



M.Tech

DATA SCIENCE & ENGINEERING



BITS Pilani
Pilani | Dubai | Goa | Hyderabad

Work Integrated Learning Programmes





WHO SHOULD APPLY?

Prepare for career in Data Science with the most comprehensive Master's degree programme in Data Science & Engineering without taking a break from your career.

M.Tech. Data Science and Engineering is a four-semester programme designed for working professionals that helps learners build mathematical and engineering skills required to advance their career as a Data Scientist or Data Engineer.





WHAT ARE THE MAIN HIGHLIGHTS OF THE PROGRAMME?

- ▶ The programme is offered by BITS Pilani, a top-ranked institution, recently announced as an Institution of Eminence by MHRD, Govt. of India.
- ▶ The programme is of four semesters, and can be pursued without a career break.
- ▶ Classes will be conducted by BITS Pilani faculty over weekends through live online sessions.
- ▶ The curriculum covers areas that prepare you for most lucrative careers in the space of Data Science, Data Engineering and Advanced Analytics. It helps learners master critical skills such as Mathematical modeling, Machine learning, Artificial Intelligence, Product development and scripting languages.
- ▶ Tools & Technologies covered include Apache Spark, Apache Storm for Big Data Systems/ Real time Processing, Tableau for data visualization, Tensorflow for Deep Learning and various packages within Python for data processing, machine learning and data visualization.
- ▶ The programme emphasizes on experiential learning through Simulations, Online Labs, Case Studies, Group Discussions, Assignments and Project work.
- ▶ Dissertation/ Project Work in the final semester enables learners to apply concepts and techniques learnt during the programme.

WHAT IS THE EDUCATION DELIVERY METHODOLOGY?



CLASSROOM SESSIONS

- ▶ Classroom sessions in this programme will be conducted through live online sessions which can be accessed by the learners from any location using a computer and a high-speed internet connection.
- ▶ Classes will be conducted by BITS Pilani faculty over weekends. A typical weekend classroom session per subject is of 1.5-2 hours duration. Since students typically pursue 4 courses in a semester, they will be expected to attend approximately 4 classroom sessions over a weekend.
- ▶ These classroom sessions will be typically scheduled over 16 weekends per semester.
- ▶ The schedule of the classroom sessions, will be announced at the beginning of each semester.

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EXPERIENTIAL LEARNING & LABS

The programme emphasises on Experiential Learning that allows learners to apply concepts learnt in classroom in simulated and real work situations. This is achieved through Simulations, Online Labs, Case Studies, Group Discussions, and Assignments, etc.

Some or all of the following would be utilised across the programme:

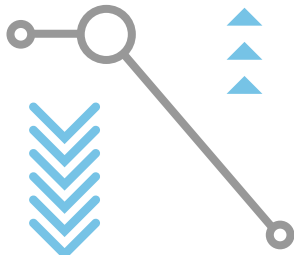


Apache Spark, Apache Storm for Big Data Systems/ Real time Processing; Tableau for data visualisation; Tensorflow for Deep Learning; Various Packages within Python for data processing, machine learning, data visualization etc.



PROJECT WORK

During the final semester participants carryout a semester-long intensive project work applying the various concepts learnt throughout the program guided by the organisation mentor and supervisor. Participants are provided access to virtual labs where applicable, and faculty expertise to support the project work.



EXAMINATIONS & CONTINUOUS ASSESSMENT

The learners' performance is assessed continuously throughout the semester using various tools such as quiz, assignments, mid-semester and comprehensive exams. The assessment results are shared with the learners to improve their performance.

Each course will entail a minimum of 1 Assignment/ Quiz, a Mid-semester exam and a final Comprehensive exam. Your semester calendar will clearly indicate the dates of the Mid-semester and Comprehensive exam. Typically, a Mid-semester or Comprehensive examination for a course is for 2-3 hours duration. The examinations are typically conducted over a weekend, i.e. Saturday and Sunday. These exams will be conducted either at the learners' office premises, or at another suitable location. Details regarding the exam location will be communicated at the beginning of the semester.





