TEXT BOOKS:

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall of India Pvt. Ltd, 2003.
2. S. Pirzada, “An Introduction to Graph theory”, University Press, 2012.

REFERENCES:

1. Frank Harary, “Graph Theory”, Narosa Publishing House, 2001.
2. West D. B., “Introduction to Graph Theory”, 2nd Edition, Pearson Education, 2001.
3. Diestel R, "Graph Theory", 5th Edition, Springer, 2017.

EVALUATION METHOD TO BE USED:

Category of Course	Continuous Assessment	Mid – Semester Assessment	End Semester
Theory	**40**	**20**	**40**

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓						✓			
CO2	✓	✓	✓					✓				✓
CO3	✓	✓	✓		✓			✓				✓
CO4	✓	✓	✓						✓		✓	
CO5	✓	✓	✓		✓					✓		

EC6201 SIGNALS AND SYSTEMS

OBJECTIVES:

- To understand the types of signals and systems
- To gain knowledge about understanding continuous time and discrete time signals.
- To learn time domain and frequency domain analysis of signals
- To learn the transformations from time domain to frequency domain
- To gain knowledge about the various functionalities available in signal processing software to support signal processing applications

SIGNALS AND SYSTEMS	L	T	P	EL	TOTAL CREDITS
	3	0	4	3	6

MODULE I :	L	T	P	EL
	3	0	4	3
Classification of Signals - Useful Signal models – periodic and a periodic signals, random signals, Energy & Power signals -Systems – Classification of systems				

SUGGESTED ACTIVITIES :

- In Class activity – expressing signals as a function of step, ramp.
- Practical – Plotting of Continuous signals and operations on them using either Open CV, MATLAB, OCTAVE
- EL – Study of any one Open CV, MATLAB, OCTAVE

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes

MODULE II	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Time Domain analysis of continuous-time systems – unit impulse response – Convolution Integral – System response

SUGGESTED ACTIVITIES :

- EL – Visualizing signals of practical day to day activities like traffic light, count of vehicles, temperature of the day, stock market changes
- Practical - Implementation of continuous signals and understanding

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes
- Practical exercises demo

MODULE III	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Fourier Series – Periodic representation by trigonometric Fourier series – Role of amplitude and phase spectra - LTI continuous system response to periodic inputs – Signals as vectors

SUGGESTED ACTIVITIES :

- EL – Flipped Class-room – Signal representation by orthogonal signal set
- Practical – Fourier series application using Open CV, MATLAB or OCTAVE

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes
- Practical exercises demo

MODULE IV	**L**	**T**	**P**	**EL**
	3	**0**	**4**	**3**

Fourier Transform – Aperiodic representation by Fourier integral – Properties of Fourier transform – Fourier transform in the analysis of Continuous time systems

SUGGESTED ACTIVITIES :

- Flipped Class room
- EL – Application of Fourier transform
- Practical –Properties of Fourier transform implementation using Open CV, MATLAB, or OCTAVE

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes
- Practical exercises demo

MODULE V	L	T	P	EL
	3	0	4	3

Classification of Discrete time systems – Sampling theorem – signal reconstruction – Discrete-time signal models

SUGGESTED ACTIVITIES :

- EL – Signal operations
- Practical - Open CV, MATLAB, or OCTAVE – implementation and visualization of discrete time systems

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes
- Practical exercises demo

MODULE VI	L	T	P	EL
	3	0	4	3

Impulse response – Convolution sum – Discrete time systems response – Differential equation – Block diagram representation of Discrete time systems

SUGGESTED ACTIVITIES :

- EL – Impulse response for special cases, Correlation
- Practical –Convolution Implementation using MATLAB, OCTAVE or Open CV

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes
- Practical exercises demo

MODULE VII	L	T	P	EL
	3	0	4	3

Z-transform – Properties of Z-transform – Inverse Z-transform – Pole-Zero location

SUGGESTED ACTIVITIES :

- Practical –Implementation of Z-transform using Open CV, MATLAB, or OCTAVE
- EL – Bilateral Z-transform, Inverse Z-transform using alternate methods

SUGGESTED EVALUATION METHODS:

- Tutorial problems
- Assignment problems
- Quizzes
- Practical exercises demo

MODULE VIII	L	T	P	EL
	3	0	4	3
Discrete Time Fourier transform – Properties – Inverse Discrete Time Fourier Transform				
SUGGESTED ACTIVITIES : • EL – DTFS, relationship between DTFT and Z-transform • Practical – Implementation DFT, properties using MATLAB, OCTAVE or Open CV				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes • Practical exercises demo				

MODULE IX	L	T	P	EL
	3	0	4	3
Discrete Fourier Transform – Properties – Circular Convolution – Inverse Discrete Fourier transform				
SUGGESTED ACTIVITIES : • EL – DTFS, relationship between DTFT and Z-transform • Practical – Implementation DFT, properties using MATLAB, OCTAVE or Open CV				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Assignment problems • Quizzes • Practical exercises demo				

MODULE X	L	T	P	EL
	3	0	4	3
Fast Fourier Transform –Divide and Conquer – Decimation in Time – Radix-2 algorithm - Complexity				
SUGGESTED ACTIVITIES : • EL – Radix – n implementation of Fast Fourier Transform • Practical – Analyzing the FFT of signals and their interpretation				
SUGGESTED EVALUATION METHODS: • Assignment problems • Practical exercises demo				

MODULE XI	L	T	P	EL
	3	0	4	3
Fast Fourier transform – Decimation in frequency – Radix-2 algorithm - Inverse DFT using one FFT technique				
SUGGESTED ACTIVITIES : • EL – Derivation of Radix-n FFT for DIF algorithms				
SUGGESTED EVALUATION METHODS: • Tutorial problems • Quizzes				

OUTCOMES:

Upon completion of the course, the students will be able to:

- Analyze and classify any given signal and system
- Propose appropriate time domain and frequency domain analysis for a signal to satisfy an application
- Suggest appropriate frequency transformation to convert an analog signal to a digital signal
- Convert any input data to a signal and analyse it mathematically
- Code and represent a signal and analyse using a signal processing software

TEXT BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, Pearson Education, Second Edition, 2014.
2. B. P. Lathi, “Principles of Linear Systems and Signals”, Oxford University Press, Second Edition, 2009.

REFERENCES:

1. M.J. Roberts, “Signals & Systems, Analysis using Transform Methods & MATLAB”, Tata McGraw Hill (India), Third Edition, 2019.
2. P. Ramakrishna Rao, “Signals and Systems”, Second Edition, Tata McGraw Hill Publications, 2017.
3. H P Hsu, “Signals and Systems”, Schaum‘s Outline Series, Third Edition, Tata McGraw Hill, 2013.
4. S. Haykin and B. Van Veen, "Signals and Systems", Second Edition, Wiley, 2007.
5. Edward W. Kamen and Bonnie S. Heck, “Fundamentals of Signals and Systems Using the Web and MATLAB”, Pearson, Third Edition, 2006.
6. John Alan Stuller, “An Introduction to Signals and Systems”, Cengage Learning, 2007

EVALUATION PATTERN:

Category of Course	Continuous Assessment	Mid – Semester Assessment	End Semester
Theory Integrated with Practical	**15(T) + 25 (P)**	**20**	**40**

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓	✓							
CO2	✓	✓	✓	✓	✓	✓	✓					
CO3	✓	✓	✓	✓	✓				✓			
CO4	✓	✓	✓	✓	✓	✓	✓		✓			
CO5	✓	✓	✓	✓	✓	✓	✓	✓				