



# NED University of Engineering and Technology

## Department of Computer Science & IT

## Bachelor of Science in Computer Science

**DEPARTMENTAL OUTCOME BASED EDUCATION (OBE) CATALOGUE**

## Batch 2021 and Onwards

# Contents

# 1. Vision Statement

**a. University Vision**

Be a leader in enabling Pakistan's social and economic transformation.

**b. Department Vision**

To be a leader in Computer Science and Information Technology education and interdisciplinary research for generating national and global impact that includes economic and social benefits.

# 2. Mission Statement

**a. University Mission**

Acquire education and research excellence in engineering and allied disciplines to produce leadership and enabling application of knowledge and skills for the benefit of the society with integrity and wisdom.

**a. Programme Mission**

To provide quality education in Computer Science and emerging and cross disciplinary avenues with well-balanced emphasis on conceptual knowledge and hands-on experience that enable graduates to lead their profession with integrity, serve society, and uplift the economy.

# 3. Program Educational Objectives (PEOs)

After three to five years, the graduates of the program will be able to exhibit the following computational skills:

**PEO-1:** Demonstrate a sound understanding of computing fundamentals with an ability to exercise critical judgment across a range of related issues.

**PEO-2:** Critically analyze and design solutions for complex computing problems with best practices and use of modern tools and techniques.

**PEO-3:** Function and communicate effectively as a leader or team member having understanding of professional ethics and social responsibility.

**PEO-4:** Adapt technological advancements through active participation in life-long learning to serve society.

## 4. Mapping of PEOs to University and Departmental Vision and Mission

| Vision and Mission | | Program Educational Objectives (PEOs) | | | |
|---|---|---|---|---|---|
| | | PEO-1 | PEO-2 | PEO-3 | PEO-4 |
| University Vision | Be a leader[3] in enabling Pakistan's social[3] and economic transformation[1,2,4]. | ✔ | ✔ | ✔ | ✔ |
| University Mission | Acquire education and research excellence in engineering and allied disciplines[1,2] to produce leadership[3] and enabling application of knowledge and skills[2] for the benefit of the society[4] with integrity and wisdom. | ✔ | ✔ | ✔ | ✔ |
| Department's Vision | To be a leader[3] in Computer Science and Information Technology education[1,2] and interdisciplinary research[1,2] for generating national and global impact[4] that includes economic and social benefits[1,4]. | ✔ | ✔ | ✔ | ✔ |
| Programme's Mission | To provide quality education in Computer Science and emerging and cross disciplinary avenues[1,2] with well-balanced emphasis on conceptual knowledge and hands-on experience[2] that enable graduates to lead[3] their profession with integrity, serve society, and uplift the economy[4]. | ✔ | ✔ | ✔ | ✔ |

## 5. Program Learning Outcomes (PLOs)

**PLO-1 Academic Education:**
To prepare graduates as computing professionals.

**PLO-2 Knowledge for Solving Computing Problems:** Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

**PLO-3 Problem Analysis:** An ability to identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**PLO-4 Design / Development of Solutions:** Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

**PLO-5 Modern Tool Usage:** Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

**PLO-6 Individual and Teamwork:** Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.

**PLO-7 Communication:** Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

**PLO-8 Computing Professionalism and Society:** Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

**PLO-9 Ethics:** Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.

**PLO-10 Life-long Learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

## 6. Mapping of PLOs to PEOs

| Program Learning Outcomes (PLOs) | Program Educational Objectives (PEOs) | | | |
|---|---|---|---|---|
| | PEO-1 | PEO-2 | PEO-3 | PEO-4 |
| PLO 1: Academic Education | ✔ | | | |
| PLO 2: Knowledge for Solving Computing Problems | | ✔ | | |
| PLO 3: Problem Analysis | | ✔ | | |
| PLO 4: Design / Development of solutions | | ✔ | | |
| PLO 5: Modern Tool Usage | | ✔ | | |
| PLO 6: Individual and Team Work | | | ✔ | |
| PLO 7: Communication | | | ✔ | |
| PLO 8: Computing Professionalism and Society | | | ✔ | |
| PLO 9: Ethics | | | ✔ | |
| PLO 10: Lifelong Learning | | | | ✔ |