WHAT IS THE ELIGIBILITY CRITERIA?

Minimum eligibility to apply - Employed professionals holding B.E. / B.Tech. / MCA / M.Sc. or equivalent with at least 60% aggregate marks or more in their qualifying exam, and minimum two years of relevant work experience within HCL are eligible to apply.

Applicants should possess basic programming knowledge and adequate background in Mathematics.

FEE STRUCTURE

The following fees schedule is applicable for candidates seeking new admission during the academic year 2022-23

Application Fees (one time)	:INR 1,500
Admission Fees (one time)	:INR 16,500
Semester Fees (per semester)	:INR 60,500

SEMESTER-WISE PATTERN

The programme features 12 courses between Semester 1-3, and a Dissertation in Semester 4. All the courses will be offered using live online mode.

First Semester

- Data Mining
- Mathematical Foundations for Data Science
- Data Structures and Algorithms Design
- Computer Organization and Systems Software

Second Semester

- Introduction to Statistical Methods
- Introduction to Data Science
- Elective 1
- Elective 2

Third Semester

- Elective 3
- Elective 4
- Elective 5
- Elective 6

Fourth Semester

- Dissertation

Electives

- Deep Learning
- Natural Language Processing
- Artificial and Computational Intelligence
- Data Visualisation & Interpretation
- Graphs - Algorithms & Mining
- Optimization Methods for Analytics
- Big Data Systems
- Information Retrieval
- Probabilistic Graphical Models
- Data Warehousing
- Systems for Data Analytics
- Ethics for Data Science
- Machine Learning
- Distributed Data System
- Stream Processing & Analytics

Electives finally offered will be at the discretion of the BITS Pilani, and will be decided in consultation with HCL. Offered electives will be made available to enrolled students at the beginning of each semester.



DETAILED COURSE CURRICULUM

▶ Introduction to Data Science

Learn about the need for data science, with emphasis on data; Visualization and ethics aspects involved in data science and engineering processes; Various applications of data science

▶ Mathematical Foundations for Data Science

Learn about concepts in linear algebra and use it as a platform to model physical problems; Analytical and numerical solutions of linear equations; Mathematical structures, concepts and notations used in discrete mathematics

▶ Introduction to Statistical Methods

Learn about basic and some advanced concepts of probability and statistics; Concepts of statistics in solving problems arising in data science

▶ Data Structures and Algorithms Design

Learn about applications of basic and advanced data structures & algorithms; How to determine the space and time complexities of various algorithms; Identifying and choosing the relevant data structures and algorithms for a given problem and justifying the time and space complexities involved

▶ Computer Organization & Software Systems

Learn about computer organization, architecture aspects and operating system concepts; Advanced systems and techniques used for data processing.

▶ Systems for Data Analytics

Learn about fundamentals of data engineering; Basics of systems and techniques for data processing - comprising of relevant database, cloud computing and distributed computing concepts

▶ Data Mining

Learn about data pre-processing & cleaning; Association rule mining, classification, clustering techniques

▶ Machine Learning

Learn about basic concepts and techniques of Machine Learning; Using recent machine learning software for solving practical problems; How to do independent study and research in the field of Machine Learning

▶ Data Visualization

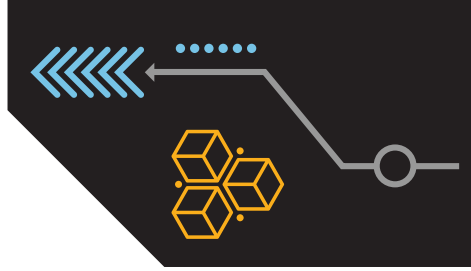
Learn about design principles, human perception and effective story telling with data; Modern visualization tools and techniques.

▶ Ethics for Data Science

Learn about the need for data ethics; Challenges of data privacy; Data policies for maintaining the privacy of data; Data Privacy.

