Course outline of CT214: Analog and Digital Communications

1. Title: Analog and Digital Communications (Instructor: Prof. Laxminarayana Pillutla)

2. Credit Structure (L-T-P-Cr): 3 0 1.5 4.5

3. Course Code: CT 214

4. Semester: 4th

5. Category: B. Tech core

6. Prerequisites: Signals and Systems

7. Foundation for: Communications and Signal Processing

8. Abstract Content:

Module 1: Introduction to communication systems and Review of Signals and Systems
- History and evolution of communication systems, review of signals and spectra, Time and frequency relations, Response of LTI systems, Transfer functions, Frequency response, Band-limited signals, Signal distortion in transmission, Filters, Hilbert transforms, Correlation and spectral density functions.

Module 2: Linear CW Modulation
- Band pass signals and systems, AM, DSB, signals and spectra, Product modulators, Square law modulators, Switched modulators, Envelope detection, SSB, VSB signals and spectra, generation and synchronous detection, QAM

Module 3: Angle Modulation
- Phase and frequency modulation, Narrowband PM and FM, single Tone and multitone modulations, Transmission bandwidth, Generation and detection of FM and PM signals, De-emphasis and pre-emphasis filtering.

Module 4: Sampling, Pulse Modulation and PCM
- Review of sampling theorem, Ideal sampling, Practical sampling Aliasing and reconstruction, pulse modulation techniques: PAM, PWM, PPM (may be skipped). Pulse code modulation (PCM): generation, reconstruction, quantization noise, and companding. Differential-PCM (D-PCM) and delta modulation.

Module 5: Digital Modulation Schemes and Multiplexing
- Digital modulation techniques: ASK, PSK, FSK, QAM and MSK. Frequency division multiplexing, quadrature carrier multiplexing and time division multiplexing.

9. Suggested Text/s:
- Communication Systems: An Introduction to Signals and Noise in Electrical Communication (Fifth edition) by A. Bruce Carlson and Paul B. Crilly, Publisher: McGraw-Hill (Preferred).

10. Detailed Contents: Please see above.

11. Outcomes and Objectives:
- This course builds on the concepts covered in CT 111: Introduction to Communication Systems. Specifically, the course extensively uses frequency domain based analysis, to which the students were exposed in CT 203: Signals and Systems.
- At the end of the course the student would be able to demonstrate understanding of analog modulation systems, analog-to-digital conversion and digital modulation schemes.
- The course would be an excellent foundation course for students who intend to do pursue further studies in the area of communications.

12. Comments:
- All the students should enroll into the course web page available on the courses.daiict.ac.in website. All the course announcements such as labs, etc., will be made through the course web page.

13. Grading Policy:
- 1 – Insem examination: 15%
- 2 – Insem examination: 25%
- Final examination (comprehensive): 35%
- 2 (surprise) lab examinations: 10%
- Pop (or surprise) quizzes: 15%
(Note: The syllabus for all the three exams would be based on whatever that has been covered till that point in time.)

14. Policy on academic dishonesty: Instances of academic dishonesty could entail a maximum penalty of Grade “F” in the course. These instances could include cheating during in class quizzes, lab exams and the three regular exams.

15. Attendance policy: Attendance would be taken regularly during the lectures. If your lecture attendance is less than 75%, then your grade would be one less than what you actually deserve.

16. Leave exemption policy: If you happen to miss a lecture/exam/lab, then your typeset leave application has to be duly approved by UG convenor/Dean AP for consideration. A copy of the approved leave application has to be dropped off in my letter box that is available on the ground floor of Faculty Block-4. Please do not send any e-mail in this regard, any e-mail sent would be ignored.

17. Lab Guidelines:
- The purpose of lab is to complement the theoretical concepts covered in the class. For most part the lab would be based on the stuff covered in the class, although, occasionally you may be taken outside the syllabus to broaden your thinking horizon.
- To promote group work the lab sessions are done in teams of size no more than 2. Once you identify your team mate you are required to retain him/her for entire semester.
- You are requested to do your lab work in the designated time and day. Please do not shift your lab timings for any reason. If you happen to miss the lab due to a valid reason (please refer to the point number 15 above, as what needs to be done in this regard), then it may be done during the make up lab session. The announcement for which would be made in the due course.
- Lab Attendance is compulsory, the TAs would take attendance for all the labs. **If your lab attendance is not 100%, then you may stand to lose the entire lab examination credit.**
- The software labs would be based on LABVIEW. It is your duty to get accustomed to this software. The first lab would help you in getting started with LABVIEW **(Note: DA-IICT has a campus wide license of LABVIEW, therefore it can be installed on your personal computers as well. Please talk to Mr. Rajendra Shah on this).**
- Every lab would be put one week before the corresponding date of the lab. It is your duty to go through the lab and do the required pre-lab preparation (both on the theoretical and software front).
- As mentioned in the grading policy, there can be surprise lab exams based on the labs that were done until then. The lab exam grading would be based on (i) viva-voce and (ii) lab report. The guidelines for lab report are given below.
- The following are a few guidelines you need to follow in preparing your lab report (each report should have a cover page that contains following: Subject code and Name, Experiment Number and title, Experiment date and Your name, id and lab group):
  1. The report must have a lab objective.
  2. You need to state clearly the theoretical concepts and equations used.
  3. Lab results (in the form of plots, tabular columns, etc., as and where applicable) and the associated analysis.
  5. Appendices showing your source code.
- Always ensure you carry a pen drive with you to copy the data corresponding to a particular lab. The stored data can be used subsequently.