## 7. Scheme of Studies

**BS Computer Science**

**First Year**

**Fall Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CT-175 | Programming Fundamentals | 3 | 1 | 4 |
| CT-174 | Fundamentals of Information Tech | 3 | 1 | 4 |
| MT-171 | Differential & Integral Calculus | 3 | 0 | 3 |
| PH-122 | Applied Physics | 3 | 0 | 3 |
| HS-205 | Islamic Studies OR | 2 | 0 | 2 |
| HS-209 | Ethical Behavior (for Non-Muslims) | | | 0 |
| MT-001 | Mathematics-1 (Pre-Medical) | | | NC |
| | | | | |
| | **Total** | **14** | **2** | **16** |

**Spring Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CS-251 | Logic Design & Switching Theory | 3 | 1 | 4 |
| CT-162 | Discrete Structures | 3 | 0 | 3 |
| CT-260 | Object Oriented Programming | 3 | 1 | 4 |
| HS-104 | Functional English | 3 | 0 | 3 |
| HS-105 | Pakistan Studies OR | 2 | 0 | 2 |
| HS-127 | Pakistan Studies (for Foreigners) | | | 0 |
| HSK-1<br>HS-231 | Chinese Language OR<br>Turkish Language | | | NC<br>NC |
| MT-002 | Mathematics-2 (for Pre-Medical) | | | NC |
| | **Total** | **14** | **2** | **16** |

**Second Year**

**Fall Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CT-159 | Data Structures Algorithms & Applications | 3 | 1 | 4 |
| MT-227 | Differential Equations | 3 | 0 | 3 |
| HS-115 | Academic Reading & Writing | 3 | 0 | 3 |
| HS-219 | Professional Ethics | 2 | 0 | 2 |
| CT-259 | System Analysis & Design | 3 | 0 | 3 |
| HSK-II<br>HS-231 | Chinese Language OR<br>Turkish Language | | | NC<br>NC |
| | **Total** | **14** | **1** | **15** |

**Spring Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CS-252 | Computer Architecture & Organization | 3 | 1 | 4 |
| CT-261 | Database Management Systems | 3 | 1 | 4 |
| HS-218 | Business Communication | 2 | 1 | 3 |
| CT-258 | Financial & Cost Accounting | 3 | 0 | 3 |
| MT-272 | Linear Algebra & Geometry | 3 | 0 | 3 |
| HS-200 | Community Service | | | NC |
| | **Total** | **14** | **3** | **15** |

**Third Year**

**Fall Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CT-365 | Software Engineering | 3 | 0 | 3 |
| CT-353 | Operating Systems | 3 | 1 | 4 |
| CT-363 | Design & Analysis of Algorithm | 3 | 0 | 3 |
| MT-331 | Probability & Statistics | 3 | 0 | 3 |
| CT-364 | Theory of Automata & Formal Language | 3 | 0 | 3 |
| | **Total** | **15** | **1** | **16** |

**Spring Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CT-376 | Computer Communication Network | 3 | 1 | 4 |
| CT-361 | Artificial Intelligence & Expert Systems | 3 | 1 | 4 |
| CT-362 | Web Engineering | 3 | 1 | 4 |
| CT-367 | Theory of Programming Languages | 3 | 0 | 3 |
| MT-442 | Numerical Methods | 3 | 0 | 3 |
| | **Total** | **15** | **3** | **18** |

**Final Year**

**Fall Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CT-486 | Network & Information Security | 3 | 1 | 4 |
| MG-482 | Organizational Behavior | 3 | 0 | 3 |
| CT-### | Elective I | 3 | 0 | 3 |
| CT-### | Elective II | 3 | 1 | 4 |
| CT-499 | Software Based Project | 0 | 3 | 3 |
| | **Total** | **13** | **4** | **17** |

