

# Department of Computer Science and Engineering (CSE)

## Outcome-Based Curriculum of B. Sc. in CSE Program

(Effective from Summer Semester 2018)

### Vision Statement of CSE Department

To be internationally renowned in Computer Science and Engineering and to exalt excellence in education, research and industrial profession for sustainable transformation of the society.

### Mission of CSE Department

To advance knowledge and learning of evolving challenges in Computer Science and Engineering through quality education and research towards the development of the society.

To sustain an outstanding hub dedicated to excellence in teaching, learning, and research and to become internationally recognized to meet national and international needs.

To enhance the quality of students with advanced knowledge and skills of Computer Science and Engineering to meet contemporary industrial requirements.

### Program Educational Objectives (PEOs) of B. Sc. in CSE Program

Graduates of the B. Sc. in Computer Science and Engineering (CSE) program are expected to attain the following Program Educational Objectives (PEO) within few years, such as 3-5 years, of graduation.

|      |  |
|------|--|
| PEO1 | Graduates will establish themselves as leading computational professionals and continue to learn and address evolving challenges in Computer Science and Engineering.  |
| PEO2 | Graduates will engage in lifelong pursuit of knowledge and interdisciplinary learning for industrial, research, and academic careers.  |
| PEO3 | Graduates will contribute to sustainable development and the well-being of society through the use of Computer Science and Engineering principles, practices and tools in an ethical and responsible manner. |

### Program Outcomes (POs) of B. Sc. in CSE Program

Graduates of the B. Sc. in Computer Science and Engineering (CSE) program are expected to attain the following Program Outcomes (POs) by the time of graduation.

| PO | Description |
|----|-------------|
|    |             |

| PO  | Description  |
|---|--|
| <b>PO1:</b><br><b>Engineering Knowledge</b> | Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex computer science and engineering problems (EP1 to EP7).   |
| <b>PO2: Problem Analysis</b>                | Identify, formulate, research literature and analyze complex computer science and engineering problems (EP1 to EP7) reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4)  |
| <b>PO3: Design/Development of Solutions</b> | Design solutions for complex computer science and engineering problems (EP1 to EP7) and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (WK5)                           |
| <b>PO4: Investigation</b>                   | Conduct investigations of complex computer science and engineering problems (EP1 to EP7) using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.                          |
| <b>PO5: Modern Tool Usage</b>               | Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex computer science and engineering problems (EP1 to EP7), with an understanding of the limitations. (WK6)   |
| <b>PO6: The Engineer and Society</b>        | Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional computer science and engineering practice and solutions to complex computer science and engineering problems (EP1 to EP7). (WK7) |
| <b>PO7: Environment and Sustainability</b>  | Understand and evaluate the sustainability and impact of professional computer science and engineering work in the solution of complex computer science and engineering problems (EP1 to EP7) in societal and environmental contexts. (WK7)  |

| <b>PO</b>                                   | <b>Description</b>   |
|---|--|
| <b>PO8: Ethics</b>                          | Apply ethical principles and commit to professional ethics and responsibilities and norms of computer science and engineering practice. (WK7)  |
| <b>PO9: Individual Work and Teamwork</b>    | Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.   |
| <b>PO10: Communication</b>                  | Communicate effectively on complex computer science and engineering activities (EA1 to EA5) with the computer science and engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| <b>PO11: Project Management and Finance</b> | Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.   |
| <b>PO12: Life-Long Learning</b>             | Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.  |

### **Course Summary**

| <b>Course Category</b>   | <b>Credits</b> |
|--|----------------|
| Compulsory Language and General Education Courses                      | 9              |
| Elective General Education Courses                                     | 9              |
| Basic Science Courses  | 11             |
| Mathematics and Statistics Courses                                     | 15             |
| Core Computer Science and Engineering Courses                          | 62             |
| Capstone Project   | 6              |
| Major Compulsory and Elective Computer Science and Engineering Courses | 20             |

|   |            |
|---|------------|
| Non-major Elective Computer Science and Engineering Courses | 8          |
| <b>Total</b>  | <b>140</b> |

