Birla Institute of Technology & Science, Pilani
Hyderabad Campus

ACADEMIC-GRADUATE STUDIES AND RESEARCH DIVISION

First Semester 2023-2024

Course Handout

Date: 01/08/2023

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

Course Number : EEE G612
Course Title : Coding Theory & Practice
Course Coordinator : Prof. RUNA KUMARI.

1. **Course Description**
   Codes for data-compression: instantaneous codes; Kraft inequality; Mcmillan theorem; Huffman codes; codes for error-detection and correction; binary symmetric channel; channel capacity, Shannon's fundamental theorem; linear codes; Macwilliam's identity; Reed-muller codes; cyclic codes; BCH codes; codes for secrecy and security; private-key cryptosystems; affine codes; twisted codes; one-time-pads; public-key cryptosystems based on large primes and discrete logarithms.
2. **Scope and Objective of the Course:**
   The course covers source coding, channel coding & encryption. The former deals with error correction in noisy channel, and the latter deals with secrecy of communication. Channel coding, which constitutes the major portion of the course, will introduce a number of important classes of error-detecting and error-correcting codes and their decoding. Finally the course will give an introduction to encryption & decryption of data for secret communications.
3. **Text Books:**
   Information theory, Coding and Cryptography, Ranjan Bose, Tata McGraw Hill, 3rd ed, 2017.
4. **Reference Books:**
   1. Element of Information Theory, Thomas M Cover, John Wiley & Sons, 2004
   2. Information Theory and Coding, Normal Abrahamson, Mcgraw Hill, Electronic Sciences Series.
   3. Principles of Digital Communication by Robert Gallager, Cambridge University Press.
   4. Introduction to Data Compression by Khalid Sayood, Morgan Kaufmann, Elsevier.
   5. Error Control Coding-Fundamentals and Applications, Shu Lin and Daniel Costello, Prentice Hall
5. **Course Plan / Schedule:**

Sl. #	Learning objectives	Topics to be covered	Chapter No.	No. of lectures
1.	Introduction	Introduction to the course & Coding		1
2.	To introduce the concept of Uncertainty, Entropy	Data compression, Entropy	TB:Ch. 1 Ref:Ch.2	3
3.	To introduce the concepts of	Unique and instantaneous	TB:Ch. 1	1

	coding and decoding	codes, Kraft's inequality	Ref:Ch.5	
4.	To introduce Universal Source coding	Huffman, Shannon-Fano-Elias, Arithmetic, L-z, Run Length Coding	TB:Ch.1	5
5.	To introduce optimal codes	Rate distortion theorem, Optimal code length	TB:Ch. 1 Ref:Ch. 13	2
6.	To introduce the concept of channel capacity and coding	Channel models, channel capacity, Shannon limit	TB:Ch. 2	2
7.	To introduce the concept of error correcting codes	Linear block codes, generator & parity check matrix	TB:Ch. 3	4
8.	To introduce the concept of syndrome and decoding through syndrome	Syndrome decoding of linear codes	TB:Ch. 3	2
9.	To study cyclic codes, their encoding & decoding	Cyclic codes	TB:Ch. 4	4
10	To study certain well known linear codes	Well-known block codes ; Golay code, CRC codes	TB:Ch. 4	3
11	To introduce the important class of BCH codes	BCH codes, Reed-Solomon codes	TB:Ch.5	3
12	To introduce the important class of Convolutional coder & decoder	Convolutional codes, Viterbi decoding, turbo codes	TB:Ch. 7	6
13	To introduce the concept of data encryption and decryption	Models, goals and early cipher systems	TB:Ch.9	2
14	To introduce Public Key Cryptosystems	Public Key Crypto systems and some examples	TB:Ch. 9	2
		Total no. of classes planned		**40**

6. Evaluation Scheme:

Component	Duration	Weightage	Marks	Date & Time	Remarks
Mid Sem	90 mts.	20%	60	13/10 - 9.30 - 11.00AM	Closed Book
Quizzes		10%	30	-	Closed Book
Laboratory Component		20%	60	2 Hr Lab Session per week + design expt + 2Hr End semester Practical Exam	Open Book
Term Project		20%	60	Weekly interaction+ literature survey + simulation + mid sem and End semester Project presentation	Open Book
Comprehensive	3 Hrs	30%	90	18/12/23	Closed Book
Totals		**100%**	**300**		

7. **Chamber Consultation Hour:** To be announced in Class

8. **Make-up Policy:** Make-up will be given on extremely genuine grounds only. Prior application should be made for seeking the make-up examination.
9. **Notices:** Notices, if any, concerning the course will be put up on CMS only

10. **Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Runa Kumari
Instructor-in-Charge
EEE G612