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|  | **AMERICAN INTERNATIONAL UNIVERSITY- BANGLADESH (AIUB)**  Faculty of Engineering  Department of Electrical and Electronic Engineering Undergraduate Program |  |

**PART A**

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| 1. Course No/Course Code | COE 3201 |
| 2. Course Title | Data Communication |
| 3. Course Type | Core Course for COE and CSE |
| 4. Year/Level/Semester/Term | Third year (7th Semester) |
| 5. Academic Session | Spring 2023-24 |
| 6. Course Teachers/Instructors | Dr. Shuvra Mondal, Dr. Muhammad Morshed Alam, Mr. Sadman Shahriar Alam, Mr. Abrar Fahim Liaf, Ms. Nowshin Alam, **Dr. Amirul Islam**. |
| 7. Pre-requisite (If any) | EEE 2209: Analog Electronics |
| 8. Credit Value | 3 credit hours |
| 9. Contact Hours | 2 hours of theory per week |
| 10. Total Marks | 100 |
| 11. Mission of EEE Department | * Educate young leaders for academia, industry, entrepreneurship, and public and private organization through theory and practical knowledge to solve engineering problems individually and in teams. * Create knowledge through innovative research and collaboration with multiple disciplines and societies. * Serve the communities at national, regional, and global levels with ethical and professional responsibilities. |
| 12. Vision of EEE Department | To become a front runner in preparing Electrical and Electronics Engineering graduates to be nationally and globally competitive and  thereby contribute value for the knowledge-based economy and welfare for the people of the world. |
| 13. Rationale of the Course (Course Description) | This is a core course of Electrical and Electronic Engineering program that presents basic tools for the design of power electronic circuits. It promotes the knowledge about the design and implementation of  converters for practical engineering applications and formulating their solutions. |
| 14. Course Content | The course is designed to provide students with:   * Basic concepts of Data Communication, Different types of networks, OSI and TCP/IP network models, Digital Transmission, Analog Transmission, Bandwidth Utilization, Switching. * Information regarding Transmission impairment, Protocols of different layers, Data encapsulation, Signal rate, Sampling, Quantization, Encoding. * Fundamentals of Different domains of signal representation, Frequency domain analysis of simple and composite signals. * Knowledge of Bandwidth, Attenuation, Distortion, Noise, Data rate, , Network Performance, Transmission medium. * Application of Nyquist’s Data Rate, Shannon’s Capacity,   Line Coding Schemes, Shift Keying, Modulation, Multiplexing, Switching. |

By the end of this course, students should be able to –

**15. Course Outcomes (CO)/Course Learning Outcomes (CLOs):**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs/ CLOs**  **Number** | **COs/CLOs Statements** | **K** | **P** | **A** | **Assessed Program Outcome Indicator** | **BNQF**  **Indicat or** | **Teaching**  **-**  **Learning Strategy** | **Assessment Strategy** |
| **1** | **Apply** information and concepts of data communication network, network models, protocols and data encapsulation, analog and digital signal, digital transmission, data rate to solve complex engineering problems with a range of conflicting requirements | K3 | P1,  P2, P6 |  | P.a.3.C3 | FS.1 | Lecture | Quiz & Term Exam (Mid) |
| **2** | **Apply** information and concepts of switching and transmission medium, analog transmission, shift keying, modulation, multiplexing with  the in-depth of analysis of a complex engineering problem | K4 | P1,  P3, P7 |  | P.a.4.C3 | FS.2 | Lecture | Quiz &Term Exam (Final) |
| **3** | **Evaluate** solutions to line coding schemes that meet specified needs with  appropriate environmental considerations | **K5** | **P1,**  **P2, P6** |  | **P.c.3.C5** | **PS.2** | Lecture | **OBE**  **Assignment (Mid)** |
| **4** | **Design** solution for frequency division multiplexing problems  in accordance with professional practices | **K7** | **P1,**  **P3, P7** |  | **P.f.2.C6** | **FS.4** | Lecture | **OBE**  **Assignment (Final)** |

