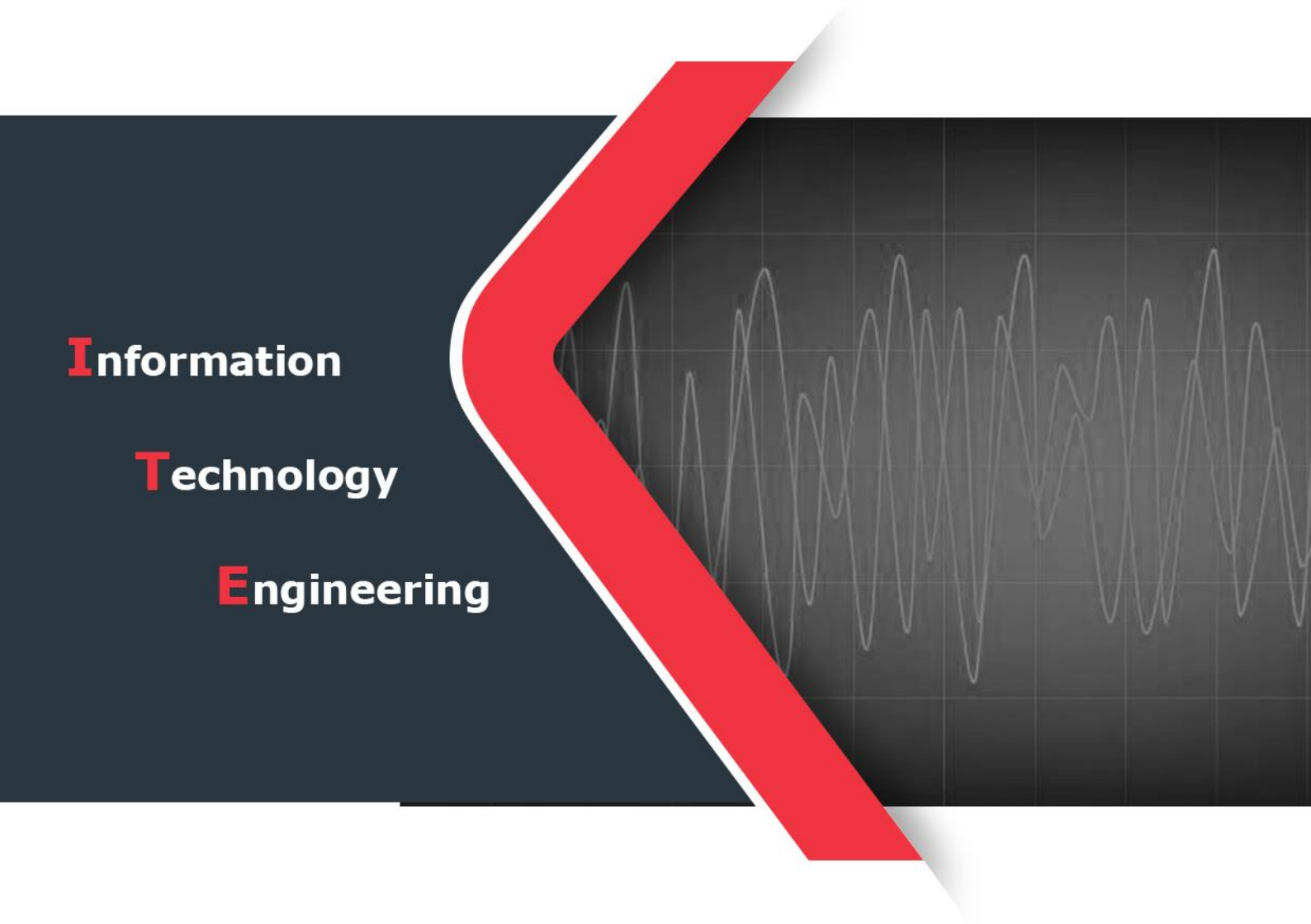
الجامعة الافتراضية السورية
SYRIAN VIRTUAL UNIVERSITY

