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| A picture containing diagram  Description automatically generated | **AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)**  Faculty of Science and Technology (FST)  Department of Computer Science (CS)  Undergraduate Program |

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| **COURSE PLAN** | **SEMESTER: Fall 2024-2025** |
| **I**. **Course Code and Title**  COE 3204 Computer Networks  **II**. **Credit**  3 credit hours (3 hours of theory per week)  **III**. **Nature**  Core Course for CS, CSE, CSSE, SE, CIS, COE  **IV**. **Prerequisite**  COE 3103 Data Communication | 1. **Vision:**   Our vision is to be the preeminent Department of Computer Science through creating recognized professionals who will provide innovative solutions by leveraging contemporary research methods and development techniques of computing that is in line with the national and global context.   1. **Mission:**   The mission of the Department of Computer Science of AIUB is to educate students in a student-centric dynamic learning environment; to provide advanced facilities for conducting innovative research and development to meet the challenges of the modern era of computing, and to motivate them towards a life-long learning process. |

## **VII - Course Description**

* Illustrate basic concepts of OSI model.
* Use FLSM and VLSM for subnetting a network.
* Apply the concept of DHCP for allocating IP addresses to different devices.
* Demonstrate how to use different datalink layer protocols for sharing a transmission medium among multiple devices.
* Change a LAN into multiple VLANs for ensuring better security and easy management.
* Apply various congestion and flow control mechanisms to limit the network congestion and data flow.
* Perform configuration of switch and routers for designing and implementing computer networks
* Use IPv6 address to configure a network.
* Determine the best routing path using different routing protocols such as RIP, EIGRP, OSPF etc.
* Apply NAT to allow many devices to be connected to the Internet with a limited number of public IP addresses.
* Use the concepts of error control techniques, HDL, and fragmentation for reliable communications.

## **VIII - Course outcomes (CO) Matrix:**

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

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| **COs**\* | **CO Description** | Level of Domain\*\*\* | | | PO Assessed \*\*\*\* |
| C | P | A |
| CO1  \*\* | **Determine** various subnetting techniques to design subnets and the parameters of the subnets for complex engineering problems through appropriate investigation | 5 |  |  | PO-d-1 |
| CO2 \*\* | **Develop** different network design by using modern engineering tools for modeling of different network topologies considering complex engineering problems |  | 5 |  | PO-e-3 |
| CO3 | **Apply** error control codes to detect and/or correct transmission error with a trade-off between error detection capability and throughput. | 3 |  |  | PO-a-4 |
| CO4 | **Determine** and **demonstrate** various types of IP addressing techniques. | 5 |  |  | PO-b-3 |
| CO5 | **Evaluate** and **investigate** solution of complex engineering problem by combination of information to provide valid conclusions. | 5 |  |  | PO-d-3 |
| *C: Cognitive; P: Psychomotor; A: Affective Domain*  *\* CO assessment method and rubric of COs assessment is provided in later section*  *\*\* COs will be mapped with the Program Outcomes (POs) for PO attainment \*\*\* The numbers under the ‘Level of Domain’ columns represent the level of Bloom’s Taxonomy each   CO corresponds to.*  *\*\*\*\* The numbers under ‘PO Assessed’ column represent the POs each CO corresponds to.* | | | | | |