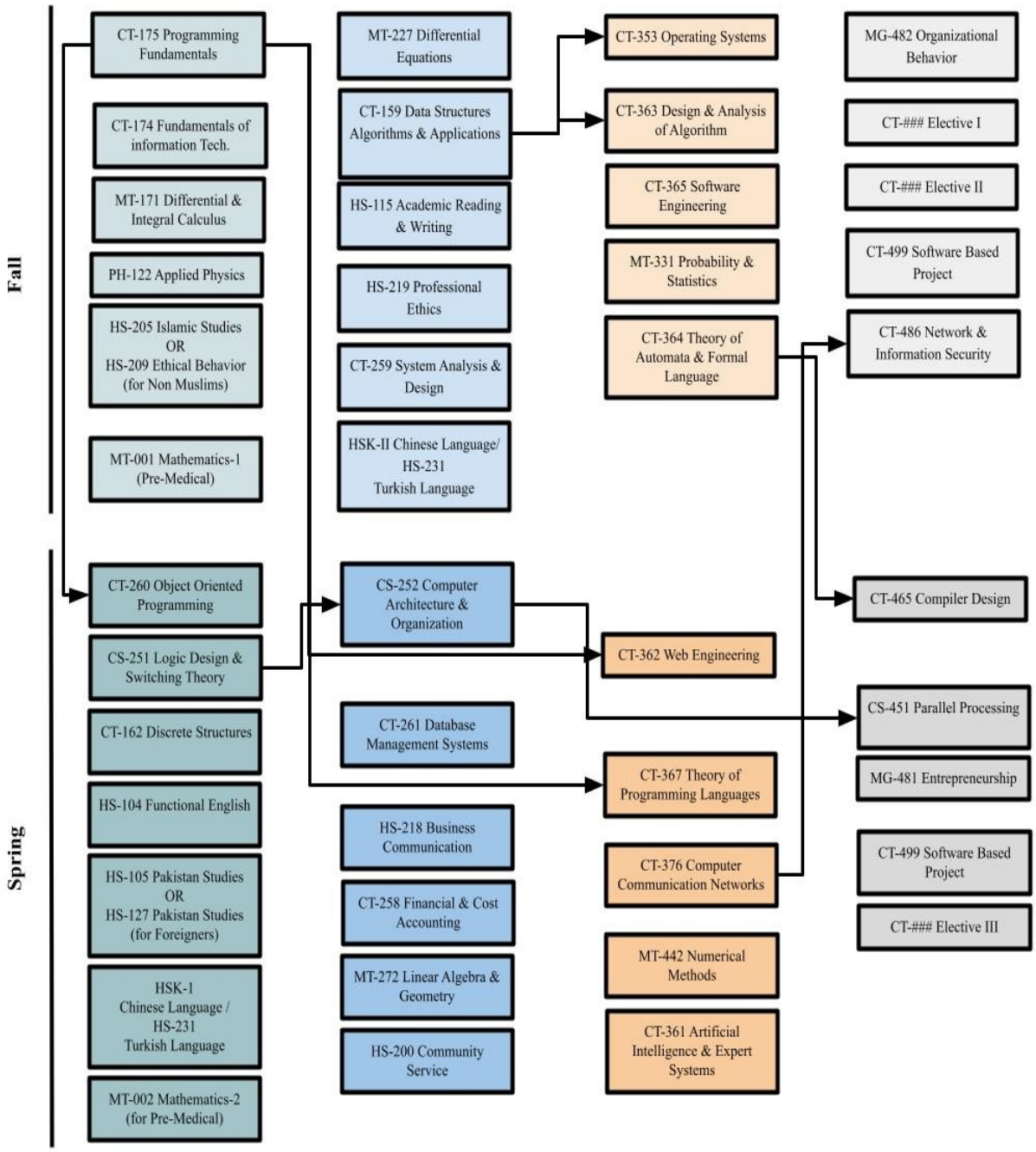
**Spring Semester**

| Course Code | Course Title | Credit Hrs | | |
|---|---|---|---|---|
| | | Th | Pr | Total |
| CS-451 | Parallel Processing & Distributed Computing | 3 | 1 | 4 |
| CT-465 | Compiler Design | 3 | 0 | 3 |
| MG-481 | Entrepreneurship | 3 | 0 | 3 |
| CT-### | Elective III | 3 | 1 | 4 |
| CT-499 | Software Based Project | 0 | 3 | 3 |
| | **Total** | **12** | **5** | **17** |

