**20EC3201-DIGITAL SIGNAL PROCESSING**

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| **Course category:** | Program core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practical:** | 2 - 1 - 0 |
| **Prerequisite:** | Signal & System, Fourier transform, Laplace Transform & Z transform | **Sessional Evaluation:****External Evaluation:****Total Marks:** | 4060100 |
| **Course****Objectives** | Students undergoing this course are expected to understand: |
| 1. The basic concepts and analytical methods of Z-transform.
2. The various DFT & FFT algorithms.
3. The techniques and tools for digital filter structures.
4. The design of FIR filters.
5. The various IIR filters.
6. The truncation and Rounding errors, Quantization noise
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| **Course Outcomes** | Upon successful completion of the course, the students will be able to: |
| CO1 | Explain the concept of Z-transform, its properties and understand the concept of discrete and fast Fourier trans forms.  |
| CO2 | Understand the concept of IDFT and IZT. |
| CO3 | Apply the Concept of FIR, IIR Structures and frequency domain filter models. |
| CO4 | Design Parallel and cascade structure and Butterworth, Chebyshev filters. |
| CO5 | Design FIR filter using Fourier series method and understand the concept of fixed point and floating-point representation. |
| CO6 | Understand limit cycle oscillations concept and windowing technique. |
| **Course****Content** | **UNIT – I****REVIEW OF Z-Transforms:** Z-transform and Inverse Z-Transform, Theorems and Properties, system function, Fourier representation of finite duration sequences.**UNIT – II****DISCRETE & FAST FOURIER TRANSFORM**: DFT, properties of DFT, FFT, FFT algorithms, Use of DFT for fast computation of convolution, IDFT. **UNIT – III****DIGITAL FILTER STRUCTURES:** Basic FIR structures, IIR structures: Direct form-I, Direct form-II, Parallel form, Cascade form.**UNIT – IV****DESIGN OF IIR FILTERS:** Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Impulse Invariant and Bilinear Transformation Method.**UNIT – V****DESIGN OF FIR FILTERS**: Introduction to FIR filter, Methods of FIR filters: Fourier series method, Windowing, Sampling.**UNIT-VI****FINITE WORDLENGTH EFFECTS**: Fixed point and floating-point number representations – Truncation and Rounding errors – Quantization noise – coefficient quantization error – Product quantization error – Overflow error – Round off noise power – limit cycle oscillations due to product round off and overflow errors.  |
| **Text Books and Reference Books** | **TEXTBOOKS:**1. “Digital Signal Processing”, by A.V Oppenheim and R.W. Schafer, ‎Pearson Education India, First edition, 2015.
2. “Digital Signal Processing”, by S. Salivahanan – TMH, fourth edition 2019.
3. “Digital Signal Processing Computer Based Approach”, by Sanjit.K. Mitra – Tata McGraw-Hill, 4e,2013.

**REFERENCES BOOKS:**1. “Digital Signal Processing”, by P. Ramesh Babu, Scitech Publications, seventh edition 2018.
2. “Digital Signal Processing”, by John G Proakis and manolakis- ‎Pearson Education, 4th edition, 2014.
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| **E-Resources** | 1. <http://nptel.ac.in/courses>
2. <https://dspace.mit.edu/handle/1721.1/57007>
3. http://dl.acm.org/citation.cfm?id=562622
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| **Contribution of Course Outcomes towards achievement of Program Outcomes** |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 1 |  1 | - | - | 1 | - | - |  2 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | 1 | - | - | 2 | 3 | 2 |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 |