**16. Mapping with Course Learning Outcomes (CLOs) with Program Learning Outcomes (PLOs)**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CLOs** | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** | **PLO 8** | **PLO 9** | **PLO 10** | **PLO 11** | **PLO 12** |
| **1** | FS.1 |  |  |  |  |  |  |  |  |  |  |  |
| **2** | FS.2 |  |  |  |  |  |  |  |  |  |  |  |
| **3** |  |  | PS.2 |  |  |  |  |  |  |  |  |  |
| **4** |  |  |  |  |  | FS.4 |  |  |  |  |  |  |

**PART B**

**17. Course plan:**

By the end of this course, students should be able to –

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| --- | --- | --- | --- | --- | --- | --- |
| **Time Frame (Week)** | | **Topics** | **Teaching Learning Strategy** | **Assessment Strategy** | **Corresponding COs /CLOs** | **Assessment Tools** |
| **Week 1** | | Mission & Vision of AIUB, Dept. of EEE, Data Communication meaning and objectives of this course.  Data Communications Introduction: Components of Data Communication, Data Representation, LAN, WAN, MAN. | Lecture | \*Calculation- based question: test/  mid-term exam  \*Theoretical- based question: test/  mid-term exam | 1 | Quiz, Term Exam |
| **Week 2** | | Network Models: OSI Model, Layers in OSI Model, Basic Idea of Different Layers, TCP/IP Protocol. | Lecture |  | 1 | Quiz, Term Exam |
| **Week 3** | | Network Models: Analog & Digital Signals: Bandwidth, Bit rate, Transmission Impairment: Attenuation, Distortion &  Noise. | Lecture |  | 1 | Quiz, Term Exam |
| **Week 4** | | Data rate limits: Nyquist bit rate, Shannon capacity Performance: Bandwidth, throughput, latency. | Lecture |  | 1 | Quiz, Term Exam |
| **Week 5** | | Data & Signals: Digital to digital conversion, Signal element vs Data  element | Lecture |  | 1 | Quiz, Term Exam |
| **Week 6** | | Line Coding Schemes: Unipolar, Polar, Bi-polar, Multilevel, MLT-3 | Lecture |  | 1, 3 | Quiz, Term Exam, Assignment |
| **Week 7** | | Data & Signals: Pulse Code modulation | Lecture |  | 1 | Quiz, Term Exam |
| **Week 8** | | **MID-TERM EXAM WEEK** | | | | |
| **Week 9** | | Analog Transmission: ASK, FSK, PSK & QPSK | Lecture | \*Calculation- based question: test/final exam  \*Theoretical- based question: test/  final exam | 2 | Quiz, Term Exam |
| **Week 10** | Analog Transmission: QAM, AM, PM, FM. | | Lecture |  | 2 | Quiz, Term Exam, | |
| **Week 11** | Bandwidth Utilization: Multiplexing, FDM: Multiplexing and Demultiplexing Process, Analog Hierarchy | | Lecture |  | 2, 4 | Quiz, Term Exam, Assignment | |
| **Week 12** | Bandwidth Utilization: WDM Synchronous TDM: Time slots and Frame | | Lecture |  | 2 | Quiz, Term Exam | |
| **Week 13** | Continuation on Bandwidth Utilization: WDM Synchronous TDM: Time slots and Frame | | Lecture |  | 2 | Quiz, Term Exam | |
| **Week 14** | Interleaving, multilevel multiplexing, multiple-slot allocation, and pulse stuffing. Digital Hierarchy: T- Lines & E-Lines | | Lecture |  | 2 | Quiz, Term Exam | |
| **Week 15** | Transmission Media: Guided: Twisted pair, Co- Axial, Fiber Optic, Unguided, Switching: Circuit switching, Packet switching, Datagram network & Virtual Circuit  Network, Network Topology. | | Lecture |  | 2 | Quiz, Term Exam | |
| **Week 16** | Data Link Layer: Nodes and Link, Addressing mechanism, Link layer Addresses, Address resolution protocol. | | Lecture |  | 2 | Quiz, Term Exam | |
| **Week 17** | **FINAL-TERM EXAM WEEK** | | | | | | |

\* The faculty reserves the right to change, amend, add, or delete any of the contents.