** Duration one academic year: Requires literature survey and preliminary work during this Semester*

| Elective Courses | | |
|---|---|---|
| **Course Code** | **Course Names** | **Elective Category** |
| CT-366 | E-Commerce | Elective-I |
| CT-485 | Natural Language Processing | |
| CT-464 | Modeling & Simulation | |
| CT-352 | Computer Graphics | Elective-II & Elective-III |
| CT-487 | Visual Programming | |
| CT-488 | Distributed Computing | |
| CT-463 | Data Warehouse Mining | |
| CT-481 | Wireless Network & Mobile Computing | |
| CT-484 | Introduction to Cyber Security | |

## Course Dependency Chart



## 8. Mapping of Curriculum to PLOs

| Computer Science Courses | | | Program Learning Outcomes (PLOs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO-1 | PLO-2 | PLO-3 | PLO-4 | PLO-5 | PLO-6 | PLO-7 | PLO-8 | PLO-9 | PLO-10 |
| First Year | Fall | CT-175 Programming Fundamentals | C2 | | C3 | C3 | | | | | | |
| | | CT-174 Fundamentals of Information Tech | C2 | C3 | C3 | | | | | | | |
| | | MT-171 Differential & Integral Calculus | | C1 | C3 | | | | | | | |
| | | PH-122 Applied Physics | C2 | C3, P3 | C3 | | | | | | | |
| | | HS-205 Islamic Studies | | | | | | | | | C2, C2 | |
| | | HS-209 Ethical Behavior (for Non-Muslims) | | | | | | | | | C2, C2 | |
| | Spring | CS-251 Logic Design & Switching Theory | | C2 | C3 | P3 | | | | | | |
| | | CT-162 Discrete Structures | C2 | C3 | C4 | | | | | | | |
| | | CT-260 Object Oriented Programming | C1 | C2 | C3 | | | | | | | |
| | | HS-104 Functional English | | | | | | | A3, C2, C6 | | | |
| | | HS-105 Pakistan Studies | | | | | | | | C2 | | C2 |
| | | HSK-I Chinese Language / HS-231 Turkish Language | | | | | | | | | | |
| Second Year | Fall | CT-159 Data Structures Algorithms & Applications | C2 | C3 | C4 | | | | | | | |
| | | MT-227 Differential Equations | | C2 | C3 | | | | | | | |
| | | HS-115 Academic Reading & Writing | | | | | | | C2, C6, C3 | | | |
| | | HS-219 Professional Ethics | | | | | | | | | C2, C3, A3 | |
| | | CT-259 System Analysis & Design | | C1 | C2 | | | C3 | | | | |
| | | HSK-II Chinese Language/HS-231 Turkish Language | | | | | | | | | | |
| | Spring | CS-252 Computer Architecture & Organization | C2 | | C3 | | C3 | | | | | |
| | | CT-261 Database Management Systems | C2 | | | C5 | C3 | | | | | |
| | | HS-218 Business Communications | | | | | | | A3, C3, C6 | | | |
| | | CT-258 Financial and Cost Accounting | | C1 | C2 | C3 | | | | | | |
| | | MT-272 Linear Algebra & Geometry | | C2 | C3 | | | | | | | |
| | | HS-200 Community Service | | | | | | | | A3 | | A2 |

| Computer Science Courses | | | Program Learning Outcomes (PLOs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PLO-1 | PLO-2 | PLO-3 | PLO-4 | PLO-5 | PLO-6 | PLO-7 | PLO-8 | PLO-9 | PLO-10 |
| Third Year | Fall | CT-365 Software Engineering | C2 | | | | | C3 | | C5 | | |
| | | CT-353 Operating Systems | C2 | | C4, C3 | | | | | | | |
| | | CT-363 Design & Analysis of Algorithm | C1 | C2 | C4 | | | | | | | |
| | | MT-331 Probability & Statistics | | C2 | C4 | | | | | | | |
| | | CT-364 Theory of Automata & Formal Language | C1 | C3 | C4 | | | | | | | |
| | | | | | | | | | | | | |
| | Spring | CT-376 Computer Communication Networks | | C2 | C3 | | P3 | | | | | |
| | | CT-361 Artificial Intelligence & Expert Systems | C1 | C2 | | C3 | | | | | | |
| | | CT-362 Web Engineering | | C2 | | C3 | P3 | | | | | |
| | | CT-367 Theory of Programming Languages | C2 | C3 | | | | | | | | C3 |
| | | MT-442 Numerical Methods | | C2, C3 | C3 | | | | | | | |
| Final Year | Fall | CT-486 Network & Information Security | C1 | | | C3 | P3 | | | | | |
| | | MG-482 Organizational Behavior | | | | | | A3 | | C4 | | C2 |
| | | CT-### Elective 1 | | C | C | C | | | | | | |
| | | CT-### Elective 2 | | C | C | | C | | | | | |
| | | CT-499 Software Based Project | C | | C | C | | A | A | A | A | |
| | Spring | CS-451 Parallel Processing | | C2 | C4 | C3 | | | | | | |
| | | CT-465 Compiler Design | | C1 | C3 | C5 | | | | | | |
| | | MG-481 Entrepreneurship | | | | | | | C3 | | A3 | C2 |
| | | CT-### Elective 3 | C | C | | | C | | | | | |
| | | CT-499 Software Based Project | | | C | C | | A | A | A | A | A |
| | | Internship | C | C | C | | | A | A | A | A | |