### List of Courses

| Course   | Credits  | Prerequisite |
|--|----------|--------------|
| <b>Compulsory Language and General Education Courses</b> | <b>9</b> |              |
| ENG101 Basic English                                     | 3        |              |
| ENG 102 Composition and Communication Skills             | 3        | ENG101       |
| GEN226 Emergence of Bangladesh                           | 3        | ENG102       |

|   |          |        |
|---|----------|--------|
| <b>Elective General Education Courses</b>           | <b>9</b> |        |
| <b>Social Science Courses (any one course)</b>      | <b>3</b> |        |
| ECO101 Principle of Microeconomics                  | 3        | None   |
| GEN203 Ecological System and Environment            | 3        | None   |
| GEN214 Development Studies                          | 3        | ENG102 |
| SOC317 Sociology of Science and Technology          | 3        | None   |
| <b>Arts and Humanities Courses (any one course)</b> | <b>3</b> |        |
| GEN201 Bangladesh Studies                           | 3        | ENG102 |
| GEN204 Western Thought                              | 3        | None   |
| GEN210 International Relation                       | 3        | ENG102 |
| SOC211 Eastern Culture and Heritage                 | 3        | None   |

| <b>Course</b>   | <b>Credits</b> | <b>Prerequisite</b> |
|---|----------------|---------------------|
| SOC217 Religion, Ethnicity, Culture and Development in South Asia | 3              | ENG102              |
| <b><i>Business Courses (any one course)</i></b>                   | <b>3</b>       |                     |
| ACT101 Financial Accounting                                       | 3              | None                |
| BUS321 Business for Engineering and Technology                    | 3              | ENG102              |
| BUS231 Business Communication                                     | 3              | ENG102              |
| MGT321 Industrial Management                                      | 3              | ENG102              |
| MGT337 Production Operations Management                           | 3              | STA102              |
| FIN101 Principle of Finance                                       | 3              | STA102              |
| MKT101 Principle of Marketing                                     | 3              | None                |

|   |               |        |
|---|---------------|--------|
| <b>Core Natural Science Courses</b>                           | <b>9+2=11</b> |        |
| PHY109 Engineering Physics-I (Introductory Classical Physics) | 3+1=4         | MAT102 |
| PHY209 Engineering Physics-II (Introductory Quantum Physics)  | 3+0=3         | MAT205 |
| CHE109 Engineering Chemistry                                  | 3+1=4         |        |

|   |           |        |
|---|-----------|--------|
| <b>Core Mathematics and Statistics Course</b>       | <b>15</b> |        |
| MAT101 Differential and Integral Calculus           | 3         |        |
| MAT102 Differential Equations and Special Functions | 3         | MAT101 |
| MAT104 Coordinate Geometry and Vector Analysis      | 3         | MAT101 |
| MAT205 Linear Algebra and Complex Variable          | 3         | MAT102 |

| <b>Course</b>                     | <b>Credits</b> | <b>Prerequisite</b> |
|-----------------------------------|----------------|---------------------|
| STA102 Statistics and Probability | 3              |                     |

|  |                 |        |
|--|-----------------|--------|
| <b>Core Computer Science and Engineering Courses</b> | <b>48+14=62</b> |        |
| CSE103 Structured Programming                        | 3+1.5=4.5       |        |
| CSE106 Discrete Mathematics                          | 3+0=3           | CSE103 |
| CSE110 Object Oriented Programming                   | 3+1.5=4.5       | CSE106 |
| CSE200 Computer-Aided Engineering Drawing            | 0+1=1           |        |
| CSE209 Electrical Circuits                           | 3+1=4           |        |
| CSE207 Data Structures                               | 3+1=4           | CSE110 |
| CSE251 Electronic Circuits                           | 3+1=4           | CSE209 |
| CSE221 Operating Systems                             | 3+1=4           | CSE207 |
| CSE326 Algorithms                                    | 3+1.5=4.5       | CSE207 |
| CSE302 Database Systems                              | 3+1.5=4.5       | CSE106 |
| CSE345 Digital Logic Design                          | 3+1=4           | CSE251 |
| CSE347 Information System Analysis and Design        | 3+1=4           | CSE302 |
| CSE360 Computer Architecture                         | 3+0=3           | CSE221 |
| CSE405 Computer Networks                             | 3+1=4           | CSE326 |
| CSE407 Green Computing                               | 3+0=3           | CSE405 |
| CSE487 Cyber Security, Ethics and Law                | 3+0=3           | CSE405 |
| CSE495 IT Project Management and Entrepreneurship    | 3+0=3           | CSE347 |

| Course | Credits | Prerequisite |
|--------|---------|--------------|
|--------|---------|--------------|

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|--|---|---|
| <b>Core Capstone Project</b>   | <b>0+6=6</b>                                |   |
| CSE400 Capstone Project  | 0+6=6                                       | Completed at least 105 credit hours     |
| <b>Major Requirements</b>  | <b>Courses from the selected major area</b> |   |
| Student should select one of the four major areas for degree major requirement   | Two Compulsory courses (6+2=8 credits)      | Three elective courses (9+3=12 credits) |
| <b>Non-Major Elective Requirements</b>   |   |   |
| Minimum 8 credits (two to three courses depending on credits of the courses) from one or more major/non-major areas other than selected major area |   |   |

