems, Antenna Tracking, High Power Amplifier, Low Noise Amplifier, Up-converter, Down converter, IF subsystems, Baseband subsystems, Terrestrial Interface equipment, Earth station performance, Redundancy and reliability, Mission Control for Communication Satellites | | | | | * Student will know the types of earth stations, and the methods of antenna tracking * Student will know the subsystems of earth station | [2]Ch.8 | |
| 3 | **Propagation effects**  Rain attenuation, Depolarization, Cross polarization, Propagation impairments and Mitigation techniques | | | | | * Student will be able estimate the losses in the propagation path | [1] Ch.8  [2] Ch.4, Ch.5 | |
| **Satellite link design**  Introduction, Satellite Communication system model, Basic transmission equation, Noise at the receiver, G/T ratio for earth stations, Uplink Equations, Downlink Equations, Total link, System Design Examples | | | | | * Student will be able to compute the performance of satellite link | [1] Ch.4, [2]Ch.12 | |
| 4 | **Satellite Multiple Access**  Introduction, Frequency Division Multiple Access, SCPC, MCPC, SPADE,  Time Division Multiple Access, SS-TDMA, Acquisition and Burst synchronization,  Spread Spectrum Multiple Access  Demand Assigned Multiple Access, Random Access | | | | | * Student will be able to compare and select different methods of accessing satellite * Student will be able to compute the channel capacity using different multiple access methods | **[**1]Ch.6  [2]Ch.14 | |
| **Satellite Applications**  VSAT Systems, Voice Network Configurations, Data Networks, VSAT Terminal  Broadcast Services: TVRO, DTH, DVB, HDTV  Satellite Radio, DAB  Satellite News Gathering  Satellite broadcast standards | | | | | * Student will be able to choose between options of measuring instruments and program | [1] Ch.9. Ch.11, Ch.12  [2] Ch.15, Ch.16, Ch.17 | |
| Text books: | | [1] | | | T.Pratt, C.Bostian, J.Allnutt, “Satellite Communications” 2nd Ed., Wiley India, 2009 | | | | |
| [2] | | | Dennis Roddy, “Satellite Communication”, 4th Ed., McGraw Hill, 2008 | | | | |
| Reference Books | | [1] | | Louis J. Ippolito, Jr., “Satellite Communications Systems Engineering”, Wiley, 2008 | | | | |
| [2] | | B.G.Evans, “Satellite Communication Systems”, IET Telecommunication Series 38, 2008 | | | | |
| [3] | | M.Richharia, “Stellite Communication Systems: Design Principles”, McGraw Hill, 1999 | | | | |
| **Digital Learning Resources** | | | | NPTEL Video lectures  **<https://nptel.ac.in/courses/117105131/>** | | | | |
| **Question Paper Pattern for End Sem Exam** | | | | Question paper will contain 8 questions (2 full questions distributed in 1 unit) covering all the chapters of the course. Student has to answer total FIVE full questions choosing at least one from each unit. | | | | |
| **Note** | | | | Activity Based Learning shall be Tutorial / Site Visit / Seminar / Practical / Workshop/Mini project/Simulation study etc. | | | | |