**IX - Topics to be covered in the class and/or lab: \***

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| **Time Frame** | **CO**  **Mapped** | **Topics** | **Teaching**  **Activities** | **Assessment Strategy(s)** |
| Week 1 | CO1, CO4 | OBE, Brief review of OSI, TCP/IP model, Networking basics  LAB: IP addressing | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 2 | CO1, CO4 | Basics of IP addressing.  LAB: IP addressing | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 3 | CO1, CO4 | Application layer protocols: DNS, HTTP  LAB: VLSM | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 4 | CO3,  CO5 | Data Link layer protocol-I: Channelization and Controlled multiple access technique  LAB: Cabling and connection | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 5 | CO3,  CO5 | Data Link layer protocol-II: Random access Protocol: ALOHA, CSMA, CSMA/CD, CSMA/CA  LAB: Basic network design | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 6 | CO1, CO2, CO5 | Routing, static and dynamic routing, RIP V1 & V2  LAB: Basic network design with VLSM and RIP | Lecture, Question-answer, Lab Practice | Lab Exam, Term Exam |
| Week 7 | CO1, CO2, CO5 | Network layer protocol: DHCP, Network Layer protocol: ARP  LAB: Lab Evaluation | Lecture, Question-answer | Quiz, Lab Exam, Term Exam |
| Midterm (Week 8) | | | | |
| Week 9 | CO2, CO3 | Error Control mechanism: Cyclic redundancy check, Linear block code  LAB: DHCP server, DNS server and Email server | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 10 | CO2, CO5 | Switched network: Illustrate Virtual Local Area Network (VLAN), Inter-VLAN and Virtual Trunk Port (VTP)  LAB: Implementation of VLAN and VTP | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 11 | CO2, CO5 | Introduction to Logical addressing (IPv6): Explain IPv6 addresses, Special addressing of IPv6, address mapping.  LAB: Implementation of Inter-VLAN | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 12 | CO2, CO5 | Network Address Translation (NAT): Explain NAT and Port Address Translation (PAT)  LAB: Implementation of NAT/PAT | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 13 | CO2, CO5 | Transport layer protocol-I: TCP (TCP three-way handshake), Scenarios of error control mechanism), UDP  LAB: Implementation of dynamic routing protocol: EIGRP | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 14 | CO2, CO5 | Transport layer protocol-II: Congestion control algorithm (Reno), Sliding window technique.  LAB: Implementation of dynamic routing protocol: OSPF | Lecture, Question-answer, Lab Practice | Quiz, Lab Exam, Term Exam |
| Week 15 | CO5 | HDLC, Fragmentation  LAB: Lab Evaluation | Lecture, Question-answer | Lab Exam, Term Exam |
| Final term (Week 16) | | | | |
| Assignment Submission/Defense/Viva (Week 17) | | | | |

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

## **X - Mapping of PO to Courses and K, P, A**

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| PO Indicator ID | PO Indicators Definition (As per the requirement of WKs) | Domain | K | P | A |
| PO-d-1 | Investigate the design of experiments for complex engineering problems through appropriate research. | Cognitive Level 5 (Evaluating) | K8 | P1 P3 P7 |  |
| PO-e-3 | Create relevant resources for complex engineering problems using modern engineering tools | Psychomotor  Level 5 (Naturalization) |  | P1 P3 P7 |  |
| PO-a-4 | Apply information and concepts in specialized engineering sciences with the in-depth of analysis of a complex engineering problem. | Cognitive  Level 3 (Applying) | K4 | P1  P3  P7 |  |
| PO-b-3 | Analyze solutions for complex engineering problem reaching substantiated conclusion. | Cognitive Level 5 (Evaluating) | K3 | P1  P3  P7 |  |
| PO-d-3 | Investigate solution of complex engineering problem by synthesis of information to provide valid conclusions. | Cognitive  Level 5 (Evaluating) | K8 | P1  P4  P5 |  |

## **XI – K, P, A Definitions**

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| **Indicator** | **Title** | **Description** |
| **K3** | Theory based engineering fundamentals | A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline |
| **K4** | Forefront specialist knowledge for practice | Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline |
| **K8** | Research Literature | Engagement with selected knowledge in the research literature of the discipline |
| **P1** | Depth of knowledge required | Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach |
| **P3** | Depth of analysis required | Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models |
| **P4** | Familiarity of issues | Involve infrequently encountered issues |
| **P5** | Extent of applicable codes | Are outside problems encompassed by standards and codes of practice for professional engineering |
| **P7** | Interdependence | Are high level problems including many component parts or sub-problems |

## **XII – Mapping of CO Assessment Method and Rubric**

The mapping between Course Outcome(s) (COs) and The Selected Assessment method(s) and the mapping between Assessment method(s) and Evaluation Rubric(s) is shown below:

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| **COs** | **Description** | **Mapped**  **POs** | **Assessment Method** | **Assessment Rubric** |
| **CO1** | *Determine* various subnetting techniques to design subnets and the parameters of the subnets for complex engineering problems through appropriate investigation | PO-d-1 | Quiz, Lab Exam, Term Exam | Rubric for Midterm Exam |
| **CO2** | *Develop* different network design by using modern engineering tools for modeling of different network topologies considering complex engineering problems | PO-e-3 | Quiz, Lab Exam, Term Exam | Rubric for Final Term Exam |
| **CO3** | *Apply* error control codes to detect and/or correct transmission error with a trade-off between error detection capability and throughput. | PO-a-4 | Quiz, Term Exam | Rubric for Quiz, Term Exam |
| **CO4** | *Determine* and *demonstrate* various types of IP addressing techniques. | PO-b-3 | Quiz, Lab Exam, Term Exam | Rubric for Quiz, Term Exam |
| **CO5** | *Evaluate* and i*nvestigate* solution of complex engineering problem by combination of information to provide valid conclusions. | PO-d-3 | Term Exam | Rubric for Term Exam |

