



Course Specification: Analog and Digital Signal Processing ECE363



1. Basic Information

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|---|---|
| Program Title | Biomedical Engineering |
| Department offering the Program | Biomedical Engineering |
| Department Responsible for the Course | Electronics and communication engineering |
| Course Code | ECE363 |
| Year/ Level | Level 300 |
| Specialization | Major |
| Requirements | ECE261 |
| Authorization data of course specification | |

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|-----------------------|--------|----------|----------|-----------|
| Teaching Hours | Credit | Lectures | Tutorial | Practical |
| | 3 | 2 | 2 | |

2. Course Aim:

| No. | Aim |
|-----|---|
| 1 | Apply knowledge of continuous time and discrete time principles and transforms in the design and realization of analog and digital systems. |
| 2 | Design analog and digital filters to meet the required needs within realistic constrains. |

3. Intended Learning Outcomes (ILOs):

a. Knowledge and Understanding:

| No. | Knowledge and Understanding |
|-----|---|
| A1 | Outline the Concepts and theories of analog and digital signal processing. |
| A4 | Identify the Basics of design and analyze of FIR and HR filters with cascade and parallel design. |
| A5 | Recognize the Methodologies of discrete-Fourier transform and z-transform. |

b. Intellectual Skills

| No. | Intellectual Skills |
|-----|---|
| B2 | Select appropriate method for analog and digital filter design. |
| B3 | Think in creative and innovative way in structure of special digital signal processors. |
| B4 | exchange different ideas of Butterworth, Chebyshev and Elliptic filters for analog filter design and impulse-invariant design and Digital to Digital transformations design for digital filter design |
| B17 | Distinguish the main characteristics of the digital design contributing to the optimal biomedical engineering systems. |

c. Professional Skills

| No. | Professional Skills |
|-----|---|
| C1 | Apply appropriate method for analog and digital filter design such as Butterworth, Chebyshev and Elliptic filters for analog filter design and impulse-invariant design and Digital to Digital transformations design for digital filter design and apply to medical applications |
| C16 | Improve methods and designs based on engineering knowledge and understanding by using different realization methods for FIR and HR filter design. |

d. General Skills

| No. | General Skills |
|-----|--|
| D3 | Communicate effectively. |
| D4 | Demonstrate efficient IT capabilities. |

4. Course Contents:

| No. | Topics | Weeks |
|-----|---|-------|
| 1 | Signal conversion | 1 |
| 2 | discrete time Fourier transform | 2 |
| 3 | fast Fourier transform (FFT) | 3 |
| 4 | random processes | 4 |
| 5 | linear time invariant filters | 5 |
| 6 | analysis of filter response and stability | 6 |
| 7 | digital filter design: FIR, HR filters | 7 |
| 8 | digital filter implementations | 9 |
| 9 | effect of finite word length | 10-11 |
| 10 | Wiener filter- adaptive digital filters | 12 |
| 11 | data coding and compression | 13 |



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|----|---------------------------------|----|
| 12 | signal restoration applications | 14 |
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5. Teaching and Learning Methods:

| No. | Teaching Method |
|-----|---------------------|
| 1 | Lectures |
| 2 | Discussion Sessions |
| 3 | Research Assignment |

6. Teaching and Learning Methods for Disabled Students:

| No. | Teaching Method | Reason |
|-----|-----------------------|--------------------------|
| 1 | More solved examples. | To increase their skills |

7. Student Evaluation:

7.1 Student Evaluation Methods:

| No. | Evaluation Method | ILOs |
|-----|----------------------------------|----------------------------|
| 1 | Mid Term Examination – Written | A1,A4 ,B4 |
| 2 | Semester work | A1,A4,A5,B2,B3 ,C1 ,D3, D4 |
| 3 | Final Term Examination - Written | A1,A4,A5 ,B3,B17 |

7.2 Evaluation Schedule:

| No. | Evaluation Method | Weeks |
|-----|------------------------|----------|
| 1 | Mid Term Examination | 8 |
| 2 | Semester work | Biweekly |
| 3 | Final Term Examination | 15 |

7.3 Weighting of Evaluations:

| No. | Evaluation Method | Weights |
|-------|--------------------------------------|---------|
| 1 | Mid Term Examination | 20% |
| 2 | Semester work (Quizzes, HW, reports) | 30% |
| 3 | Final Term Examination | 50% |
| Total | | 100% |

8. List of Resources

| No. | Reference List |
|-----|--|
| 1 | Richard G. Lyons, D. Lee Fugal, "The Essential Guide to Digital Signal Processing", 2014. |
| 2 | Li Tan and Jean Jiang, "Digital Signal Processing, Second Edition: Fundamentals and Applications ", 2013 |
| 3 | Lawrence R. Rabiner and Bernard Gold, " Digital Signal Processing " ,1975. |
| 4 | B. P. Lathi, Roger A. Green, "Essentials of Digital Signal Processing", 2014. |

9. Facilities Required for Teaching and Learning:

| No. | Facility |
|-----|-------------------|
| 1 | Lecture Classroom |
| 2 | White Board |
| 3 | Data Show System |
| 4 | Sound System |
| 5 | Wireless Internet |

10. Matrix of Knowledge and Skills of the Course:

| No. | Topic | Aims | Knowledge & Understanding | Intellectual Skills | Professional Skills | General Skills |
|-----|---------------------------------|------|---------------------------|---------------------|---------------------|----------------|
| 1 | Signal conversion | 1 | 1.1 | 2.2 | B3.1 | |
| 2 | discrete time Fourier transform | 2 | 1.4 | 2.3 | 3.7 | |
| 3 | fast Fourier transform (FFT) | 1, 2 | | 2.4 | B3.1 | 4.3 |
| 4 | random processes | 2 | 1.8 | | | 4.4 |
| 5 | linear time invariant filters | 1 | 1.8 | | 3.7 | |
| 6 | analysis of filter response and | 2 | | 2.4 | | |



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|----|---|------|-----|-----|----------|-----|
| | stability | | | | | |
| 7 | digital filter design: FIR, HR filters | 1 | 1.1 | 2.2 | B3.1,B17 | |
| 8 | digital filter implementations | 2 | 1.4 | 2.3 | 3.7 | |
| 9 | effect of finite word length | 1, 2 | 1.4 | 2.4 | B3.1 | 4.3 |
| 10 | Wiener filter- adaptive digital filters | 2 | 1.8 | | | 4.4 |
| 11 | data coding and compression | 1 | 1.8 | | 3.7 | |
| 12 | signal restoration applications | 2 | | 2.4 | | |

Course Coordinator: Prof. Dr.

Head of Department: Assoc. Prof. HossamEldeenMoustafa

Date of Approval: