**Course File Index**

**2019-20**

**Course Name: Principles of Communication Engineering** **Course ID:ITC305**

**Semester: III**

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| Course  Code | Course Name | Theory | Practical | Tutorial | Theory | Oral &  Practical | Tutorial | Total |
| ITC305 | Principle of Communications | 03 | -- | 01 | 03 | -- | 01 | 04 |

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| Course Code | Course Name | Examination Scheme | | | | | | | |
| Theory Marks | | | | Term Work | Oral & Practical | Oral | Total |
| Internal assessment | | | End Sem. Exa m |
| Test1 | Test 2 | Avg. of 2 Tests |
| ITC305 | Principle of Communications | 20 | 20 | 20 | 80 | -- | -- | -- | 100 |

$ 3 hours shown as theory to be taken class wise and 1 hour to be taken tutorial as batch wise

**Course Objectives:** Students will try to:

1. Study the basic principles and techniques used in analog and digitalcommunications.
2. Understand the concept of noise and Fourier transform for designing and analysing communicationsystem.
3. Acquire the knowledge of different modulation techniques such as AM , FM and studythe block diagrams of transmitter andreceiver.
4. Study the Sampling theorem and Pulse Analog Modulationtechniques.
5. Learn the concepts of Digital modulation techniques such as PCM, DM, ADM and multiplexingtechniques.
6. Gain the core idea of Electromagnetic Radiation and propagation ofwaves.

**Course Outcomes:** Students will be able to:

1. Differentiate analog and digital communicationsystems
2. Identify different types of noise occurred, its minimization and able to apply Fourier analysis in frequency & time domain to quantify bandwidth requirement of variety of analog and digital communicationsystems.
3. Design generation & detection AM, DSB, SSB, FM transmitter andreceiver.
4. Apply sampling theorem to quantify the fundamental relationship between channel bandwidth, digital symbol rate and bitrate
5. Explain different types of line coding techniques for generation and detection ofsignals.
6. Describe Electromagnetic Radiation and propagation ofwaves.
7. **Prerequisite:** Basic Electrical Engineering

# Detailed syllabus:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr.**  **No.** | **Module** | **Detailed Content** | **Hours** | **CO**  **Mapping** |
| 0 | Prerequisite | Electrical engineering concepts,  analog and digital electronics. | 02 | -- |
| I | Introduction | Basics of analog communication systems (Block diagram), Sources of information, Baseband and band pass signals, Types of communication channels, Frequency / Spectrum allocations, Need for modulation and  demodulation | 03 | CO1 |
| II | Fourier Transform and Noise | Introduction to Fourier Transform, its properties (time and frequency shifting and convolution property), Fourier transform of unit step, delta and gate function. Correlated and uncorrelated sources of noise in communication system, Noise parameters –Signal to noise ratio, Noise factor, Noise figure, Friis formula and Equivalent noise  temperature | 05 | CO2 |
| III | Modulation and Demodulation (AM and FM) | AM: Amplitude modulation techniques and its types- DSBFC AM,  DSBSC-AM, SSB SC AM-  spectrum, waveforms, bandwidth, Power calculations. AM Receivers  – Block diagram of TRF receivers and Super heterodyne receiver.  Receiver characteristics - Sensitivity, Selectivity, Fidelity, Image frequency and its rejection and double spotting  FM : Principle of FM- waveforms, spectrum, bandwidth. Pre- emphasis and de-emphasis in FM, FM noise triangle, Comparison of AM and  FM systems, FM generation:Direct method –Varactor diode Modulator, Indirect method (Armstrong method) block diagram andwaveforms.  FM demodulator: Foster Seely  discriminator, Ratio detector. | 12 | CO3 |
| IV | Pulse Analog Modulation | Sampling theorem for low pass and band pass signals with proof,  Anti- aliasing filter, PAM, PWM  and PPM generation and | 05 | CO4 |

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|  |  | Degeneration. |  |  |
| V | Digital Modulation  Techniques and Transmission | Introduction to digital  communication (Block diagram), Quantization process, Pulse code modulation, Delta modulation, Adaptive delta modulation, Principle of time division multiplexing, Frequency division multiplexing and its applications. Introduction to Line codes, Inter- symbol interference, Binary phase shift keying, Differentially encoded phase shift keying, Quadrature phase shift keying, M-ary phase shift keying, Quadrature amplitude  shift keying | 08 | CO5 |
| VI | Radiation and Propagation of  Waves | Electromagnetic radiation, fundamentals, types of propagation,  ground wave, sky wave, tropospheric scatter propagation | 04 | CO6 |

**Text Books:**

1. Simon Haykin, Michael Moher, Introduction to Analog & Digital Communications, WileyIndia Pvt. Ltd., 2ndEd.
2. Herbert Taub, Donald L Schilling, GoutamSaha, Principles of Communication Systems, Tata McGraw Hill,3rdEd.
3. V Chandrasekar, Communication Systems, Oxford University Press, IstEd.