## **XIII – Evaluation and Assessment Criteria**

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| **CO1:** *Determine* various subnetting techniques to design subnets and the parameters of the subnets for complex engineering problems through appropriate investigation | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1)** | **Satisfactory (2)** | **Excellent (3)** |
| Content knowledge | Does not demonstrate the knowledge of subnetting principles and cannot define key terms. | Demonstrate a primary understanding of subnetting concepts and answer with limited explanation. | Demonstrate a partial understanding of subnetting techniques with proper use of the key terms. | Demonstrate a clear understanding of subnetting techniques. |
| Creation of the subnets | Does not create the subnets for the problem analysis. | Attempt to investigate the subnet creation with lack of essential information or parameters. | Partially create the subnets, with limited clarification of concepts. | Properly create the subnets and clarify the concept. |
| Calculation of FLSM/VLSM | Does not calculate the values accurately or provide incorrect logic. | Attempt to calculate the FLSM/VLSM but lacks justification or presents the solution inadequately. | Apply subnetting techniques with moderate accuracy of calculation. | Values are calculated correctly with proper logic. |
| Submission | No attempt of applying the subnetting technique with no solution provided. | The solution is submitted with inaccuracy. | The solution is submitted with partial accuracy within time. | The solution is submitted within due time. |

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| **CO2:** *Develop* different network design by using modern engineering tools for modeling of different network topologies considering complex engineering problems | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1)** | **Satisfactory (2)** | **Excellent (3)** |
| Problem Analysis | Could not identify the problem and design the solution according to the provided scenario. | Perform the analysis partially such as, identify the number of subnets. However, could not complete the full subnetting. | Perform the subnetting part and demonstrate the solution mostly. | Clearly identifies and summarizes a particular task. |
| Correctness | Identification and the solution presented with major error. | Most of the network design of the scenario and configuration presented with minor error. | The network design of the scenario is almost correct and significant part of the demonstration is working accurately | The task is properly solved and demonstrated. |
| Submission | The solution is not submitted within due time following instructions. | The solution submitted within due time does not follow all the instructions. | The solution is submitted within due time but with several flaws in accordance with the instructions. | The solution is submitted within due time following instructions. |

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| **CO3:** *Apply* error control codes to detect and/or correct transmission error with a trade-off between error detection capability and throughput. | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1)** | **Satisfactory (2)** | **Excellent (3)** |
| Necessity | Able to explain the reasons with major errors. | Able to explain the reasons with minor errors. | Not able to explain the reasons clearly. | Able to explain the knowledge and reasons clearly. |
| Correctness | Attempt to do graph related calculation with major errors. | Graph related calculation done with few logical errors. | Calculated with logic containing unclear explanation. | Given problem is perfectly calculated with proper logic. |
| Argumentation | Attempt to explain conflicting requirements with major errors. | Attempt to explain conflicting requirements with minor errors. | Failed to present clear concepts of conflicting requirements. | Successfully present clear concepts and explain comprehensive conflicting requirements. |

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| **CO4:** *Determine* and *demonstrate* various types of IP addressing techniques. | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1)** | **Satisfactory (2)** | **Excellent (3)** |
| Content knowledge | No demonstration of the key concepts of IP addressing techniques. | Demonstrate inconsistent understanding with incomplete demonstration or explanation of IP addressing techniques. | Discuss and investigate the IP addressing techniques with primitive content knowledge. | Demonstrate a clear understanding of IP addressing techniques. |
| Correctness | Cannot apply the IP addressing techniques for the given problem. | Apply IP addressing techniques but contains significant errors in calculations and solutions related to IP addressing. | Exhibits partially correct solutions with minor errors when implementing different IP addressing methods. | Given problem is solved correctly and values are demonstrated. |

