**Course Specification**

**(**IT 341 Digital Signal Processing**)**

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| **University:** | Helwan University |
| **Faculty:** | Faculty of Computers & Information |
| **Department:** | Information Technology |

**1. Course Data**

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| **Code:** |  **IT 341**  |
| **Course title:** | Digital Signal Processing |
| **Level:** | 3 |
| **Specialization:** | Information Technology |
| **Credit hours:** | 3 hours |
| **Number of learning units (hours):**  | ( 3) theoretical (2 ) practical |

**2. Course Objective**

The aim of this course is to provide students with an understanding of digital signal processing concepts and theories which are applied for analyzing, designing as well as implementing discrete-time signals and systems.

**3. Intended Learning Outcomes:**

1. **Knowledge and Understanding**

A27. Discuss the basic foundations of Mathematics for computing field.

1. **Intellectual Skills**

B20. Generate methodologies for Problem Solving.

B22. Negotiate advanced technologies.

B23. Formulate and implement IT systems.

1. **Professional and Practical Skills**

C21. Choose appropriate Data Modeling.

1. **General and Transferable Skills**

D14. Support Engineering skills.

**4. Course contents**

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| **Topic** |
| Classification of Discrete-Time Signals and Systems; Linearity; Time-Invariance; Causality; Stability |
| Difference Equation; Impulse Response; Convolution. Sampling and Reconstruction of Analog Signals; Nyquist Theorem |
| z-Transform; Discrete-Time Fourier Transform (DTFT); Discrete Fourier Transform (DFT) |
| Fast Fourier Transform; Relationship between Analysis Tools; Analysis of Discrete-Time Linear Time-Invariant Systems |
| Responses and Properties of Digital Filters; Signal Flow Graph Representation; Block Diagram Representation; |
| Realization of Digital Filters; Implementation Considerations; Linear Phase Finite Impulse Response (FIR) Filters using Windows; Linear Phase FIR Filters by Frequency Sampling; |
| Gibbs Phenomenon; Optimum Approximations of FIR Filters; Continuous-Time Butterworth and Chebyshev Filters; |
| Infinite Impulse Response (IIR) Filter Design by Impulse Invariance and Bilinear Transformation; Frequency Transformation of Lowpass IIR Filters |

**Mapping contents to ILOs**

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| **Topic** | Intended Learning Outcomes (ILOs) |
| Knowledge and understanding | Knowledge and understanding | Knowledge and understanding | Knowledge and understanding |
| Classification of Discrete-Time Signals and Systems; Linearity; Time-Invariance; Causality; Stability | A27 | B22 | C21 |  |
| Difference Equation; Impulse Response; Convolution. Sampling and Reconstruction of Analog Signals; Nyquist Theorem | A27 | B22 | C21 |  |
| z-Transform; Discrete-Time Fourier Transform (DTFT); Discrete Fourier Transform (DFT) | A27 | B20,B23 | C21 |  |
| Fast Fourier Transform; Relationship between Analysis Tools; Analysis of Discrete-Time Linear Time-Invariant Systems | A27 | B23 | C21 |  |
| Responses and Properties of Digital Filters; Signal Flow Graph Representation; Block Diagram Representation; |  | B23 | C21 | D14 |
| Realization of Digital Filters; Implementation Considerations; Linear Phase Finite Impulse Response (FIR) Filters using Windows; Linear Phase FIR Filters by Frequency Sampling; |  | B23 |  |  |
| Gibbs Phenomenon; Optimum Approximations of FIR Filters; Continuous-Time Butterworth and Chebyshev Filters; |  | B23,B20,B22 | C21 | D14 |
| Infinite Impulse Response (IIR) Filter Design by Impulse Invariance and Bilinear Transformation; Frequency Transformation of Lowpass IIR Filters |  | B22 | C21 | D14 |

**5.Teaching and Learning Methods**

Lecture/Tutorial/Laboratory Mix

**6. Teaching and Learning Methods for students with limited capability**

* Using data show
* e-learning management tools

**7. Students Evaluation**

1. **Used Methods**
2. **Time**

Assessment 1

Assessment 2

Assessment 3

Assessment 4

1. **Grades Distribution**

Mid-Term Examination 20%

Final-term Examination 50%

Practical Examination 10%

Semester Work and Project 20%

Total 100%

**List of Books and References**

**a) Notes**

* Course Notes

**b) Mandatory Books**

**c) Suggested Books**

**d) Other publications**

 - Periodicals, Web Sites … etc

**Course Coordinator: Dr. Hossam**

**Chairman of the Department: Prof. Dr.**