Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC501	Digital communication	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test2	Avg.					
ECC501	Digital communi-cation	20	20	20	80	03	--	--	100

Course Pre-requisite:

ECC401 - Engineering Mathematics-IV
ECC404 - Signals and Systems
ECC405 - Principles of Communication Engineering

Course Objectives:

1. To describe the basics of information theory and source coding.
2. To illustrate various error control codes.
3. To describe baseband system.
4. To learn different digital modulation and demodulation techniques

Course Outcomes:

After successful completion of the course student will be able to:

1. Apply the concepts of information theory in source coding.
2. Compare different error control systems and apply various error detection codes.
3. Analyze different error correction codes.
4. Compare various baseband transmission methods for digital signals.
5. Evaluate the performance of optimum baseband detection in the presence of white noise.
6. Compare the performances of different digital modulation techniques

Module No.	Unit No.	Topics	Hrs.
1.0		**Information Theory and Source Codes**	**05**
	1.1	Block diagram of digital communication system, Information content of a source symbol, Source entropy, Average information rate, AWGN channel, and Shannon-Hartley channel capacity theorem.	03
	1.2	Introduction of source code, Huffman code, Shannon-Fano code.	02
2.0		**Error Control System and Error Detection Codes**	**03**
	2.1	Introduction of error control system, Automatic Retransmission Query (ARQ) system, Types of ARQ systems and comparison, Forward error correction (FEC) system. Comparison between FEC and ARQ.	01
	2.2	Error detection codes: Vertical Redundancy Check (VRC) code, Longitudinal Redundancy Check (VRC) code, Cyclic Redundancy Check (CRC) code and Checksum code.	02
3.0		**Error Correction Codes**	**10**
	3.1	Linear block code: Code generation, calculation of minimum Hamming distance, error detection capability, error correction capability, implementation of encoder, error detection, syndrome table, error correction and implementation of decoder.	03
	3.2	Cyclic code: Code generation, calculation of minimum Hamming distance, error detection capability, error correction capability, implementation of encoder, error detection, syndrome table, error correction and implementation of decoder.	03
	3.3	Convolutional code: Generation, path responses, encoder, state transition table, state diagram, tree diagram, trellis diagram, decoding using Viterbi's algorithm.	04
4.0		**Baseband Transmission**	**05**
	4.1	Block diagram of baseband transmitter-receiver system, Line codes (RZ and NRZ UniPolar formats, RZ and NRZ Polar formats, NRZ Bipolar format (AMI format), NRZ Manchester format, and Quaternary Polar format). Comparison of line codes with respect to bandwidth, power requirement, synchronization capability, DC level, polarity inversion error and complexity. Power spectral density and spectrum of NRZ Unipolar and Polar formats.	03
	4.2	Inter Symbol Interference (ISI), Inter Channel Interference (ICI). Nyquist criterion for distortionless baseband binary transmission, Nyquist bandwidth and practical bandwidth.	02
5.0		**Optimum Detection of Baseband Signal**	**04**
	5.1	Matched filter, Output SNR, Transfer function, Impulse response and Error probability. Integrate and dump receiver, Correlator receiver.	04
6.0		**Digital Modulations**	**12**
	6.1	Generation, Detection, Error probability (using signal space representation and Euclidean distance), Bandwidth (using PSD and spectrum except for MSK) and applications of the following modulations: Binary ASK, Binary PSK, Quadrature PSK, Off-Set QPSK, M-ary PSK, Binary FSK, M-ary FSK, 16-ary QASK and MSK.	12
		Total	**39**

Text Books:

1.H. Taub, D. Schlling, and G. Saha-Principles of Communication Systems, Tata Mc- Graw Hill, New Delhi, Third Edition, 2012.
2. Lathi B P, and Ding Z-Modern Digital and Analog Communication Systems, Oxford University Press, Fourth Edition, 2017.
3. Haykin Simon-Digital Communications, John Wiley and Sons, New Delhi, Fourth Edition, 2014.
4. John G. Proakis-Digital Communications, McGraw-Hill, Fourth Edition

Reference Books:

1. Sklar B, and Ray P. K.-Digital Communication: Fundamentals and applications, Pearson,Dorling Kindersley (India), Delhi, Second Edition, 2009.
2. T L Singal-Analog and Digital Communication, Tata Mc-Graw Hill, New Delhi, First Edition,2012.
3. P Ramakrishna Rao-Digital Communication, Tata Mc-Graw Hill, New Delhi, First Edition,2011.
4. K. Sam Shanmugam-Digital and analog communication Systems, John Wiley and sons.
5. Upamanyu Madhow- Fundamentals of Digital Communication- Cambridge University Press
6. W.C. Huffman, Vera Pless- Fundamentals of Error Correcting Codes, Cambridge University Press
7. Graham Wade-Coding Techniques, Palgrave, New York

NPTEL / Swayam Course:

1. https://nptel.ac.in/courses/108/101/108101113/
2. https://nptel.ac.in/courses/108/102/108102096/
3. https://nptel.ac.in/courses/108/102/108102120/

Internal Assessment (20-Marks):

Internal Assessment (IA) consists of two class tests of 20 marks each. IA-1 is to be conducted on approximately 40% of the syllabus completed and IA-2 will be based on remaining contents (approximately 40% syllabus but excluding contents covered in IA-I). Duration of each test shall be one hour. Average of the two tests will be considered as IA marks.

End Semester Examination (80-Marks):

Weightage to each of the modules in end-semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of **total 06** questions, each carrying **20 marks**.
2. **Question No: 01** will be **compulsory** and based on entire syllabus wherein 4 to 5 sub-questions will be asked.
3. Remaining questions will be mixed in nature and randomly selected from all the modules.
4. Weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
5. **Total 04 questions** need to be solved.