

**INDIAN INSTITUTE OF INFORMATION TECHNOLOGY  
DESIGN AND MANUFACTURING (IIITD&M) KANCHEEPURAM**

INTRODUCTION OF NEW COURSE

|  |   |                                 |   |  |   |   |
|--|---|---------------------------------|---|--|---|---|
| Course Title   | Wireless Communications   | Course No<br>(will be assigned) |   |  |   |   |
| Specialization   | Electronics   | Structure (LTPC)                | 3                                       | 0  | 0 | 3 |
| Offered for  | UG(Final Year)/PG/Ph.D.   | Status                          | Core <input type="checkbox"/>           | Elective <input checked="" type="checkbox"/> |   |   |
| Faculty  | Dr. M.D. Selvaraj   | Type                            | New <input checked="" type="checkbox"/> | Modification <input type="checkbox"/>        |   |   |
| Pre-requisite  |   | To take effect from             | January 2013                            |  |   |   |
| Submission date  | Oct 2012  | Date of approval by Senate      |   |  |   |   |
| Objectives   | Wireless communications is a rapidly growing segment of the telecom industry, with the potential to provide fast data rate and reliable communication services. This course covers advanced topics in wireless communication and in-depth analytical details of wireless channels, modulation techniques, performance analysis, receiver structures and diversity techniques.   |                                 |   |  |   |   |
| Contents of the course<br>(With approximate break up of hours) | <p>Overview of Wireless Communications: History of Wireless Communications, Wireless Spectrum, Methods for Spectrum Allocation, Spectrum Allocations for Existing Systems, Standards. (2 hours)</p> <p>Statistical Multipath Channel Models :Time-Varying Channel Impulse Response, Narrowband Fading Models, Autocorrelation, Cross Correlation, and Power Spectral Density, Envelope and Power Distributions, Level Crossing Rate and Average Fade Duration, Wideband Fading Models, Power Delay Profile, Coherence Bandwidth, Doppler Power Spectrum and Channel Coherence Time, Transforms for Autocorrelation and Scattering Functions, Discrete-Time Model, Space-Time Channel Models. (8 hours)</p> <p>Mathematical Analysis of Digital Modulation and Detection Techniques: Signal Space Analysis, Signal and System Model, Geometric Representation of Signals, Receiver Structure and Sufficient Statistics , Decision Regions and the Maximum Likelihood Decision Criterion, Error Probability and the Union Bound, Passband Modulation Principles, Phase Shift Keying (MPSK), Quadrature Amplitude Modulation (MQAM) , Differential Modulation, Constellation Shaping, Quadrature Offset, Frequency Modulation, Frequency Shift Keying (FSK) and Minimum Shift Keying (MSK), Continuous-Phase FSK (CPFSK) (10 hours)</p> <p>Performance of Digital Modulation over Wireless Channels: AWGN Channels, Signal-to-Noise Power Ratio and Bit/Symbol Energy, Error Probability for BPSK and QPSK, Error Probability for MPSK, Error Probability for FSK and CPFSK, Alternate Q Function Representation, Fading, Outage Probability, Average Probability of Error, Moment Generating Function Approach to Average Error Probability, Combined Outage and Average Error Probability. (10 hours) <b>Diversity:</b> Realization of Independent Fading Paths, Receiver Diversity, System Model, Selection Combining, Threshold Combining, Maximal Ratio Combining, Equal-Gain Combining, Transmitter Diversity, Channel Known at Transmitter, Channel Unknown at Transmitter - The Alamouti Scheme, Moment Generating Functions in Diversity Analysis, Diversity Analysis for MRC, EGC and SC techniques. (10 hours)</p> <p>Discussion on possible implementation of wireless algorithms in real-time applications. (2 hours)</p> |                                 |   |  |   |   |
| Textbook   | <ol style="list-style-type: none"> <li>1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.</li> <li>2. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.</li> </ol>  |                                 |   |  |   |   |
| References   | <ol style="list-style-type: none"> <li>1. T.S. Rappaport, "Wireless Communications, Principles and Practice", 2<sup>nd</sup> Ed., Pearson Education, 2002.</li> <li>2. Vijay K. Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers (Elsevier), 2007.</li> </ol>   |                                 |   |  |   |   |