



M.Tech.

SOFTWARE SYSTEMS

with specialization in Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud



**WORK
INTEGRATED
LEARNING
PROGRAMMES**





New age digital technologies are transforming the world. There is a massive demand of specialists in areas like data analytics, IoT, Embedded systems, Security, Networks, and cloud etc. Specialists in data analytics are powering organizations with transformative capacities.

Massive growth in connectivity means greater need for security specialists. Huge, connected infrastructure needs specialists in network and cloud. M.Tech Software Systems is a unique programme. Programme enables working professionals to specialize in many new age technology areas and be ready to transition into high demand careers. The programme enables the learners to specialize in some of the fastest growing domains like Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud. A comprehensive curriculum, extensive emphasis on experiential learning using remote labs and cloud labs.

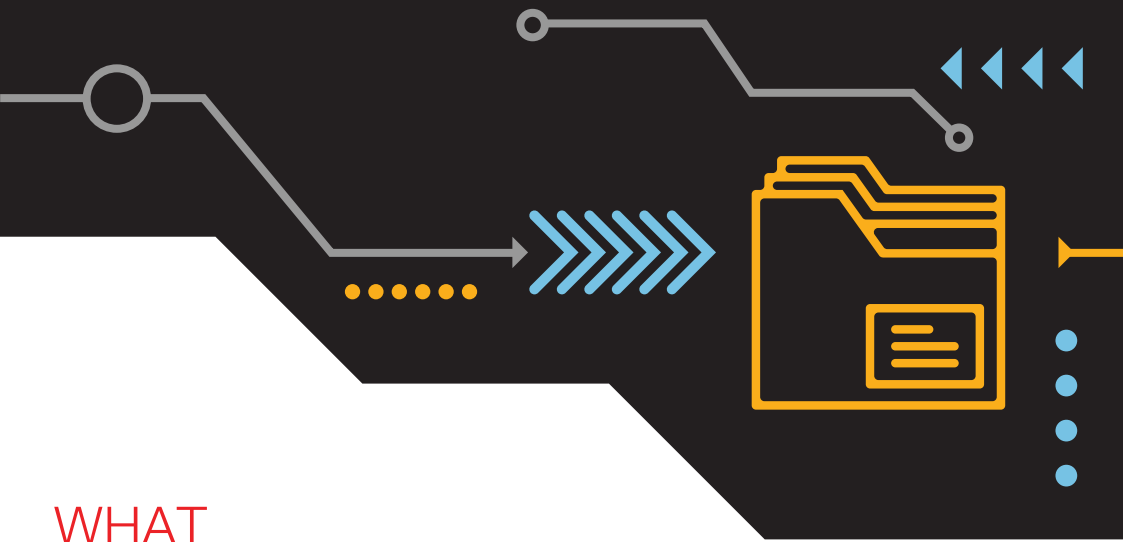
Flexible education methodology that enables working professionals to acquire a prestigious post graduate engineering degree while pursuing their careers. The M.Tech Software Systems is just the right programme for career growth in the software industry.

WHO SHOULD APPLY?

Analysts who wish to hone their technical skills in:

- ▶ Engineers working in software industry. Ambitious & Highly driven engineers. Professionals seeking career advancement in hypergrowth areas of Data Analytics, Internet of Things, Embedded Systems, Security, Networks and cloud.

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WHAT ARE THE MAIN HIGHLIGHTS OF THE PROGRAMME?

- ▶ 4 semester M.Tech. Software Systems programme.
- ▶ The programme makes use of Languages, Platforms, and Libraries.
- ▶ Blend of classroom and experiential learning.
- ▶ These include NS2, Net-SNMP, WireSha, R, Python, Prolog, Lisp, RStudio, Weka, Microsoft Power BI, TensorFlow etc.
- ▶ Semesters 1st, 2nd, and 3rd cover four courses each.
- ▶ In the final semester, students can apply the programme concepts of their dissertation projects in real-world situations.
- ▶ Fee submission using easy - EMI with 0% interest and 0 down payment.
- ▶ UGC approved programme for Working professionals.
- ▶ Pursue the programme without any career break.
- ▶ Online classes conducted mostly on weekends.
- ▶ Enabling students to specialize in Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud.
- ▶ 4th semester covers dissertation or project work.
- ▶ Continuous Evaluation System for learners in regular intervals.
- ▶ Become a part of Elite and Global BITS Pilani Alumni community.

