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37. Course Specification of Digital Communications

|] | I. Course Identification and G | ener | al Infor | matio | n: | |
|-----|--|---|--------------|-----------|----------|-------|
| 1. | Course Title: | Digita | ıl Commur | nications | | |
| 2. | Course Code & Number: | CNE3 | 323 | | | |
| | | | C. | Н | | Total |
| 3. | Credit hours: | Th. | Tu. | Pr | Tr. | Total |
| | | 2 | 2 | 2 | - | 4 |
| 4. | Study level/ semester at which this course is offered: | Fourth Year/ First Semester | | | | |
| 5. | Pre –requisite (if any): | Probability and Statistics for Engineers (BR131), Signals and Systems (CNE216), Communication Principles (CNE221) | | | | |
| 6. | Co –requisite (if any): | Digita | ıl Signal Pı | rocessing | (CNE3 | 17) |
| 7. | Program (s) in which the course is offered: | Communication Engineering and Networks | | | | |
| 8. | Language of teaching the course: | Englis | sh | | | |
| 9. | Location of teaching the course: | Electr | ical Engin | eering De | epartmei | nt |
| 10. | Prepared By: | Asst. | Prof. Dr. A | di Nagi I | Nosary | |
| 11. | Date of Approval | | | | | |

II. Course Description:

This course presents an introduction to the basic principles of digital communication systems, a digital communication system is one that transmits a source information (voice, video, data, etc.) from one point to another, by first converting it into a stream of bits, and then into symbols that can be transmitted over channels (cable, wireless, storage, etc.). The course gives an overview of the design of digital communication systems, and explains the mathematical foundation of decomposing the systems into separately designed source codes and channel codes. It introduces the principles and commonly used algorithms in each stage of a digital communication system including encoding, multiplexing, modulation, and errors detection techniques.

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| | III. Course Intended learning outcomes (CILOs) | Referenced |
|-----------|--|------------|
| | of the course | PILOs |
| a1 | Understand the basic concepts of digital communication systems regarding design stages, functions, and applications. | A2 |
| a2 | Perform standard calculations regarding digital modulation and error detection. | A2 |
| b1 | Analyze and compare various choices of digital modulation methods and coding methods in terms of error probabilities, minimum distances, throughput, and related concept. | B1 |
| b2 | Select appropriate methods for solving error detection problems depending on the given conditions and requirements. | B2 |
| c1 | Use basic signal processing devices and software simulators to generate signals and apply different types of digital processing to the signal to show the properties and outcome of each type. | C2, C5 |
| d1 | Use learned digital communication systems principles as a base to develop a good understanding of modern telecommunication engineering techniques and applications. | D5 |

| (A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies: | | | | | |
|--|---|---|--|--|--|
| Course Intended Learning Outcomes | Teaching strategies | Assessment Strategies | | | |
| a1- Understand the basic concepts of digital communication systems regarding design stages, functions, and applications. | Lectures Cooperative Learning Experiential Learning Class Discussion | Quizzes, Homework, Project, Practical test, Mid and Final Exams | | | |
| a2- Perform standard calculations regarding digital modulation and error detection. | Lectures Cooperative Learning Experiential Learning Class Discussion | Quizzes, Homework, Project, Practical test, Mid and Final Exams | | | |

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| (B) Alignment Course Intended Lear Strategies and Assessment Strategies | 8 | lectual Skills to Teaching |
|---|---|---|
| Course Intended Learning Outcomes | Teaching strategies | Assessment Strategies |
| b1- Analyze and compare various choices of digital modulation methods and coding methods in terms of error probabilities, minimum distances, throughput, and related concept. | Lectures Cooperative Learning Experiential Learning Class Discussion | Quizzes, Homework, Project, Practical test, Mid and Final Exams |
| b2- Select appropriate methods for solving error detection problems depending on the given conditions and requirements. | Lectures Cooperative Learning Experiential Learning Class Discussion | Quizzes, Homework, Mid and Final Exams |

| © Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies: | | | | | |
|--|--|---------------------------------|---|--|--|
| Cou | rse Intended Learning Outcomes | Teaching strategies | Assessment Strategies | | |
| c1- to | Use basic signal processing devices and software simulators generate and signals and apply different types of digital processing to the signal to show the properties and outcome of | Learning Experiential Learning | Project,Practical test | | |
| each | type. | | | | |

| (D) Alignment Course Intended Learning Outcomes of Transferable Skills to | | | | | | |
|---|-------|----------------|-----------|---|---------------------|---------------------------|
| Teaching Strategies and Assessment Strategies: | | | | | | |
| Course Intended Learning Outcomes | | | Outcomes | | Teaching strategies | Assessment Strategies |
| d1- | Use | learned | digital | • | Cooperative | |
| | commu | nication | systems | | Learning | Project |
| princi | ples | as the base to | develop a | • | Research | |

