**20EC2103 – SIGNALS AND SYSTEMS**

(Common to ECE and EEE)

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| **Course category:** | Program core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 3- 0 – 0 |
| **Prerequisite:** | Knowledge of vectors Trigonometry, Differentiation & Integration | **Sessional Evaluation :**  **External Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course**  **Objectives** | Students undergoing this course are expected to understand: | |
| 1. Various analysis and operations on signals. 2. The Fourier series for periodic signals. 3. The Fourier Transform of various signals. 4. The different type of sampling technique. 5. The response of systems. 6. The discrete time signals and systems. | |
| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| CO1 | Define a signal and perform various operation on signals. |
| CO2 | Find the Fourier series of various Periodic signals. |
| CO3 | Analyse a signal in frequency domain by applying FT and its properties |
| CO4 | Establish the need for sampling and gaining various sampling technique. |
| CO5 | Perform distortion less transmission through a system. |
| CO6 | Apply signal analysis using DTFT. |
| **Course**  **Content**  **Course**  **Content** | **UNIT-I**  **SIGNAL ANALYSIS**: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals, Concepts of Impulse function, Unit Step function, Signum function. Operations on signals.  **UNIT-II**  **FOURIER SERIES**: Representation of Fourier series, Properties of Fourier Series, Dirichlet’s conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.  **UNIT III**  **FOURIER TRANSFORMS**: Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.  **UNIT-IV**  **SAMPLING**:Sampling theorem – Graphical and analytical proof for Band Limited Signals, Types of Sampling – Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling.  **UNIT-V**  **SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS**:Linear System, Convolution, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and Rise time.  **UNIT-VI**  **DISCRETE TIME SIGNALS AND SYSTEMS**: Linear Shift Invariant(LSI) system – Stability – Causality – Convolution and Correlation –Linear constant coefficient difference equation – Impulse response -Definition of Discrete Time Fourier Transform – Properties – Transfer function – System analysis using DTFT. | |
| **Text Books and Reference Books** | **TEXT BOOKS:**   1. Signals and Systems – A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2nd Ed., Pearson New international Edition-2014 2. Principles of Linear Systems and Signals, 2nd Ed, B. P. Lathi, 2009, Oxford. 3. Signals and Systems , 4th Edition, [Ramesh Babu](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Rameshbabu%22&source=gbs_metadata_r&cad=2), Scitech Publications (India), 2010   **REFERENCES:**   1. Signals & Systems – Simon Haykin and Van Veen, Wiley, 2 Ed.-2018 2. Signals and Systems – A.Rama Krishna Rao – 2008, TMH, 2014 3. Fundamentals of Signals and Systems – Michel J. Robert, 2017, MGH   International Edition. | |
| **E-Resources** | 1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit | |

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| Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low) | | | | | | | | | | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | - | - | 1 | - | - | 2 | - | - | - | 1 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 2 | - | - | - | 2 | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 1 | - | 1 | - | 2 | - | 2 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 | 1 | - | - | 1 | - | - | 3 | 3 | 3 |
| CO6 | 3 | 3 | 2 | 1 | 2 | 1 | - | 1 | 2 | - | - | 2 | 3 | 3 |