Signal Processing Course Definition Form

Course definition



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1. Basic Information:

Course Name	Signal Processing
Course Code	BSP501
Number of Presentational Sessions*	2 × 12
Number of Synchronous Sessions**	12
Number of Shorter Tests***	4
Number of Exams***	1
Theoretical Sessions Work Load (hrs.)	36
Practical Sessions Work Load (hrs.)	36
Credit Hours	5

***Each presentational session comprises both recorded lecture (1.5 hrs.) and interactive learning content (1.5 hrs).**

****Each synchronous session comprises the interactive lecture carried out in real time in a virtual class (1.5 hrs).**

*****Each shorter test is 0.5 hr. long. The final exam is 2 hrs. long.**

N.B.

Generally, each chapter requires two presentational sessions: one for the recorded content and one for the interactive content (unless the chapter is too long, in which case it may require more sessions). This note applies to synchronous sessions as well, where each chapter requires one synchronous session generally.

2. Prerequisites courses:

Course	ID
Mathematical Analysis (2)	BMA402

3. Course Objectives:

This course aims to introduce the basics of Digital Signal Processing using the mathematical tools presented in previous courses. We review some of these tools with additional new concepts to go more deeply in analyzing digital systems. The concepts and characteristics of Fourier series and their applications in discrete signals.

We present the basic digital networks used to implement discrete systems including the various structures of FIR and IIR digital filters. The effect of coefficients quantization and finite precision arithmetic on the performance of LTI systems is also presented. We also present the main methods used in digital filters design. A special interest is given to the interpretation of the DFT of sinusoidal signals to understand the limits of this tool in spectral analysis. We conclude by introducing the discrete cosine transform which is used in many applications as in JPEG image compression.

4. Learning Outcomes:

By the end of this course the learner is expected to:

1. Describe discrete-time signals and its properties.
2. Describe discrete-time systems and its properties.
3. Apply Fourier Transform to analyze for discrete-time systems.
4. Understand the Sampling theorem and the quantization operation.
5. Review the Z-transform and its properties.
6. Apply the Z-transform to analyze discrete systems.
7. Analyze linear digital (time invariant) systems.
8. Describe the digital networks and main methods to implement discrete systems.
9. Understand the effect of coefficient quantization and finite precision arithmetic on the performance of discrete systems.
10. Identify design methods for FIR filters.
11. Identify design methods for IIR filters.
12. Apply the Discrete Fourier Transform to analyze discrete signals.
13. Apply the Cosine Transform and its main applications.
14. Apply DSP in sound and image applications.

Syrian Arab Republic		الجمهورية العربية السورية
Ministry of Higher Education		وزارة التعليم العالـــي
Syrian Virtual University		الجامعة الافتراضية السورية

5. Assessment Results:

Chapter Number	Chapter Title	General Objectives	Assessment Type				
			Interactive Content & Recorded Sessions	Applied Activities (Synch. Sessions)	Final Exam*/ Shorter Tests**	Presentations And Interviews ***	Reports ***
CH1	Discrete–Time Signals	Comprehension–Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH2	Discrete–time systems	Comprehension–Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH3	Fourier analysis for discrete systems	Comprehension–Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓

CH4	Sampling and Quantization	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH5	Z–Transform	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH6	Transform analysis of discrete systems	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH7	Implementation of discrete systems	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH8	Finite precision effects on digital filters	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓

CH9	Design of FIR filters	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH10	Design of IIR filters	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH11	Discrete Fourier Transform DFT	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓
CH12	Discrete Cosine transform	Comprehension –Analytical Thinking–Tools And Application Hands–On	✓	✓	✓	✓	✓

***The final exam is two hours long and is given at the end of the course.**

****Shorter tests are about 30 minutes long and are given after three or four lectures throughout the semester during synchronous sessions.**