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| good | understanding | of | modern |
|------|--------------------|-------|-----------|
| | telecommunication | n eng | gineering |
| | techniques and app | plica | tions. |

IV. Course Content: A – Theoretical Aspect: Number Learning Contact **Order Units/Topics List Sub Topics List** of **Outcomes** hours Weeks ■ An overview on Communication Systems. Digital Communication Systems. Classification of Signals, Spectral a1, a2, b1, Density 1. Introduction 2 4 b2, d1 and Autocorrelation. Random Signals. Signal Transmission

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2.

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Formatting and

signal

transmission of baseband

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a1, a2, b1,

b2, d1

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Through Linear

Baseband Systems.Formatting Textual

Data (Character

Characters, and

Systems.

Bandwidth of Digital Data.

Coding).

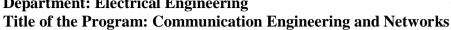
Messages,

Symbols.

Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

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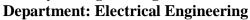
| | | | Formatting Analog Information. Sources of Corruption Pulse Code Modulation (PCM). Uniform and Nonuniform Quantization. Baseband modulation. | | |
|----|-------------------------------------|-----------------------|---|-----|---|
| 3. | Baseband demodulation/Detection | a1, a2, b1, b2, d1 | Receiver structure. Detection of Binary signal in GN. Vector representation of signals (signal space). Intersymbol Interference Equalization. | 2 | 4 |
| 4. | Bandpass modulation/demodulation | a1, a2, b1, b2, d1 | Why Modulate? Digital Bandpass Modulation Techniques Detection of Signals in Gaussian Noise Coherent Detection Noncoherent Detection Error Performance for Binary Systems M-ary Signaling and Performance | 2.5 | 5 |

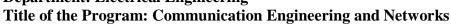
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| | | | | Symbol Error Performance for M-ary Systems Summary of Digital modulations techniques | | |
|---|-----------|----------------------------|-----------------------|---|-----|---|
| 5 | | Spread Spectrum Techniques | a1, a2, b1, b2, d1 | Spread-Spectrum Overview Pseudonoise Sequences Direct-Sequence Spread-Spectrum Systems Frequency Hopping Systems Multiple access: FDMA, TDMA and CDMA CODING | 2.5 | 5 |
| 6 | 5. | Channel Coding | a1, a2, b1, b2, d1 | Waveform Coding and Structured Sequences Types of Error Control Structured Sequences Linear Block Codes Error-Detecting and Correcting Capability | 2 | 4 |

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| Number of Weeks / and Units Per Semester 14 28 | Number of Weeks /and Units Per Semester | 14 | 28 |
|--|---|----|----|
|--|---|----|----|

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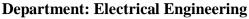


| B - Tu | B - Tutorial Aspect: | | | | |
|--|--|--------------------|------------------|----------------------|--|
| Order | Tasks/ Experiments | Number of Weeks | Contact hours | Learning Outcomes | |
| 1. | Introduction | 1 | 2 | a1, a2, b1, b2, d1 | |
| 2. | Classification of Signals, Spectral Density and Autocorrelation. | 2 | 4 | a1, a2, b1, b2, d1 | |
| 3. | Formatting and transmission of baseband signal | 3 | 6 | a1, a2, b1, b2, d1 | |
| 4. | Baseband demodulation/Detection | 2 | 4 | a1, a2, b1, b2, d1 | |
| 5. | Bandpass modulation/demodulation | 2 | 4 | a1, a2, b1, b2, d1 | |
| 6. | Spread Spectrum Techniques | 2 | 4 | a1, a2, b1, b2, d1 | |
| 7. Channel Coding | | 2 | 4 | a1, a2, b1, b2, d1 | |
| Number of Weeks /and Units Per Semester | | 14 | 28 | | |

| C - Pr | C - Practical Aspect: | | | | |
|--------|------------------------------------|-----------------------|------------------|----------------------|--|
| Order | Tasks/ Experiments | Number of Weeks | Contact hours | Learning Outcomes | |
| 1. | PAM 1 | 1 | 2 | a1, a2, b1, c1 | |
| 2. | PAM 2 | 1 | 2 | a1, a2, b1, c1 | |
| 3. | PA Demodulation | 1 | 2 | a1, a2, b1, c1 | |
| 4. | PCM using Quantization | 1 | 2 | a1, a2, b1, c1 | |
| 5. | PCM using DPCM | 1 | 2 | a1, a2, b1, c1 | |
| 6. | PC Demodulation using Quantization | 1 | 2 | a1, a2, b1, c1 | |
| 7. | PC Demodulation using DPCM | 1 | 2 | a1, a2, b1, c1 | |
| 8. | Revision | 1 | 2 | a1, a2, b1, c1 | |
| 9. | Reports submission | 1 | 2 | - | |