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|---|----------------|--|
| <b>Four Major Areas and Courses (2 Compulsory and 3 Elective Courses)</b> | <b>15+5=20</b> |  |
|---|----------------|--|

|  |                |        |
|--|----------------|--------|
| <b>1. Intelligent Systems and Data Science</b> | <b>15+5=20</b> |        |
| <b>Compulsory Courses</b>                      | <b>6+2=8</b>   |        |
| CSE303 Statistics for Data Science             | 3+1=4          | STA102 |
| CSE366 Artificial Intelligence                 | 3+1=4          | CSE326 |
| <b>Elective Courses (Any 3 Courses)</b>        | <b>9+3=12</b>  |        |
| CSE420 Computer Graphics                       | 3+1=4          | CSE326 |
| CSE438 Digital Image Processing                | 3+1=4          | CSE326 |

| <b>Course</b>                             | <b>Credits</b> | <b>Prerequisite</b> |
|---|----------------|---------------------|
| CSE445 Computer Vision                    | 3+1=4          | CSE326              |
| CSE452 Distributed Systems and Algorithms | 3+1=4          | CSE221              |
| CSE474 Pattern Recognition                | 3+1=4          | CSE366              |
| CSE475 Machine Learning                   | 3+1=4          | CSE366              |
| CSE477 Data Mining                        | 3+1=4          | CSE366              |
| CSE481 Nature-Inspired Computing          | 3+1=4          | CSE326              |
| CSE486 Bioinformatics Algorithms          | 3+1=4          | CSE326              |
| CSE488 Big Data Analytics                 | 3+1=4          | CSE302              |

|  |                |        |
|--|----------------|--------|
| <b>2. Software Engineering</b>                 | <b>15+5=20</b> |        |
| <b><i>Compulsory Courses</i></b>               | <b>6+2=8</b>   |        |
| CSE412 Software Engineering                    | 3+1=4          | CSE347 |
| CSE430 Software Testing and Quality Assurance  | 3+1=4          | CSE412 |
| <b><i>Elective Courses (Any 3 Courses)</i></b> | <b>9+3=12</b>  |        |
| CSE422 Simulation and Modeling                 | 3+1=4          | CSE326 |
| CSE423 Software Architecture                   | 3+1=4          | CSE412 |
| CSE428 Human Computer Interactions             | 3+1=4          | CSE412 |
| CSE452 Distributed Systems and Algorithms      | 3+1=4          | CSE221 |
| CSE464 Advanced Database System                | 3+1=4          | CSE302 |
| CSE479 Web Programming                         | 3+1=4          | CSE302 |

| <b>Course</b>                                   | <b>Credits</b> | <b>Prerequisite</b> |
|---|----------------|---------------------|
| CSE489 Mobile Programming                       | 3+1=4          | CSE326              |
| <b>3. Communications and Networking</b>         | <b>15+5=20</b> |                     |
| <b><i>Compulsory Courses</i></b>                | <b>6+2=8</b>   |                     |
| CSE350 Data Communications                      | 3+1=4          | CSE251              |
| CSE432 Digital Signal Processing                | 3+1=4          | CSE326              |
| <b><i>Elective Courses (Any 3 Courses)</i></b>  | <b>9+3=12</b>  |                     |
| CSE452 Distributed Systems and Algorithms       | 3+1=4          | CSE221              |
| CSE453 Wireless Networks                        | 3+1=4          | CSE405              |
| CSE457 Cellular Networks                        | 3+1=4          | CSE405              |
| CSE472 Advanced Network Services and Management | 3+1=4          | CSE405              |
| CSE473 Network Security and Systems             | 3+1=4          | CSE405              |
| CSE489 Mobile Programming                       | 3+1=4          | CSE326              |

|  |                |        |
|--|----------------|--------|
| <b>4. Hardware Engineering</b>                 | <b>15+5=20</b> |        |
| <b><i>Compulsory Courses</i></b>               | <b>6+2=8</b>   |        |
| CSE355 Digital System Design                   | 3+1=4          | CSE345 |
| CSE442 Microprocessors and Microcontrollers    | 3+1=4          | CSE360 |
| <b><i>Elective Courses (Any 3 Courses)</i></b> | <b>9+3=12</b>  |        |
| CSE406 Internet of Things                      | 3+1=4          | CSE405 |
| CSE446 ASIC Design Using FPGA                  | 3+1=4          | CSE345 |