# References:

1. George Kennedy, Bernard Davis, SRM Prasanna, Electronic Communication Systems, Tata McGraw Hill, 5thEd.
2. Wayne Tomasi, Electronic Communications Systems, Pearson Publication, 5thEd.
3. BP Lathi,Zhi Ding, Modern Digital and Analog Communication Systems, OxfordUniversity.
4. K Sam Shanmugam, Digital and Analog Communication Systems, Wiley India Pvt. Ltd, 1stEd.

# Suggested Topics for Tutorials (Any 10):

1. Demonstration of Amplitudemodulation.
2. Demonstration of Frequencymodulation.
3. Study of AM/ FMreceiver.
4. Demonstration of Signal sampling andreconstruction.
5. Study of PWM generation anddetection.
6. Study of PCM coding anddecoding.
7. Study of Delta modulation anddemodulation
8. Demonstration of TDM/FDM.
9. Demonstration of BPSK, BFSK,BASK
10. Study ofQPSK
11. Study of Inter symbol Interference and Linecoding.
12. Study of different types ofPropagation.

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| **Sr.No.** | **Course Outcome Statement** |
| 1. | Differentiate analog and digital communicationsystems |
| 2. | Identify different types of noise occurred, its minimization and able to apply Fourier analysis in frequency & time domain to quantify bandwidth requirement of variety of analog and digital communication systems |
| 3. | Design generation & detection AM, DSB, SSB, FM transmitter and receiver. |
| 4. | Apply sampling theorem to quantify the fundamental relationship between channel bandwidth, digital symbol rate and bit rate. |
| 5. | Explain different types of line coding techniques for generation and detection of signals. |
| 6. | Describe Electromagnetic Radiation and propagation of waves. |

**1.2 CO Assessment Tools**

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| --- | --- | --- | --- | --- | --- | --- |
|  | **Direct Methods** | | | | **Indirect Methods** | |
| CO1 | University result(30) | Test1(30%) | Tutorial(35%) | Quiz (35%) |  | 100% |
| CO2 | University result(30) | Test2(30%) | Tutorial(40%) | Practical(30%) | 100% |
| CO3 | University result(30) | Test2(25%) | Lab(50%) | Quiz (25%) | 100% |
| CO4 | University result(30) | Test2(20%) | Lab(50%) | Practical(30%) |  | 100% |
| CO5 | University result(30) | Test2(25%) | Lab(45%) | Practical(30%) |  | 100% |
| CO6 | University result(30) | Assignment(30%) | Tutorial(70%) |  |  | 100% |

**1.3 CO-PO and CO-PSO Mapping**

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| **Course Name** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO0** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| CO1 | 3 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 |
| CO2 | 3 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 |
| CO3 |  |  | 3 |  |  |  |  |  |  |  |  |  | 1 | 1 |
| CO4 | 1 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 |
| CO5 | 1 |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 |
| CO6 | 1 | 1 |  |  |  |  |  |  |  |  |  |  | 1 | 1 |

**2.1 Lesson Plan**

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| Sr.no | **Topic Taught** | **Planned date** | **Actual Date** | **Delivery mechanism** |
|  | NAAC process,Courseoutcomes for the subjects,syllabus,markingscheme,termwork,practicals | 4/7/19 | 4/7/19 | Chalk & board |
| 1. v | Brainstorming questions,Block diagram of communication system through roleplay,explanation of each and every block,types of channels. | 5/7/19 | 5/7/19 | Chalk & board |
|  | Revision of previous topic,Wireline and wireless channels, examples of wireline channels coaxial cable, twisted pair | 11/7/19 | 11/7/19 | Chalk & board |
|  | Revision of previous topic ,Wireless, electromagnetic spectrum ,applications ,modulation, need of modulation | 12/7/19 | 12/7/19 | Chalk & board |
|  | Revision of previous topic ,Amplitude modulation, definition, waveforms, expression for amplitude modulated signal ,Spectrum of AM, disadvantage of AM | 16/7/19 | 16/7/19 | Chalk & board |
|  | Revision of previous topic ,Problems on Amplitude modulation | 18/7/19 | 18/7/19 | Chalk & board |
|  | Revision of previous topic ,Problems contd, Power relation in AM, | 19/7/19 | 19/7/19 | Chalk & board |
|  | Revision of previous topic ,Current relation in AM, Problems | 23/7/19 | 23/7/19 | Chalk & board |
|  | Revision of previous topic ,Am receivers, types of receiver, TRF receiver, disadvantages | 25/7/19 | 25/7/19 | Chalk & board |
|  | Revision of previous topic ,Super heterodyne receiver, receiver characteristics sensitivity ,selectivity, fidelity, image frequency rejection ratio | 26/7/19 | 26/7/19 | Chalk & board |
|  | Revision of previous topic ,Problems on image frequency rejection ratio, double spotting with examples | 30/7/19 | 30/7/19 | Chalk & board |
| 12 | Surprise test | 31/7/19 | 31/7/19 | Chalk & boardChalk & boardChalk & board |
|  | FM Problem Solving. | 2/8/19 | 2/8/19 | Chalk & board |
|  | FM generation methods: Direct and indirect method. Principle of direct method Reactance modulator method | 6/8/19 | 6/8/19 | Chalk & board |
|  | Working of reactance and varactor diode method | 8/8/19 | 8/8/19 | Chalk & boardChalk & board |
|  | Working of Armstrong method,comparison of various techniques | 9/8/19 | 9/8/19 | Chalk & board |
|  | Revision of previous topic ,FM demodulators, single slope detector, balanced slope detector, comparison of single and balanced slope detectors | 20/8/19 | 20/8/19 | Chalk & board |
|  | Revision of previous topic ,Foster-seeley, ratio detector, advantages and disadvantages Revision of previous topic ,Comparison of different demodulators, preemphasis and deemphasisckts | 22/8/19 | 22/8/19 | Chalk & board |
|  | Revision of previous topic ,FMNoisetriangle, Effect of noise in FM,Comparision of Fm and Am systems. Revision of previous topic ,Digital communication block diagram, examples of various blocks in digital system | 23/8/19 | 23/8/19 | Chalk & board |
|  | Revision of previous topic ,Samplingtheorem,statement and proof,different types of sampling:natural,instantaneous,flat top sampling. | 27/8/19 | 27/8/19 | Chalk & board |
|  | Revision of previous topic ,Aliasingerror,antialiasingfilter,Pulse analog modulation techniques:PAM block diagram,working and waveforms. | 29/8/19 | 29/8/19 | Chalk & board |
|  | Revision of previous topic ,source coding techniques: PCM block diagram, working, quantization, quantization error, advantages and disadvantages of PCM system. | 30/8/19 | 30/8/19 | Chalk & board |
|  | Revision of previous topic ,source coding techniques: PCM block diagram, working, quantization, quantization error, advantages and disadvantages of PCM system. | 13/9/19 | 13/9/19 | Chalk & board |
|  | Revision of previous topic ,Delta modulation : block diagram, working, errors in delta modulator: slope overload and granular error, condition to avoid slope overload error. | 19/9/19 | 19/9/19 | Chalk & board |
|  | Revision of previous topic ,Adaptive delta modulation working ,comparison of PCM,DM,ADM | 20/9/19 | 20/9/19 | Chalk & board |
|  | Revision of previous topic ,Digital modulation techniques: BPSK, block diagram of transmitter. | 24/9/19 | 24/9/19 | Chalk & board |
| 26. | Revision of previous topic ,BPSKcontd, FSK working transmitter and receiver waveforms. | 26/9/19 | 26/9/19 | Chalk & board |
| 27. | Revision of previous topic ,ASK transmitter and receiver, working, block diagram. | 27/9/19 | 27/9/19 | Chalk & board |
| 28. | Revision of previous topic ,Multiplexing techniques, frequency and time division multiplexing. Revision of previous topic ,Block diagram of TDM-PCM sysem, comparison of the frequency and time division multiplexing | 1/10/19 | 1/10/19 | Chalk & board |
| 29. | Revision of previous topic ,Different types of signals, classification, fourier transform, fourier transform of delta function. Noise different types of noise, noise parameters, some portion of topic for self study. | 3/10/19 | 3/10/19 | Chalk & board |
| 30. | Noise different types of noise:internal external | 4/10/19 | 4/10/19 | Chalk & board |
| 32. | Noise contd,noiseparameter.Fourier transform | 10/10/19 | 10/10/19 | Chalk & board |
| 33. | Properties of fourier transform | 10/10/19 | 10/10/19 | Chalk &board |

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| --- | --- | --- | --- | --- |
|  |  | Degeneration. |  |  |
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7. Study of Delta modulation anddemodulation
8. Demonstration of TDM/FDM.
9. Demonstration of BPSK, BFSK,BASK
10. Study ofQPSK
11. Study of Inter symbol Interference and Linecoding.
12. Study of different types ofPropagation.

# Assessment:

**Internal Assessment for 20 marks:**

Consisting of **Two Compulsory Class Tests**

Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:** Some guidelines for setting the question papers are as:

* + Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in thesyllabus.
  + Question paper will comprise of total **six questions**, **each carrying 20marks.**
  + **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
  + **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all themodules.)

Total **four questions** need to be solved