# PROPOSED SCHEME FOR

# B. TECH.

# IN

# DATA SCIENCE & ENGINEERING


## DEPARTMENT OF COMPUTER SCIENCE & ENGINNERING

## Dr. B R AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY

## JALANDHAR – 144027

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# DR B R AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY JALANDHAR

## INSTITUTE VISION AND MISSION STATEMENTS

### VISION

*To build a rich intellectual potential embedded with interdisciplinary knowledge, human values and professional ethics among the youth, aspirant of becoming engineers and technologists, so that they contribute to society and create a niche for a successful career.*

### MISSION

*To become a leading and unique institution of higher learning, offering state-of-the art education, research and training in engineering and technology to students who are able and eager to become change agents for the industrial and economic progress of the nation. To nurture and sustain an academic ambience conducive to the development and growth of committed professionals for sustained development of the nation and to accomplish its integration into the global Economy.*

**DR B R AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY JALANDHAR**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

# *Vision of the Department*

*To be recognized globally for imparting computer science education and research of high distinction, both of value and relevance to society*

# *Mission of the Department*

**M1** To impart contemporary knowledge and skill relevant to the field of Computer Science and Engineering to maximize employability and potential.

**M2** To strengthen multifaceted competence in the different core and allied areas of Computer Science in order to nurture creativity, innovations and out-of-the-box thinking.

**M3** To promote research and expertise in Computer Science and Engineering in order to serve the needs of Industry, Government and Society and motivate the students for lifelong learning.

**M4** To inculcate professional ethics and social values through co-curricular and extra–curricular activities for holistic nation building.

# *Program Educational Objectives (PEOs)*

- To create and sustain a community of learning in which students acquire knowledge and apply in their concerned fields with due consideration for ethical, ecological, and economic issues.
- To provide knowledge based services so as to meet the ever-changing needs of industry and society at large.
- To make the students understand, design and implement the concepts in multiple arenas.
- To foster holistic growth of students that would provide ample $E^2$ opportunities.

# *Program Outcomes (POs)*

After completion of the B. Tech Programme, student will develop:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the 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.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

## *Program Specific Outcomes (PSOs)*

**PSO1:** To demonstrate the different aspects of the data science like processing, visualization, and modelling to become better trained scientist and engineers.

**PSO2:** To apply mathematical statistics, and programming skills for analysing and developing solutions of futuristic real-world problems in the arenas of data science.

# Semester wise Distribution of all Courses

**III SEMESTER**

| S. No | Course Code | Course Title | Teaching Load | | | Credit | Course Type |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 1. | CSPC-203 | Object Oriented Programming | 3 | 0 | 0 | 3 | PC |
| 2. | CSPC-205 | Data Structures and Algorithms | 3 | 1 | 0 | 4 | PC |
| 3. | CSPC-209 | Discrete Structures | 3 | 0 | 0 | 3 | PC |
| 4. | CSPC-261 | Introduction to Data Analytics | 3 | 1 | 0 | 4 | PC |
| 5. | CSPC-263 | Data Communication and Computer Networks | 3 | 0 | 0 | 3 | PC |
| 6. | CSPC-265 | Mathematical Foundations for Data Science-I | 3 | 1 | 0 | 4 | PC |
| 7. | CSPC-223 | Object Oriented Programming Laboratory | 0 | 0 | 2 | 1 | PC |
| 8. | CSPC-225 | Data Structures and Algorithm Laboratory | 0 | 0 | 2 | 1 | PC |
| 9. | CSPC-281 | Data Analytics Laboratory | 0 | 0 | 2 | 1 | PC |
| 10. | CSPC-283 | Data Communication and Computer Networks Laboratory | 0 | 0 | 2 | 1 | PC |
| **TOTAL** | | | **18** | **3** | **8** | **25** | |

**IV SEMESTER**

| S. No | Course Code | Course Title | Teaching Load | | | Credit | Course Type |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 1. | CSPC-202 | Database Management System | 3 | 0 | 0 | 3 | PC |
| 2. | CSPC-204 | Machine Learning | 3 | 0 | 0 | 3 | PC |
| 3. | CSPC-206 | Design and Analysis of Algorithms | 3 | 1 | 0 | 4 | PC |
| 4. | CSPC-208 | Computer Organization and Architecture | 3 | 1 | 0 | 4 | PC |
| 5. | CSPC-262 | Data Handling and Visualization | 3 | 0 | 0 | 3 | PC |
| 6. | CSPC-264 | Mathematical Foundations for Data Science-II | 3 | 1 | 0 | 4 | PC |
| 7. | CSPC-222 | Database Management System Laboratory | 0 | 0 | 2 | 1 | PC |
| 8. | CSPC-224 | Machine Learning Laboratory | 0 | 0 | 2 | 1 | PC |
| 9. | CSPC-226 | Design and Analysis of Algorithms Laboratory | 0 | 0 | 2 | 1 | PC |
| 10. | CSPC-282 | Data Handling and Visualization Laboratory | 0 | 0 | 2 | 1 | PC |
| **TOTAL** | | | **18** | **3** | **8** | **25** | |