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| **CO5:** *Evaluate* and i*nvestigate* solution of complex engineering problem by combination of information to provide valid conclusions. | | | | |
| **Assessment Criteria** | **Not Attended/ Incorrect (0)** | **Inadequate  (1)** | **Satisfactory (2)** | **Excellent (3)** |
| Problem Analysis | Cannot identify the problem and analyze it at all. | Cannot identify significant portion of the problem. | Able to identify the problem but with some shortcomings. | Able to analyze a particular given computer networking problem successfully. |
| Content Knowledge | Cannot deliver the evidence of knowledge at all. | The level of knowledge demonstration is significantly poor. | The demonstration of knowledge is significant enough. | Demonstrates the clear knowledge of computer networking for a  particular given problem. |
| Completeness | Cannot complete any part of the problem. | A significant part of the submission is not complete and submitted within time. | The submitted solution is significantly correct. | The problem is solved correctly in time. |
| Argumentation | Does not provide any argument. | The argument provided is superficial and not clear at all. | Failed to clarify the concept. | A comprehensive argument is presented successfully to clarify the concept. |

## **XIV- Course Requirements**

* Students are expected to attend at least 80% class.
* Students are expected to participate actively in the class.
* For both terms, there will be at least 2 quizzes based on the theoretical knowledge and conceptual understanding of the topic covered discussed in the classes.
* Submit report based on the given course related problems.
* Submission of assignment and projects should be in due time.

## **XV – Evaluation & Grading System\***

The following grading system will be strictly followed in this class.

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| **MID TERM** | | **FINAL TERM** | |
| Attendance | 10% | Attendance | 10% |
| Quiz | 20% | Quiz | 20% |
| Lab Exam | 20% | Lab Exam | 20% |
| Midterm written exam | 50% | Final term written exam | 50% |
| Total | 100% | Total | 100% |
| **Grand Total 100% = 40% of Midterm + 60% of Final Term** | | | |

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| **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 |
| I |  | Incomplete |
| W |  | Withdrawal |
| UW |  | Unofficially Withdrawal |

*\* The evaluation system will be strictly followed as par with the AIUB grading policy.*

*\* CO attainment will be achieved with 60% of the evaluation marks.*

## **XVI – Textbook/ References**

1. B. A. Forouzan, Data Communications and Networking, McGraw-Hill, Inc., Fourth Edition, 2007, USA.
2. J. F., Kurose, K. W. Ross, Computer Networking: A Top-Down Approach, Pearson Education, Inc., Sixth Edition, USA.
3. W. Odom, Official Cert Guide CCNA 200-301, vol. 1, Cisco Press, First Edition, 2019, USA.
4. T. Lammle, CCNA Routing and Switching, John Wily & Sons, Second Edition, 2016, USA.
5. B. A. Forouzan, TCP/IP Protocol Suite, McGraw-Hill, Inc., Fourth Edition, 2009, USA.
6. W. Stallings, Data and Computer Communication, Pearson Education, Inc., Tenth Education, 2013, USA.

## **XVII - List of Faculties Teaching the Course**

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| --- | --- |
| **FACULTY NAME** | **SIGNATURE** |
| DR. MD. MEHEDI HASAN |  |
| DR. AFSAH SHARMIN |  |
| WARDAH SALEH |  |
| NUSRAT JAHAN ANANNYA |  |
| MAHMUDUL HASAN |  |



## **XVIII – Verification**

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| **Prepared by:**  ---------------------------------  **Dr. Md Mehedi Hasan**  *Assistant Professor & Course Convener*  *Department of Computer Science*  Date:......................................... | **Moderated by:**  ---------------------------------  **Dr. M. Mahmudul Hasan**  *Point Of Contact*  *OBE Implementation Committee*  Date:......................................... | **Checked by:**  ---------------------------------  **Dr. Akinul Islam Joney**  *Head (Undergraduate Program) Department of Computer Science*  Date:......................................... |
| **Verified by:**  ....................................................  **Dr. Md. Abdullah-Al-Jubair**  *Director*  *Faculty of Science & Information Technology*  Date:.......................................... | **Certified by:**  .....................................................  **Prof. Dr. Dip Nandi**  *Associate Dean*,  *Faculty of Science & Information Technology*  Date:............................................ | **Approved by:**  .........................................................  **Mr. Mashiour Rahman**  *Dean*,  *Faculty of Science & Information Technology*  Date:............................................... |