| <b>Course</b>                               | <b>Credits</b> | <b>Prerequisite</b> |
|---|----------------|---------------------|
| CSE491 VLSI Design                          | 3+1=4          | CSE345              |
| CSE492 Robotics                             | 3+1=4          | CSE366              |
| CSE494 Embedded Systems                     | 3+1=4          | CSE442              |
| <b>Non-Major Area: Computational Theory</b> |                |                     |
| CSE225 Numerical Methods                    | 3+1=4          | CSE103              |
| CSE313 Theory of Computations               | 3+0=3          | CSE326              |
| CSE460 Cryptography                         | 3+0=3          | CSE326              |
| CSE471 Compiler Design                      | 3+1=4          | CSE326              |
| CSE483 Graph Theory                         | 3+0=3          | CSE326              |
| CSE484 Computational Geometry               | 3+0=3          | CSE326              |

### Course Flowchart

|                                | 1 <sup>st</sup> Year                                    |               | 2 <sup>nd</sup> Year                              |               | 3 <sup>rd</sup> Year                                  |               | 4 <sup>th</sup> Year                                      |               |
|--------------------------------|---|---------------|---|---------------|---|---------------|---|---------------|
|                                | Course (Credit)   | Pre-requisite | Course  | Pre-requisite | Course  | Pre-requisite | Course  | Pre-requisite |
| <b>1<sup>st</sup> Semester</b> | ENG101 Basic English (3)                                |               | GEN226 Emergence of Bangladesh (3)                | ENG102        | Elective General Education-III (3)                    |               | CSE400 Capstone Project-I (0+1=1)                         |               |
|                                | MAT101 Differential and Integral Calculus (3)           |               | STA102 Statistics and Probability (3)             |               | CSE326 Algorithms (3+1.5=4.5)                         | CSE207        | CSE407 Green Computing (3+0=3)                            | CSE405        |
|                                | CSE103 Structured Programming (3+1.5=4.5)               |               | CSE200 Computer-Aided Engineering Drawing (0+1=1) |               | CSE302 Database Systems (3+1.5=4.5)                   | CSE106        | Elective Major-I (3+1=4)                                  |               |
|                                |   |               | CSE209 Electrical Circuits (3+1=4)                |               |   |               | Elective Non-Major-I (3+1=4)                              |               |
| <b>2<sup>nd</sup> Semester</b> | ENG102 Composition And Communication Skills (3)         | ENG101        | Elective General Education-I (3)                  |               | CSE345 Digital Logic Design (3+1=4)                   | CSE251        | CSE400 Capstone Project-II (0+2=2)                        |               |
|                                | MAT102 Differential Equations and Special Functions (3) | MAT101        | MAT205 Linear Algebra and Complex Variables (3)   | MAT102        | CSE347 Information System Analysis and Design (3+1=4) | CSE302        | CSE487 Cyber Security, Ethics and Law (3+0=3)             | CSE405        |
|                                | CSE106 Discrete Mathematics (3+0=3)                     | CSE103        | CSE207 Data Structures (3+1=4)                    | CSE110        | Compulsory Major-I (3+1=4)                            |               | Elective Major-II (3+1=4)                                 |               |
|                                | CHE109 Engineering Chemistry (3+1=4)                    |               | CSE251 Electronic Circuits (3+1=4)                | CSE209        |   |               | Elective Non-Major-II (3+1=4)                             |               |
| <b>3<sup>rd</sup> Semester</b> | PHY109 Engineering Physics-I (3+1=4)                    | MAT102        | Elective General Education-II (3)                 |               | CSE360 Computer Architecture (3+0=3)                  | CSE221        | CSE400 Capstone Project-III (0+3=3)                       |               |
|                                | MAT104 Coordinate Geometry and Vector Analysis (3)      | MAT101        | PHY209 Engineering Physics-II (3+0=3)             | MAT205        | CSE 405 Computer Networks (3+1=4)                     | CSE326        | CSE495 IT Project Management and Entrepreneurship (3+0=3) | CSE347        |
|                                | CSE110 Object Oriented Programming (3+1.5=4.5)          | CSE106        | CSE221 Operating Systems (3+1=4)                  | CSE207        | Compulsory Major-II (3+1=4)                           |               | Elective Major-III (3+1=4)                                |               |
| Year-Credit                    | 35  |               | 35  |               | 35  |               | 35  |               |