**V SEMESTER**

| S. No | Course Code | Course Title | Teaching Load | | | Credit | Course Type |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 1. | CSPC-303 | Operating Systems | 3 | 0 | 0 | 3 | PC |
| 2. | CSPC-305 | Software Engineering | 3 | 0 | 0 | 3 | PC |
| 3. | HMCI-301 | Economics for Engineering | 3 | 0 | 0 | 3 | CIC |
| 4. | CSPC-361 | Formal Languages and Automata Theory | 3 | 1 | 0 | 4 | PC |
| 5. | CSPC-363 | Artificial Intelligence Concepts | 3 | 0 | 0 | 3 | PC |
| 6. | CSPC-3XX | DE-I | 3 | 0 | 0 | 3 | PE |
| 7. | CSPC-323 | Operating Systems Laboratory | 0 | 0 | 2 | 1 | PC |
| 8. | CSPC-325 | Software Engineering Laboratory | 0 | 0 | 2 | 1 | PC |
| 9. | CSPC-383 | Artificial Intelligence Laboratory | 0 | 0 | 2 | 1 | PC |
| 10. | CSPC-3XX | DE-I Laboratory | 0 | 0 | 2 | 1 | PE |
| 11. | CSCI-301 | Minor Project, Phase-I | 0 | 0 | 2 | 0* | CIC |
| **TOTAL** | | | **18** | **1** | **10** | **23** | |

**DEPARTMENTAL ELECTIVE (DE)-I**

| S. No | Course Code | Course Title | Teaching Load | | | Credit |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | CSPE-331 | Advanced Programming Concepts using Java | 3 | 0 | 0 | 3 |
| 2. | CSPE-335 | Web Technologies | 3 | 0 | 0 | 3 |
| 3. | CSPE-351 | Advanced Programming Concepts using Java Laboratory | 0 | 0 | 2 | 1 |
| 4. | CSPE-355 | Web Technologies Laboratory | 0 | 0 | 2 | 1 |

**VI SEMESTER**

| S. No | Course Code | Course Title | Teaching Load | | | Credit | Course Type |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 1. | CSPC-362 | Deep Learning | 3 | 0 | 0 | 4 | PC |
| 2. | CSPC-364 | Natural Language & Text Processing | 3 | 0 | 0 | 3 | PC |
| 3. | CSPC-366 | Advanced Databases and Data Mining | 3 | 0 | 0 | 3 | PC |
| 4. | CSPC-368 | Introduction to Compiler Design | 3 | 0 | 0 | 3 | PC |
| 5. | CSPC-3XX | DE-II | 3 | 0 | 0 | 3 | PE |
| 6. | CSOE-XXX | OE-I | 3 | 0 | 0 | 3 | OE |
| 7. | CSPC-382 | Deep Learning Laboratory | 0 | 0 | 2 | 1 | PC |
| 8. | CSPC-384 | Natural Language & Text Processing Laboratory | 0 | 0 | 2 | 1 | PC |
| 9. | CSPC-386 | Advanced Databases and Data Mining Laboratory | 0 | 0 | 2 | 1 | PC |
| 10. | CSPC-3XX | DE-II Laboratory | 0 | 0 | 2 | 1 | PE |
| 11. | CSCI-301 | Minor Project, Phase-II | 0 | 0 | 2 | 2* | CIC |
| **TOTAL** | | | **18** | **0** | **10** | **25** | |

*** Minor Project will be allotted in 5th Semester, will be evaluated after 6th Semester**

**DEPARTMENTAL ELECTIVE (DE)-II**

| S. No | Course Code | Course Title | Teaching Load | | | Credit |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | CSPE-332 | Advanced Computer Networks | 3 | 0 | 0 | 3 |
| 2. | CSPE-334 | Android Programming and Mobile Applications Development | 3 | 0 | 0 | 3 |
| 3. | CSPE-336 | Internet of Things | 3 | 0 | 0 | 3 |
| 4. | CSPE-352 | Advanced Computer Networks Laboratory | 0 | 0 | 2 | 1 |
| 5. | CSPE-354 | Android Programming and Mobile Applications Development Laboratory | 0 | 0 | 2 | 1 |
| 6. | CSPE-356 | Internet of Things Laboratory | 0 | 0 | 2 | 1 |