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| 10. | Practical test | 1 | 2 | - |
|-----|--|----|----|---|
| Nui | mber of Weeks /and Units Per Semester | 10 | 20 | |

V. Teaching strategies of the course:

- Lectures
- Cooperative Learning
- Experiential Learning
- Class Discussion
- Research

| • | VI. Assignments: | | | | | | |
|----|---|------------------------|----------|------|--|--|--|
| No | Assignments | Aligned CILOs(symbols) | Week Due | Mark | | | |
| 1. | Problems Sheet #1 | a1, a2, b1, b2 | 2 | 2 | | | |
| 2. | Problems Sheet #2 | a1, a2, b1, b2 | 4 | 2 | | | |
| 3. | Problems Sheet #3 | a1, a2, b1, b2 | 6 | 2 | | | |
| 4. | Problems Sheet #4 | a1, a2, b1, b2 | 8 | 2 | | | |
| 5. | Problems Sheet #5 | a1, a2, b1, b2 | 10 | 2 | | | |
| 6. | Project (Report, Simulation, Presentation) | a1, a2, b1, b2,c1, d1 | 12 | 20 | | | |
| | Total | | | 30 | | | |

| | VII.Schedule of Assessment Tasks for Students During the Semester: | | | | | |
|-----|--|------------------|------|--------------------------------------|-------------------------------------|--|
| No. | Assessment Method | Week Due | Mark | Proportion of Final Assessment | Aligned Course Learning Outcomes | |
| 1. | Quiz #1 | 5 th | 5 | 2.5% | a1, a2, b1, b2 | |
| 2. | Midterm Exam | 8 th | 20 | 10% | a1, a2, b1, b2 | |
| 3. | Quiz #2 | 10 th | 5 | 2.5% | a1, a2, b1, b2 | |
| 4. | Homework (Problems sheets) | 10 th | 10 | 5% | a1, a2, b1, b2 | |
| 5. | Practical Reports and Test | 11 th | 20 | 10% | a1, b1, c1 | |

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| 6. | Project | 12 th | 20 | 10% | a1, a2, b1, b2, c1, d1 |
|----|------------|------------------|-----|------|---------------------------|
| 7. | Final Exam | 16 th | 120 | 60% | a1, a2, b1, b2 |
| | Total | | 200 | 100% | |

VIII. Learning Resources:

• Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1 -Bernard Sklar -1988 - Digital Communications: Fundamentals and Applications, Second Edition, Prentice Hall PTR, Upper Saddle River, New Jersey, U

2- Essential References.

1 -A. Bruce Carlson and Paul B. Crilly - 1968 - Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Kogakusha Mcgraw
2- Lan Glover and Peter Grant - 2000 - Digital Communications, Pearson.

3- Electronic Materials and Web Sites etc.

1 -MatLab (software).

IX. Course Policies:

Class Attendance:

1. A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic

Tardy:

2. For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.

Exam Attendance/Punctuality:

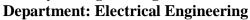
A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-

Assignments & Projects:

4. The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-

5. Cheating:

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| | For cheating in exam, a student will be considered as fail. In case the cheating is repeated | | | | |
|--|--|--|--|--|--|
| | three times during his/her study the student will be disengaged from the Faculty- | | | | |
| | Plagiarism: | | | | |
| | Plagiarism is the attending of a student the exam of a course instead of another student. | | | | |
| 6. | If the examination committee proved a plagiarism of a student, he will be disengaged | | | | |
| | from the Faculty. The final disengagement of the student from the Faculty should be | | | | |
| confirmed from the Student Council Affair of the university. | | | | | |
| | Other policies: | | | | |
| | - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise | | | | |
| 7. | the student will be asked to leave the lecture room | | | | |
| | - Mobile phones are not allowed in class during the examination. | | | | |
| | Lecture notes and assignments my given directly to students using soft or hard copy | | | | |

| Reviewed | Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek | | | |
|----------|---|--|--|--|
| By | A. Barakat | | | |
| | President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi | | | |
| | Name of Reviewer from the Department: Asst. Prof. Dr. Nasser H. Almofari | | | |
| | Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa | | | |
| | Assoc. Prof. Dr. Ahmed Mujahed | | | |
| | Asst. Prof. Dr. Munasar Alsubri | | | |