COMMUNICATION SYSTEM-II BEG431EC

Year: IV **Semester: I**

Teaching Schedule Hour/week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	2	Theory	Practical*	Theory**	Practical	125
			20	25	80	-	

***Continuous**

****Duration:3 hours**

Course Objective: To introduce the students to the principles and practices of Digital Communication Systems.

1. Introduction to digital Communication System. (4 hours)

1.1 Sources of information, signal types, transmitters, channels and receivers in digital communication systems.

1.2 Distortion, noise and interference.

1.3 Nyquist sampling theory, reconstruction of original analog message signal from its samples.

2. Pulse Modulation Systems.

2.1 Pulse Amplitude Modulation: Techniques, bandwidth requirement, reconstruction methods, Introduction to Time Division Mulitplexing (TDM).

2.2 Introduction to Pulse Duration Modulation (PDM) and pulse Width Modulation (PWM).

2.3 Pulse code modulation (PCM): quantization and codign techniques, Analog to Digital conversion Method.

2.4 Uniform quantization: method, quantization noise and signal to quantization ratio. (SQNR).

2.5 Non-Uniform quantization: companding methods: A and μ law companding.

2.6 Differential PCM: Principle and operation.

2.7 The Delta Modulation (DM): Principle and operation Q-noise and slope overload noise in DM. SQNR in DM, Adaptive Delta Modulation, Comparison between DM and PCM.

2.8 Introduction to linear production Theory and Speed coding.

3. Time Division Multiplexing (TDM) Systems: (3 hours)

3.1 Introduction to TDM principles, PAM and PCM systems as an example of TDM.

3.2 The TI and EI hierarchy.

3.3 Time Division Multiple Access (TDMA) systems.

4. Base-band Digital Communication systems. (6 hours)

4.1 Introduction to Information Theory: Definition of information, information sources, measure and units of information. Entropy, Relation between message, information and entropy.

4.2 Shannon's channel capacity theory, limitations.

4.3 Base-band(BB) digital communication system, multilevel coding using PAM.

4.4 Inter-symbol interface (ISI) in BB digital communication. Nyquist pulse shaping criteria for zero ISI, bandwidth and data speed consideration. Practical pulse shaping method (raised cosine, duo-binary and modified duo-binary encoding techniques)

4.5 The Eye diagram.

5. Modulated Digital Communication System. (6 hours)

5.1 Binary Amplitude shift keying (ASK), modulator-demodulator systems.

5.2 Binary phase shift keying (PSK), modulator-demodulator systems, carrier recovery circuits in PSK system, the 180^o phase ambiguity problem, differential phase shift keying (DPSK).

5.3 Demodulation techniques for DPSK singles.

5.4 M-ary data communication systems: quadrature Amplitude Modulation (QAM) and four phase PSK system.

5.5 Binary frequency shift keying (FSK), modulator-demodulator system.

5.6 Application of modems for data transmission and reception over telephone liens.

6. Random Signals and noise in communication system: (5 hours)

6.1 Signal power and spectral representations, the AC function and psdf.

6.2 White noise, thermal noise , psdf of white noise.

6.3 Passage of random signal noise through a LTI system. RC filtering of white noise, noise equivalent bandwidth.

6.4 The matched filter as an optimum detector of a pulse in presence of white noise, comparison of MF for rectangular pulses with ideal LPF and simple RC filter.

6.5 Narrow-band noise representation, generation of narrow-band noise, Time domain expression for narrow-band noise.

7. Noise performances of Analog and Digital Communication system: (6 hours)

7.1 Signal to noise ratio and detection gain synchronous detection of DSB-SC signal.

7.2 Detection gains for DSB-AM (synchronous and envelop detection) and SSB (synchronous detection), comparison of DSB-SC, DSB-AM and SSB in terms of noise performance and bandwidth.

7.3 Threshold effects in non-linear detection of AM.

7.4 Detection gain in FM, threshold effect in FM, SNR improvement in FM using pre-emphasis and de-emphasis networks.

7.5 Comparison of AM and FM.

7.6 Probability of error expressions for base-band binary and M-ary communication system of additive white noise channels. Comparison of binary and M-ary system.

7.7 Probability of error expression for modulated digital communication system comparison of modulated digital system in terms of error probability, data rate, digital bandwidth, input SNR and complexity.

8. Introduction of coding theory: (3 hours)

8.1 Coding theory, parameters of a code, types of codes.

8.2 Linear block coding for error detection and correction.

8.3 Convolution codes.

9. Introduction to modern communication systems: (5 hours)

9.1 High speed data communication through optical fibers.

9.2 Wireless in local loop (WLL) technology.

9.3 Cellular mobile communication technology (with particular reference to (GSM)

9.4 Global mobile personal communication systems (GMPCS)

9.5 Spread spectrum system (with particular reference to code division multiple access-CDMA)

Laboratory works:

At least five selected laboratory works on data format, sampling and reconstruction, the eye diagram, PLL, base-band data communication, duo-binary encoding, ASK, PSK, ESK etc.

References:

1. S.Haykin, “Digital communication” John Wiley andsons, 1988.
2. Leon W.couch II, “Digital and Analog communication systems”, Sixth Edition, pearson Edition Asia.2001.
3. B.P Lathi , “Modern Digital and Analog communication systems”. Third Edition, Oxford University Press, 1999.
4. J.Proakis, M.Salehi, “communication system engineering “, Prentice Hall, New Jersey,1994.
5. J.Das. SK Mullick, PK Chatarjee, “Principle of Digital communication” Wiley Eastern Limited, 1992.