PRINCIPLE OF COMMUNICATION (PCOM)

ITC 304

Subject Incharge

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Lecture 1

Introduction to the subject

Brief Outline of Syllabus

MODULE 1: Introduction

- Basics of analog communication and digital communication systems (Block diagram)
- Electromagnetic spectrum and applications
- Types of communication channels

MODULE 2: Noise and Fourier Representation of Signal and System

- Correlated and uncorrelated sources of noise in communication system
- Noise parameters – Signal to noise ratio, Noise factor, Noise figure
- Friis formula
- Equivalent Noise Temperature
- Basics of signal representation and analyses
- Introduction to Fourier Transform
- Properties (Time and Frequency shifting)
- Fourier transform of unit step, delta and gate function

MODULE 3: Amplitude and Angle Modulation Techniques

- Need for modulation
- **Amplitude Modulation**
- Techniques: DSBFC AM, DSBSC-AM, SSB SC AM
- Block diagram, spectrum, waveforms, bandwidth, power calculations
- Generation of AM using Diode, generation of DSB using Balanced modulator, Generation of SSB using Phase Shift Method.
- AM Transmitter (Block Diagram)
- AM Receivers– Block diagram of TRF and Super heterodyne receiver
- Receiver characteristics - Sensitivity, Selectivity, Fidelity, Image frequency and its rejection, Double spotting
- **Angle Modulation**
- Principle of FM - waveforms, spectrum, bandwidth
- Pre-emphasis and De-emphasis in FM
- FM generation: Direct method – Varactor diode Modulator, Indirect method (Armstrong method) block diagram and waveforms
- FM demodulator: Foster Seely discriminator, Ratio detector

MODULE 4: Pulse Analog Modulation and Digital Modulation

- Sampling theorem for low pass and band pass signals with proof
- Anti - aliasing Filter
- PAM, PWM, PPM - Generation and degeneration
- Quantization process
- Pulse code modulation, Delta modulation, Adaptive delta modulation
- Introduction to Line codes and ISI

MODULE 5: Multiplexing and Digital Bandpass Modulation Techniques

- Principle of time division multiplexing, Frequency division multiplexing, Orthogonal frequency division multiplexing and its applications
- ASK, FSK, PSK, QPSK generation and detection

MODULE 6: Radiation and Propagation of Waves

- Electromagnetic radiation fundamentals
- Types of propagation - Ground wave, Sky wave, Space wave, Tropospheric scatter propagation

Program Outcomes (POs)

- POs are consistent with Graduate Attributes as mentioned in Washington Accord
- These form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level
- GAs are exemplars of the attributes expected of a graduate of an accredited program.

- These Program Outcomes (POs) are -

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with t h e society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life- long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PEOs of Department of INFT

PEO1: To provide students with a sound foundation in mathematical, scientific and engineering fundamentals to design, analyse and solve complex engineering problems, to develop quest for higher studies and to inspire them to foster innovative research.

PEO2: To provide an environment and to make knowledge & expertise accessible for students to work in multi-disciplinary projects, to solve the real life problems with the help of modern tools and techniques and to lead towards a successful professional career.

PEO3: To develop effective soft skills, inculcate team building capabilities such as leadership skills, managerial skills, and entrepreneurial skills and simultaneously nurture professional and ethical attitude in broad social context for sustainable development through lifelong learning.

PSOs of Dept. of INFT

PSO1: Students will be able to acquire the basic knowledge of analysis and design, based on the comprehensive principles of Software Engineering, Project Management, Software Testing and Quality Assurance.

PSO2: Students will be able to apply research based approach using innovative tools and techniques in the field of Communication & Networks, Computer graphics & Image Processing and Information Security & Data Management.

PSO3: Students will be able to use the knowledge of Information Technology to develop end to end solutions in the field of SCAM (Social, Cloud, Analytics and Mobile).

PSO4: Students will be able to fuel entrepreneurship or to serve niche employment while portraying competencies like teamwork, efficient soft skills and a zeal for lifelong learning in order to contribute to society with moral and ethical values.

Course Outcomes (COs) – ITC304 (PCOM)

ITC304.1	Students will be able to *describe* analog and digital communication systems and *differentiate* between them.	Module 1
ITC304.2	Students will be able to *identify* different types of noise signals that affect communication systems and *apply* Fourier analysis to *analyze* communication systems	Module 2
ITC304.3	Students will be able to *acquire* knowledge of modulation techniques and *design* AM/FM transmitter and receiver	Module 3
ITC304.4	Students will be able to *describe* pulse analog and digital modulation techniques and *apply* sampling theorem to *evaluate* the fundamental relationship between channel bandwidth, digital symbol rate and bit rate	Module 4
ITC304.5	Students will be able to *explain* types of digital band pass modulation techniques and multiplexing schemes	Module 5
ITC304.6	Students will be able to *describe* electromagnetic radiation and propagation of waves	Module 6

Books

- George Kennedy, Bernard Davis, SRM Prasanna, Electronic Communication Systems, Tata McGraw Hill, 5th Ed.
- Simon Haykin, Michael Moher, Introduction to Analog & Digital Communications, Wiley India Pvt. Ltd., 2nd Ed.
- Vijay Garg, Wireless Communication and Networking, Mourgan Kauffman
- Wayne Tomasi, Electronic Communications Systems, Pearson Publication, 5th Ed.
- B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University
- Herbert Taub, Donald L Schilling, Goutam Saha, Principles of Communication Systems, Tata McGraw Hill, 3rd Ed.
- K Sam Shanmugam, Digital and Analog Communication Systems, Wiley India Pvt. Ltd, 1st Ed.
- Sanjay Sharma, Communication Systems (Analog and Digital), Katson Books

- **Teaching Scheme**
  - Theory : 3 hours/week
  - No. of Credits : 3
- **Examination Scheme**
  - IAT1 & IAT2 : 20 marks each (Average of the two)
  - End Semester Exam : 80 marks
- **Assignments**
  - Assignment Test 1 & 2 (10 marks each)
- **Quizzes**
  - Graded Quiz after each module

Tentative IAT1 Portion (ITC304.1 & ITC304.2)

MODULE 1: Introduction
MODULE 2: Noise and Fourier Representation of Signal and System

Tentative IAT2 Portion (ITC304.4 & ITC304.5)

MODULE 4: Pulse Analog Modulation and Digital Modulation
MODULE 5: Multiplexing and Digital Bandpass Modulation Techniques

Tentative AT1 Portion (ITC304.3)

MODULE 3: Amplitude and Angle Modulation Techniques

Tentative AT2 Portion (ITC304.6)

MODULE 6: Radiation and Propagation of Waves

List of Self Learning Topics

Module 1 - Applications areas of analog and digital communication.

Module 2 - Practice Numerical on above topic.

Module 3 - Use of AM and FM in Modern Communication Technology.
Challenges faced by radio business. and AM

Module 4 - Implementation of Pulse code modulation and demodulation.

Module 5 - Implement TDM, FDM, OFDM.

Module 6 - List the real time examples for different types of propagation waves

Thank you…