**PART C**

**18. Assessment and Evaluation**

1. **Assessment Strategy:**

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|  | **CO/CLO 1**  **(marks)** | **CO/CLO 2**  **(marks)** | **CO/CLO 3**  **(marks)** | **CO/CLO 4**  **(marks)** | **CO/CLO 5**  **(marks)** | **Marks for Grading** |
| **Quiz 1 (Mid)** | **Q1(20)** |  |  |  |  | **20** |
| **Quiz 2 (Mid)** | **Q1(20)** |  |  |  |  | **20** |
| **Assignment (Mid)** |  |  |  | **Q1(30)** |  | **30** |
| **Mid-term Exam** | **Q1(10),**  **Q2(10),** |  |  |  |  |  |
|  | **Q3(10),**  **Q4(10),** |  | **50** |
|  | **Q5(10)** |  |  |
| **Quiz 3 (Final)** |  | **Q1(20)** |  |  |  | **20** |
| **Quiz 4 (Final)** |  | **Q1(20)** |  |  |  | **20** |
| **Assignment (Final)** |  |  |  |  | **Q1(30)** | **30** |
| **Final Exam** |  | **Q1(10),**  **Q2(10),** |  |  |  |  |
|  | **Q3(10),**  **Q4(10),** |  | **50** |
|  | **Q5(10)** |  |  |

1. **Table of Specification (TOS)**

**Mid-Term Exam**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | | | | | **Level of Bloom’s Taxonomy** | | | | | | | | | | | | | | | | | |  |
| **Topics** | **CO No.** | **No. of Days** | **No. of Items** | **No. of COs** | **Remember** | | | **Understand d** | | | **Apply** | | | **Analyze** | | | **Evaluate** | | | **Create** | | | **POI** |
| **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** |
| **Data Communication, Network Models, Data & Signals, Digital Transmission** | **CO1** | **7** | **5** |  |  |  |  |  |  |  | **1a** | **SQ** | **5** |  |  |  |  |  |  |  |  |  | **P.a.3.C3** |
|  |  |  |  |  |  |  | **1b** | **SQ** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **2a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **2b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **3a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **3b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **4a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **4b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **5a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **5b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
| **Total** |  | **7** | **5** |  |  |  |  |  |  |  |  |  | **50** |  |  |  |  |  |  |  |  |  |  |

**Final-Term Exam**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | | | | | **Level of Bloom’s Taxonomy** | | | | | | | | | | | | | | | | | |  |
| **Topics** | **CO No.** | **No. of Days** | **No. of Items** | **No. of COs** | **Remember** | | | **Understan d** | | | **Apply** | | | **Analyze** | | | **Evaluate** | | | **Create** | | | **POI** |
| **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** | **Item No.** | **Test Type** | **Marks** |
| **Transmission Medium, Switching,**  **Analog Transmission & Bandwidth Utilization** | **CO2** | **8** | **5** |  |  |  |  |  |  |  | **1a** | **SQ** | **5** |  |  |  |  |  |  |  |  |  | **P.a.4.C3** |
|  |  |  |  |  |  |  | **1b** | **SQ** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **2a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **2b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **3a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **3b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **4a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **4b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **5a** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **5b** | **PS** | **5** |  |  |  |  |  |  |  |  |  |
| **Total** |  | **8** | **5** |  |  |  |  |  |  |  |  |  | **50** |  |  |  |  |  |  |  |  |  |  |