## 9. Key Performance Indicators (KPIs)

| | | Evaluation Tool | KPI | Data Collection Frequency | Analysis Frequency |
|---|---|---|---|---|---|
| **PEO** | Programme | ▪ Employer Feedback Survey<br>▪ Alumni Feedback Survey<br>▪ Employment Statistics | 50% of the Survey Form responses must attain a score of 3 or above (on a scale of 1 to 5), and 50% of the graduates must be employed and/or engaged in higher studies. | Every Year | 4 years from graduation |
| **PLO** | Student | ▪ CLO scores of the student in the mapped course(s) | Each PLO must be attained in at least 50% of the respective mapped course(s), with an average score of at least 50%. | Every Semester | Every Semester |
| | Course | ▪ PLO scores of all the students in the mapped course | At least 50% of the students must attain that PLO | Every Semester | Every Semester |
| | Programme | ▪ Final PLO attainment statistics of all the courses including FYDP<br>▪ Internship Feedback Form<br>▪ Exit Survey | At least 50% of the mapped courses must attain the PLO and at least 50% of the students/ responses must attain a score of 3 or above on a scale of 1 to 5. | At graduation | At graduation |
| **CLO** | Student | ▪ Course work | The student must obtain at least 50% average percentage score from all attempts. | Every Semester | Every Semester |
| | Course | ▪ CLO scores of all students in the course | At least 50% of the students must attain that CLO | Every Semester | Every Semester |

## 10.Continuous Quality Improvement (CQI)

The following table shows the post KPI evaluation actions, severity-wise, as outlined in the Manual of Uniform OBE Framework.

| | **PEO CQI** | **PLO CQI** | | | **CLO CQI** | |
|---|---|---|---|---|---|---|
| | **Program KPI** | **Student KPI** | **Course KPI** | **Programme KPI** | **Student KPI** | **Course KPI** |
| **KPIs Achieved** | ▪ No Action | ▪ No Action | ▪ No Action | ▪ No Action | ▪ No Action | ▪ No Action |
| **KPIs Not Achieved** | 1. Review of curriculum strategies.<br>2. Review of assessment methods.<br>3. Review of the relevant KPIs.<br>4. Review of PEOs.<br>5. Revisions implemented. | 1. Warning through the progressive attainment sheet.<br>2. Student counselling. | 1. Review of teaching and learning process.<br>2. Review of CLOs assessment methods.<br>3. Review of CLO-PLO mapping and the relevant KPIs.<br>4. Review of curriculum design.<br>5. Revisions implemented. | 1. Review of teaching and learning process.<br>2. Review of PLOs assessment methods.<br>3. Review of Course-PLO mapping and the relevant KPIs.<br>4. Review of curriculum design.<br>5. Revisions implemented. | 1. Student provided further chances through direct assessment tools.<br>2. Student counselling. | 1. Review of CLO assessment methods.<br>2. Review of CLOs and taxonomy levels.<br>3. Review of students' course feedback.<br>4. Review of CLO KPIs.<br>5. Faculty advice by Departmental OBE Cell.<br>6. Faculty training. |

The following figure shows the overall OBE framework for an Engineering Programme as outlined in the Manual of Uniform OBE Framework.