**VII SEMESTER**

| S. No | Course Code | Course Title | Teaching Load | | | Credit | Course Type |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 1. | CSPC-461 | Image Processing and Machine Vision | 3 | 0 | 0 | 3 | PC |
| 2. | CSPC-463 | Data Privacy & Security | 3 | 0 | 0 | 3 | PC |
| 3. | CSPC-465 | Optimization for Data Science | 3 | 0 | 0 | 3 | PC |
| 4. | CSPC-4XX | DE-III | 3 | 0 | 0 | 3 | PE |
| 5. | CSOE-XXX | OE-II | 3 | 0 | 0 | 3 | OE |
| 6. | CSPC-481 | Image Processing and Machine Vision Laboratory | 0 | 0 | 2 | 1 | PC |
| 7. | CSCI-300 | Industrial Practical Training | 0 | 0 | 8 | 2 | CIC |
| 8. | CSCI-400 | Project (Phase-I) | 0 | 0 | 4 | 0* | CIC |
| **TOTAL** | | | **15** | **0** | **14** | **18** | |

**DEPARTMENTAL ELECTIVE (DE)-III**

| S. No | Course Code | Course Title | Teaching Load | | | Credit |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | CSPE-433 | Block Chain Architecture & Use Cases | 3 | 0 | 0 | 3 |
| 2. | CSPE-435 | Distributed System | 3 | 0 | 0 | 3 |
| 3. | CSPE-437 | Multimedia Analytics | 3 | 0 | 0 | 3 |
| 4. | CSPE-439 | Real-time Systems | 3 | 0 | 0 | 3 |

**VIII SEMESTER**

| S. No | Course Code | Course Title | Teaching Load | | | Credit | Course Type |
|---|---|---|---|---|---|---|---|
| | | | L | T | P | | |
| 1. | CSPC-462 | Matrix Computation for Data Science | 3 | 0 | 0 | 3 | PC |
| 2. | CSPC-4XX | DE-IV | 3 | 0 | 0 | 3 | PE |
| 3. | CSPC-4XX | DE-V | 3 | 0 | 0 | 3 | PE |
| 4. | DSOE-XXX | OE-III | 3 | 0 | 0 | 3 | OE |
| 5. | CSCI-400 | Project (Phase-II) | 0 | 0 | 8 | 4 | CIC |
| 6. | CSCI-424 | Industrial Lecture | 0 | 0 | 2 | 1 | CIC |
| **TOTAL** | | | **12** | **0** | **10** | **17** | |

*** Major Project will be allotted in 7th Semester, will be evaluated in 8th Semester**

**DEPARTMENTAL ELECTIVE (DE)-IV**

| S. No | Course Code | Course Title | Teaching Load | | | Credit |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | CSPE-442 | High Performance Computing | 3 | 0 | 0 | 3 |
| 2. | CSPE-444 | Soft Computing | 3 | 0 | 0 | 3 |
| 3. | CSPE-446 | Wireless Networks | 3 | 0 | 0 | 3 |
| 4. | CSPE-472 | Semantics Analysis | 3 | 0 | 0 | 3 |

**DEPARTMENTAL ELECTIVE (DE)-V**

| S. No | Course Code | Course Title | Teaching Load | | | Credit |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | CSPE-448 | Social Network Analysis | 3 | 0 | 0 | 3 |
| 2. | CSPE-450 | Human Computer Interaction | 3 | 0 | 0 | 3 |
| 3. | CSPE-474 | Intellectual Property Right | 3 | 0 | 0 | 3 |

# Summary Sheet of Credits

| Semester | Course Category | Number | Credits | Total Credits |
|---|---|---|---|---|
| III | CIC | - | - | **25** |
| | PC | 10 | 25 | |
| | PE | - | - | |
| | OE | - | - | |
| IV | CIC | - | - | **25** |
| | PC | 10 | 25 | |
| | PE | - | - | |
| | OE | - | - | |
| V | CIC | 2 | 3 | **23** |
| | PC | 7 | 16 | |
| | PE | 2 | 4 | |
| | OE | - | - | |
| VI | CIC | 1 | 2 | **25** |
| | PC | 7 | 16 | |
| | PE | 2 | 4 | |
| | OE | 1 | 3 | |
| VII | CIC | 2 | 2 | **18** |
| | PC | 4 | 10 | |
| | PE | 1 | 3 | |
| | OE | 1 | 3 | |
| VIII | CIC | 2 | 5 | **17** |
| | PC | 1 | 3 | |
| | PE | 2 | 6 | |
| | OE | 1 | 3 | |
| **Total Credits (III to VIII Sem)** | | | | **133** |
| Total No of PC | | 39 | 95 | |
| Total No of PE | | 07 | 17 | |
| Total No of OE | | 03 | 09 | |
| Total Credits of CIC | | 07 | 12 | |
| Credits from 1st year | | | 47 | **47** |
| **Total Credits** | | | **180** | **180** |