204189 Analog Communication

Teaching Scheme:

Lectures: 4 Hrs/ Week

Practical: 2 Hrs/ Week

Examination Scheme:

Theory Online : 50 Marks

Theory Paper : 50 Marks

Practical: 50 Marks

Course objectives and Outcomes:

The basic objective of this is course is to introduce the students to analog communication, AM, FM modulation techniques, their analysis, bandwidth calculations, receivers. It also focuses on the performance analysis of analog communications systems under the presence of noise and finally introduces the pulse and digital modulation techniques.

Having successfully completed this course, the student will be able to:

3. Understand and identify the fundamental concepts and various components of analog communication systems.
4. Understand, analyze and explain various analog modulation schemes.
5. Understand the performance of analog communications systems under the presence of noise.
6. Understand and apply concepts and techniques from Fourier analysis and circuit analysis to communication systems.
7. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems
8. Analyze Basic communications systems and their performance under the presence of noise
9. Describe various pulse and digital modulation techniques.

Unit I : Amplitude (Linear) Modulation **8L**

Base band & Carrier communication, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Non linear generation, switching modulator, Ring modulator & its spectrum, Modulation Index. SSBSC, ISB & VSB, their generation methods & Comparison, AM Broadcast technical standards (Only Analytical treatment)

Unit II : Angle(Exponential) Modulation **8L**

Instantaneous frequency, Concept of Angle modulation, frequency spectrum, Narrow band & wide band FM, Modulation index, Bandwidth, Phase Modulation, Bessel's Function and its mathematical analysis, Generation of FM (Direct & Indirect Method), Comparison of FM and PM.

Unit III : AM and FM Receivers **8L**

Block diagram of AM and FM Receivers, Super heterodyne Receiver, Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection; FM Detection using PLL.

Unit IV : Noise **6L**

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth.

Unit V : Behavior of Analog Systems in Presence of Noise **6L**

Base band systems, Amplitude modulated systems- DSBSC, SSBSC & AM, Angle modulated systems-phase modulation, frequency modulation, Threshold in angle modulation, Pre emphasis & De emphasis in FM, Comparison of performance of AM & FM systems.

Unit VI : Pulse Analog modulation **6L**

Band limited & time limited signals, Narrowband signals and systems, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. PAM PWM & PPM. Pulse Code Modulation – Generation & reconstruction

Text Books :

1. B. P. Lathi , "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford University Press
2. Dennis Roddy & Coolen, "Electronic Communication",4th Edition, Prentice Hall

Reference Books :

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons
2. Taub & Schilling, "Principles of Communication Systems", Tata McGraw-Hill
3. George Kennedy, "Electronic Communication Systems" 5th Edition, McGraw-Hill
4. Frenzel, "Principles of Electronic Communication Systems"3rd Edition, Tata McGraw-Hill

Analog Communication (Practical)

1. Study of Class C Single Tuned amplifier to demonstrate AM Generation
2. A) AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
   B) Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping
3. Generation of DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection
4. SSB modulator using Filter method, phase shift method & its detection
5. AM transmitter: Measure Total power of transmitter with the help of Spectrum Analyzer or Wattmeter, Observe variation in total power by varying modulating signal level
6. A) Frequency modulator using varactor diode and NE 566 VCO, calculation of modulation index
   B) FM demodulator using such as IC 565 (PLL based)
7. Study of FM Transmitter; observe output waveform using Spectrum Analyzer and see the effect of Eigen values on carrier power.
8. Measurement of Performance Characteristics of Receiver: Sensitivity, Selectivity, Fidelity.
9. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), Effect of variable sampling rate, filter cutoff, reconstruction of original signal using Interpolation Filter. Aliasing Effect in frequency domain.

Following assignments may be performed using suitable software (Any Two)

1. Generate AM waveform for given modulation index, signal frequency and carrier frequency.
2. Generate FM waveform for given signal amplitude and carrier frequency.

3. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency.

Note: 1.Transmitter and Receiver experiments are mandatory and to be carried out at **Radio Frequency (**Preferably above 500 KHz).

2. A visit to Broadcasting Station is desirable.