***Test Type Legend****:* ***AS:*** *Assignment;* ***BQ****: Broad question;* ***SQ****: Short question;* ***D****: Derivation;* ***ES:*** *Essay;* ***EX:*** *Exercise;* ***GE:*** *Group Exercise;* ***ID:*** *Identification;* ***MC****: Multiple Choice;* ***MT****: Matching Type;* ***OB:*** *Observation;* ***PS****: Problem Solving;* ***SA****: Short Answer;* ***TF****: True or False;* ***VV:*** *Viva Voce;* ***Other please specify****:*

# Marks Distribution:

The evaluation system will be strictly followed as par the AIUB grading policy. The following grading system will be strictly followed in this class.

|  |  |  |
| --- | --- | --- |
| **Assessment Type** | **Marking system For Theory Classes (Midterm and Final term)** | |
| Continuous | Attendance | 10% |
| Continuous | Quiz | 20% |
| Continuous | Assignment | 30% |
| Summative | Midterm/Final Exam | 40% |
|  | **Total** | 100% |

|  |  |  |
| --- | --- | --- |
|  | **Final Grade/ Grand Total** | |
| Grand Total | Midterm: | 40% |
|  | Final Term: | 60% |

1. **Grading Policy**

|  |  |  |
| --- | --- | --- |
| **Letter** | **Grade Point** | **Numerical %** |
| A+ | 4.00 | 90-100 |
| A | 3.75 | 85-<90 |
| B+ | 3.50 | 80-<85 |
| B | 3.25 | 75-<80 |
| C+ | 3.00 | 70-<75 |
| C | 2.75 | 65-<70 |
| D+ | 2.50 | 60-<65 |
| D | 2.25 | 50-<60 |
| F | 0.00 | <50(Failed) |

1. **Makeup Procedure:**

Students who fail to maintain the requirements and deadlines needed to contact faculty with reasoning. Continuous assessments will be taken with agreement with the student and faculty. For the make up of Summative assessments students need to apply for SET – B exam according to the AIUB policy.

**PART D**

**19. Learning Materials**

Formal lectures will provide the theoretical base for the subject as well as covering its practical application. A set of lecture notes, tutorial examples, with subsequent discussion and explanation, together with suggested reading will support and direct the students in their own personal study.

Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some Class notes will be uploaded on the web. White board will be used for most of the time.

For some cases, multimedia projector will be used for the convenience of the students.

Students must study up to the last lecture before coming to the class and it is suggested that they should go through the relevant chapter before coming to the class. Just being present in the class is not enough- students must participate in classroom discussions.

Few assignments will be given to the students based on that class to test their class performance.

# Recommended Readings (Textbook);

* 1. Forouzan, B. A. “Data Communication and Networking”, McGraw-Hill.
  2. Prakash C. Gupta, “Data communications”, Prentice Hall India Pvt.
  3. William Stallings, “Data and Computer Communications”, Pearson.

# Supplementary Readings (Reference Book);

* 1. Bellamy, John C. Digital Telephony (Wiley Series in Telecommunications and Signal Processing). Wiley- Interscience, 2000.
  2. Haykin, Simon. Communication systems. John Wiley & Sons, 2008.
  3. Frenzel, Louis E. "Communication electronics, principles and applications. Electrónica aplicada a los sistemas de las comunicaciones/." (2003).
  4. Viswanathan, Thiagarajan, and MANAV BHATNAGAR. Telecommunication switching systems and networks. PHI Learning Pvt. Ltd., 2015.
  5. Andrew Tanenbaum, Computer networks, Prentice Ha

**PART E**

|  |  |  |
| --- | --- | --- |
| Verification: **COE 3201: Data Communication** | | |
| Prepared by:  ………………………………... Dr. Amirul Islam  (Course Co-ordinator)  Date: 24/01/2024 | Checked and certified by:  ..........................................................  Nafiz Ahmed Chisty  Head (UG), Department of EEE, Faculty of Engineering  Date: ............................................... | Approved by:  ..........................................................  Prof. Dr. A B M Siddique Hossain Dean, Faculty of Engineering  Date: ............................................... |
|  | Moderated by:  …………………….  Date: …………………………. | Moderated by:  ……………………….  Date: …………………………. |