BITS, PILANI – K. K. BIRLA GOA CAMPUS

Semester I 2023-2024

Course Handout

In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives specific details regarding the course.

Course Number	: ECE/EEE F418
Course Name	: Modern Communication Technologies
Instructor-in-charge	: Dr. Ravi Kadlimatti *(ravik@goa.bits-pilani.ac.in)*

1. Scope and Objective:

This is an elective course that provides students with a knowledge of the important technologies in modern communication systems. Topics covered include:

- The essential blocks of a modern communication system,
- Modulation and demodulation techniques,
- Link budget calculations,
- Channel capacity & coding – cursory treatment,
- Digital receiver design & performance analysis,
- Multiplexing & multiple access techniques,
- Multiple antennas systems,
- Wireless channel properties & mitigation techniques,
- Mobile communication network concepts,
- Introduction to optical communication systems.

2. Textbooks

(T1) John G. Proakis and Masoud Salehi, "Digital Communications," McGraw-Hill Education, 2018, Fifth Edition.

(T2) H. Kolimbiris, "Fiber Optic Communications," Pearson Education, First Indian Edition.

3. Reference books

(R2) Bernard Sklar and Pabitra Kumar Ray, "Digital Communications: Fundamentals and Applications," Bernard Sklar and Pabitra Kumar Ray, Pearson Education 2009, Second Edition.

(R2) Theodore Rapport, "Wireless Communications Principles and Practice," Pearson Education.

4. Course Plan

Lecture No.	Topics to be covered	Reading list (Chapter No.)
1	Introduction to the course, typical block diagram, introduction of digital communication systems blocks.	T1: Chapter 1, **Class Notes** & R2: Chapter 1
2, 3, 4	Digital modulation techniques: memory and memoryless modulation methods, power spectrum of digitally modulated signals.	T1: Chapter 3 (3.1, 3.2-1, 3.2-2, 3.2-3, 3.2-4, 3.3-1, 3.3-2, 3.4-1, 3.4-2, 3.4-5), **Class Notes** & R2: Chapters 2 & 3
5, 6, 7	Digital demodulation techniques, optimal detection of modulated signals in AWGN, bit & symbol error performance.	T1: Chapter 4 (4.1, 4.2-1, 4.2-2, 4.2-3, 4.3, 4.4, 4.5-1, 4.5-2, 4.5-5), **Class notes** & R1: Chapter 4
8, 9, 10	Introduction to information theory, source coding, channel coding, channel capacity.	T1: Chapter 6 (6.1, 6.2, 6.3, 6.4-1, 6.5), **Class notes** & R1: Chapter 6
11 to 15	Multicarrier modulation techniques, OFDM, SCFDMA, OFDMA, Spread spectrum communication techniques.	T1: Chapters 11 (11.1, 11.2-1, 11.2-3, 11.2-4, 11.2-5, 11.2-6, 11.2-8) & 12 (12.1, 12.2-1, 12.2-2, 12.3-1, 12,3-3) **Class notes,** R1: Chapters 11 & 12
16 to 20	Fading channels, characterization of wireless channels, communicating over fading channels, degrading effects due to fading and mitigation.	T1: Chapter 13 (13.1, 13.3, 13.4, 13.5, 13.6), **Class Notes,** R1: Chapter 15
21 to 26	Multiple Antenna Systems, MIMO channels, MIMO signal transmission and reception, MIMO capacity, coding for MIMO channels.	**Class notes**, T1: Chapter 15 (15.1, 15.2-1, 15.2-2, 15.2-5, 15.4-3)
27, 28	Introduction to multiple access techniques, capacity of multiple access methods, random access methods.	**Class notes**, T1: Chapter 16 (16.1, 16.2, 16.3-1, 16.3-2, 16.4-1, 16.5) & R1: Chapter 11
29, 30, 31	Link Budget importance, channels, received signal power, noise power, link budget analysis.	**Class notes** & R1: Chapter 5
32 to 35	Mobile communications, different standards, cellular concepts, frequency reuse, handoff strategies, Interference and system capacity improvements.	**Class Notes** & R2: Chapters 1 & 2
36, 37, 38	Transmitters, receivers and other optical communication subsystem, optical wireless systems.	T2: Relevant chapters & **Class Notes**

5. Evaluation Scheme (tentative)

No.	Component	Duration	Marks (%)	Date and time
1.	Test/Assignment 1	--	10%	26/08/2023 to 02/09/2023
2.	Test/Assignment 2	--	10%	23/09/2023 to 30/09/2023
3.	Mid-semester examination closed book (closed book)	90 min	25%	10/10/2023, 11:00 am – 12:30 pm.
4.	Test/Assignment 3	--	10%	28/10/2023 to 4/11/2023
5.	Test/Assignment 4	--	10%	18/11/2023 to 25/11/2023
6.	Comprehensive examination (closed book)	180 min	35%	08/12/2023, 2:00 pm – 5:00 pm.

6. Make-up Policy

Application for make-up will be considered only for the mid-semester and the comprehensive examinations. An application in writing with relevant certificates attached (medical from Campus Medical Center or SWD) needs to be submitted to the IC of the course at least a day before the scheduled exam. No make-up will be given for any other evaluation component.

7. Attendance Policy

Every student is expected to be regular in attendance in all classes, tests, quizzes, seminars, etc. and in fulfilling all tasks assigned to him/her. Attendance will be recorded.

8. Grading notice

All students registered in the course are expected to appear for all evaluation components. Per section 4.19 of the BITS, Pilani academic regulations, NC may be given to students if they fail to provide a chance for the instructor to evaluate their progress in the class. Absence in any evaluation components without prior consent of the instructor or submitting blank or incomplete/incoherent answer books may present grounds for awarding NC in the course.

9. Honor code and disciplinary action

All submissions by students in this class towards quizzes, tests and tutorials will be considered their own original and individual work. It will be assumed that the students have not resorted to any unfair means during the evaluation. If malpractice is discovered, strictest action will be initiated against the student.

10. FAQs

(i) *Is lecture attendance compulsory?* – Attendance will be taken per instructor discretion. 100% attendance for lectures is expected.

(ii) *Can I get a makeup for quizzes/tests/assignments?* – No makeup will be provided for these. They are intended to serve as techniques to assess course speed and relevance.

(iii) *If I make >10% in the course, will I be safe from an NC?* – All grading decisions will be taken by the Instructor-in-charge after the comprehensive examinations are over. There is no stipulated cut-off for NC. Students are expected to perform to the best of their abilities.

(iv) *I find the course difficult. How do I improve my performance?* – Students are encouraged to meet with instructors during their office hours for additional help.

11. Announcements

Course management and announcements will be handled through the Quanta course webpage. However, since 100% class attendance is expected, there might be a delay between class announcements to the information appearing on the course webpage.

12. Office/Chamber consultation hours

Thursdays, 5:00 pm to 6:00 pm (Please send an email: ravik@goa.bits-pilani.ac.in in advance).

Instructor-in-Charge,
ECE/EEE F418