▶ Graphs - Algorithms and Mining

Learn about concepts of graph theory so as to understand; How graph theory concepts are used in different contexts, ranging from puzzles and games to social sciences/ engineering/ computer science; Model problems in real world using graphs; Applying mining algorithms to get information from graph structures



▶ **Optimization Methods for Analytics**

Learn about applying linear programming techniques to complex business problems across various functional areas including finance, economics, operations, marketing and decision making; Implementing optimization techniques to business and industrial problems

▶ **Big Data Systems**

Learn about concepts related to big data and its processing; Applying the concepts of storage, retrieval, interfaces and processing frameworks to a given problem and design solutions for the same by choosing the relevant ones

▶ **Advanced Topics in Data Processing**

Learn about advanced strategies for data processing; The relationship between the scale of data and the systems used to process it; The importance of scalability of algorithms as the size of datasets increase

▶ **Information Retrieval**

Learn about structure and organization of various components of an IR system; Information representation models, term scoring mechanisms, etc. in the complete search system; Architecture of search engines, crawlers and the web search; Cross lingual retrieval and multimedia information retrieval

▶ **Deep Learning**

Learn about deep learning techniques, constructing deep network structures specific to applications and tuning for parameters

▶ **Natural Language Processing**

Learn about natural language processing techniques such Parts-of-Speech tagging, syntactic and semantic modelling of languages

▶ **Artificial Intelligence**

Learn about classic AI Techniques

▶ **Real time analytics**

Learn about Processing frameworks for real time analytics, and Analytics techniques for real time streaming data

▶ **Probabilistic Graphical Models**

Learn about representation, learning and reasoning techniques for graphical models

▶ **Data Warehousing**

Learn about concepts needed to design, develop, and maintain a data warehouse; End user access tools like OLAP and reporting

HOW TO APPLY

- ▶ Create your login at the Online Application Center by entering your official HCL Email ID only and create a password of your choice. Once your login has been created, you can anytime access the Online Application Center using your official email ID and password
- ▶ Begin by clicking on Step 1 - 'Fill/ Edit and Submit Application Form'. This will enable you to select the programme of your choice. After you have chosen your programme, you will be asked to fill your details in an online form. You must fill all details and press 'Submit' button given at the bottom of the form
- ▶ Now, click on 'Pay Application Fee' to pay INR 1,500/- using Netbanking/ Debit Card/ Credit Card
- ▶ Finally, click on 'Upload & Submit All Required Documents'. This will allow you to upload one-by-one all the mandatory supporting documents such academic certificates and transcripts, photograph, etc. and complete the application process. Acceptable file formats for uploading these documents are .DOC, .DOCX, .PDF, .ZIP and .JPEG
- ▶ Upon receipt of your Application Form and all other enclosures, the Admissions Cell will scrutinise them for completeness, accuracy and eligibility
- ▶ Admission Cell will intimate selected candidates by email within two weeks of submission of application with all supporting documents. The selection status can also be checked by logging in to the Online Application Centre





DISCLAIMER

Ever since it was declared as a Deemed to be University in 1964, BITS Pilani has been offering higher education programmes in science and technology, and has earned an enviable reputation for its innovations in this sphere. The Work Integrated Learning Programmes (WILP) of BITS Pilani constitutes a unique set of educational offerings for working professionals. These programmes, which BITS began to offer in 1979, have, over the years, evolved along the lines envisaged in the National Policy on Education, 1986.

The WILP are rigorous higher education programmes in technology areas, designed keeping the evolving needs of industry in view, and meant for working professionals in their respective domains. The very intent is to deliver the education at the workplace, in order that the greatest degree

of work integration of the education is achieved, and thus the WILP are very distinct in philosophy and pedagogy from open, distance learning programmes. Though it is incorrect and improper, at times the WILP are compared to ODL programmes. Accordingly, it has been our constant endeavor to engage with the regulator, and provide all necessary information about these programmes.

The WILP have been well received, and accepted by industry, because of the high quality of the programmes in terms of the curriculum and the instruction, and also because of the high degree of work integration, which results not only in up gradation of knowledge, but also in up skilling, and productivity increase.

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