*****Presentations, interviews, and reports are submitted once after each three or four lectures throughout the semester during synchronous sessions.**

6. Course Syllabus

Chapter	Subject	Content	Number of Learning Objects	Number of synchronous Learning Objects
CH1	Discrete-Time Signals	1. Discrete-time signals 2. Complex Signals 3. Famous discrete signals 4. Signal duration 5. Periodic Signals 6. Symmetric signals 7. Transformations on signals 8. Signal decomposition	8	4
CH2	Discrete-time systems	1. Properties of discrete systems 2. Linear time-invariant systems 3. Convolution properties 4. Difference equations	4	2

CH3	Fourier analysis for discrete systems	1. Frequency response for LTI system 2. Graphical representation of the frequency response 3. Discrete-Time Fourier Transform (DTFT) 4. Properties of DTFT 5. Filters	5	2
CH4	Sampling and Quantization	1. Analog to Digital conversion 2. Sampling theorem 3. Quantization and coding 4. Digital to Analog conversion 5. Changing the sampling rate	5	2
CH5	Z-Transform	1. Definition of Z-transform 2. Inverse Z-transform 3. Properties of Z-transform 4. Initial and final values theorems	4	2
CH6	Transform analysis of discrete systems	1. System function 2. Linear phase systems 3. Minimum phase systems 4. Feedback systems	4	2
CH7	Implementation of discrete systems	1. Digital networks 2. Structures for FIR systems 3. Structures for IIR systems	3	1

CH8	Finite precision effects on digital filters	1. Quantization error in fixed point systems 2. Pairing and ordering 3. Overflow	3	1
CH9	Design of FIR filters	1. Filter specifications 2. FIR Filter design using windows 3. Frequency sampling method 4. Equiripple linear phase filters 5. Alternation theorem	5	2
CH10	Design of IIR filters	1. Prototypes of analog lowpass filter 2. IIR filter design from analog filter 3. Frequency transformations 4. Least squares error methods	4	2

CH11	Discrete Fourier Transform DFT	1. Discrete Fourier Transform DFT 2. DFT analysis of sinusoidal signals 3. Time–dependent Fourier transform	3	1
CH12	Discrete Cosine transform	1. Definition of DCT 2. Relationship between DFT and DCT–I 3. Relationship between DFT and DCT–II 4. Power compacting property of DCT–II 5. Applications of DCT	5	2

7. Practical Activity:

- **Tools and Labs:**

Tool Name	Description
Word, excel, internet browsers	Available
Different available applications on DSP	Simple applications for exercises and practical activities

- **Practical Activities per Chapters:**

Chapter	Activities Type	Remarks
CH1	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	Homework
CH2	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	Homework

CH3	☑ Exercises ☑ Homework ☑ Webinars ☐ Project ☑ Experiment ☐ Other	Homework
CH4	☑ Exercises ☑ Homework ☐ Webinars ☑ Project ☑ Experiment ☐ Other	Homework
CH5	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	Homework
CH6	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	Homework

CH7	☑ Exercises ☑ Homework ☑ Webinars ☐ Project ☑ Experiment ☐ Other	Homework
CH8	☑ Exercises ☑ Homework ☐ Webinars ☑ Project ☑ Experiment ☐ Other	Homework
CH9	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	Homework
CH10	☑ Exercises ☑ Homework ☐ Webinars ☐ Project ☑ Experiment ☐ Other	Homework

CH11	☑ Exercises ☑ Homework ☑ Webinars ☐ Project ☑ Experiment ☐ Other	Homework
CH12	☑ Exercises ☑ Homework ☐ Webinars ☑ Project ☑ Experiment ☐ Other	Homework

8. References:

Monson H. Hayes, "Digital Signal Processing", McGraw Hill, 1999.

9. Additional References:

Alan V. Oppenheim, Ronald W. Schafer, "Discrete-Time Signal Processing", Second Edition, Prentice Hall, New Jersey, 1999.