# **23EC2101-SIGNALS, SYSTEMS AND STOCHASTIC PROCESSES**

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| **CourseCategory:** | | ProfessionalCore | | **Credits:** | 3 |
| **CourseType:** | | Theory | | **Lecture-Tutorial-**  **Practical:** | 3-0-0 |
| **Prerequisite:** | | Basic Mathematics, TransformTechniques,and randomvariables | | **Sessional Evaluation:Univ.ExamEvaluation:**  **TotalMarks:** | 30  70  100 |
| **CourseObjectives** | | 1. UnderstandingthebasicsofsignalsandsystemsrequiredforECEcourses. 2. Toteachconceptsofsignalsandsystemsandtheiranalysisusing   differenttransformtechniques.   1. Toprovideabasicunderstandingofrandom processeswhichisessentialfortherandomsignalsandsystemsencounteredincommunicationsandsignalprocessing areas. | | | |
| **CourseOutcomes** | Uponsuccessfulcompletionofthecourse,thestudentswillbeableto: | | | | |
| CO1 | | Understandthemathematicaldescriptionandrepresentationofcontinuous-time and discrete-time signals and systems, Also, understandthe concepts of various transform techniques and Random Processes(L2) | | |
| CO2 | | Apply sampling theorem to convert continuous-time signals to discrete-timesignalsandreconstructback,differenttransformtechniquestosolve signalsandsystem-relatedproblems.(L3) | | |
| CO3 | | Formulateandsolveengineeringproblemsinvolvingrandomprocesses.(L3) | | |
| CO4 | | Analyzethefrequencyspectraofvariouscontinuous-timesignalsusingdifferent transformmethods.(L4) | | |
| CO5 | | Classifythesystemsbasedontheirpropertiesanddeterminetheresponseof them.(L4) | | |
| **CourseContent** | **UNIT-I**  **Signals & Systems:** Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals-Orthogonality,Mean square error.  **Fourier series:** Trigonometric & Exponential forms of Fourier series, Properties, Concept of discrete spectrum, Illustrative problems.  **UNIT-II**  **Fourier Transform:**Definition, Computation and properties of Fourier transform for different types of signals and systems ,Inverse Fourier transform .Sampling: Sampling theorem–Graphical and analytical proof for Band Limited Signals, Reconstruction of signal from its samples ,Effect of under sampling– Aliasing .Illustrative problems.  **Laplace Transform:** Definition, ROC, Properties, Inverse Laplace transforms, the s-plane and BIBO stability, Transfer functions, System Response to standard signals,Solutionofdifferentialequationswithinitialconditions,Illustrativeproblems. | | | | |
|  | **UNIT-III**  **Signal Transmission through Linear Systems:** Linear system, impulse response, Response of a linear system for different input signals, 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 ,Energy and Power spectral densities, Illustrative problems.  **UNIT-IV**  **Random Processes – Temporal Characteristics:** The Random Process Concept, Classification of Processes, Deterministic and Non-deterministic Processes ,Distribution and Density Functions ,concept of Stationarity and Statistical Independence. First-Order Stationary Processes ,Second-Order and Wide-Sense Stationarity, (N-Order) and Strict Sense Stationarity, Time Averages and Ergodicity,Auto-correlation Function and Its Properties ,Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes ,Poisson Random Process .Random Signal, Mean and Mean-squared Value of System Response ,auto correlation Function of Response ,Cross-Correlation Functions of Input and Output.  **UNIT-V**  **Random Processes – Spectral Characteristics:** The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross Correlation Function. Spectral Characteristics of System Response: PowerDensitySpectrumofResponse,Cross-PowerDensitySpectrumsofInputandOutput. | | | | |
| **TextBooks&ReferenceBooks** | **TEXTBOOKS:**   1. PeytonZ.Peebles,“Probability,RandomVariables&RandomSignalPrinciples”,4thEdition,TMH,2002. 2. A.V.Oppenheim,A.S.WillskyandS.H.Nawab,“SignalsandSystems”,2ndEdition,PHI,2009.   **REFERENCEBOOKS:**   1. Signals,Systems&Communications-B.P.Lathi,2013,BSP. 2. Athanasios Papoulis and S. Unnikrishna Pillai, “Probability,RandomVariablesandStochasticProcesses”,4thEdition,PHI,2002 3. SimonHaykinandVanVeen,“Signals&Systems”,2ndEdition,Wiley,2005. 4. MatthewSadikuandWarsameH.Ali,“SignalsandSystemsAprimerwithMATLAB”,CRC Press,2016. 5. HweiHsu,“Schaum'sOutlineofSignalsandSystems”,4thedition,TMH,2019. | | | | |

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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 | 2 | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO5 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 2 |