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WHAT ARE THE PROGRAMME OBJECTIVES?

- ▶ An ability to apply the knowledge of computer theories
- ▶ An ability to apply software architectural design.
- ▶ An ability to design and use database systems.
- ▶ Enable learners to choose their specialization in some of the fastest-growing domains like Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud.
- ▶ Principles for the process of design and analysis of software systems.
- ▶ Patterns for the implementation of software systems.
- ▶ An ability to build and test distributed systems and associated communication models.





WHAT ARE THE STUDENT LEARNING OUTCOMES?

Upon successful completion of the programme, participants will be able to:

- ▶ A strong foundation in software development methods and learnt the best practices.
- ▶ An understanding of various software technologies used to develop software system.
- ▶ Ability to understand and analyze requirements of large software systems and to design, develop and manage them in an effective manner.



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LEARNING METHODOLOGY



ATTEND ONLINE LECTURES OVER WEEKENDS

Lectures are conducted live via online classes. These lectures can be attended via the internet using a computer from any location. These online classrooms offer similar levels of interactivity as regular classrooms at the BITS Pilani campus.

The class schedule is announced within 1 week of completion of the admission process.

The online lectures are conducted usually over weekends for a total of 7-8 hours per week. If you miss a lecture, you can also access the recorded lecture on the internet.



DIGITAL LEARNING

Learners can access engaging learning material at their own pace which includes recorded lectures from BITS Pilani faculty members, course handouts and recorded lab content where applicable.



CONTINUOUS ASSESSMENT

Continuous Assessment includes graded Assignments/ Quizzes, Mid-semester exam, and Comprehensive Exam.



EXPERIENTIAL LEARNING

The programme emphasizes on Experiential Learning that allows learners to apply concepts learned in classrooms to real-work situations.

Networks: NS2, Net-SNMP and WireShark.
Data Analytics.

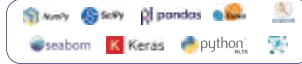
Languages



Platforms



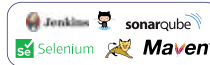
Libraries Python Ecosystem



Embedded and IOT



Devops



Programming Environments



Others & CPU-OS Simulator



Remote Lab facility caters to the needs of resource intensive requirements of Big Data Analytics applications with the following platforms:

- Apache Hadoop
- CockroachDB
- Apache Kafka
- Apache Spark
- MPI
- MongoDB
- Apache Storm
- MPI

Remote Lab facility caters to the needs of Embedded Systems and IoT. It supports the following:

- Hardware / Software tools: MultiCore STM32 microcontroller based development boards.
- Simulation tools: Tossim, Cheddar

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WHAT IS THE ELIGIBILITY CRITERIA?

Minimum eligibility to apply: Employed professionals holding B Tech., BE, M.Sc, MCA or equivalent in relevant disciplines with at least 60% aggregate marks and minimum 18 months of relevant work experience within HCL Technologies, are eligible to apply.

The above are only the minimum criteria to apply. The final decision to offer admission to an applicant rests with BITS Pilani which will be made based on an overall review of your application information.

FEE STRUCTURE

The following fees schedule is applicable for candidates seeking new admission during the academic year 2023-24:

Application Fees
(one time) :INR **1500**

Admission Fees
(one time) :INR **16,500**

Semester Fees
(per semester) :INR **63,500**



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PROGRAMME CURRICULUM

The programme offers 5 specializations in high-demand areas such as Data Analytics, Internet of Things, Embedded Systems, Security, Network and Cloud. Participant can pursue M.Tech. in Software Systems with or without specialization. Participant is allowed to have only one specialization.

Electives can be chosen either from the General pool of electives or from across other pools of electives for specializations. To earn a specialization, a participant must select and successfully complete at least 5 courses from that specialization pool.

First Semester

- Distributed Computing
- Data Structures & Algorithms
- Design Database Design & Applications
- Elective 1

Third Semester

- Elective 5
- Elective 6
- Elective 7
- Elective 8

General Pool of Electives

- Artificial Intelligence
- Computer Organization and Software Systems
- Distributed Data Systems
- Software Engineering and Management
- Usability Engineering
- Object-oriented Analysis & Design

Second Semester

- Software Architectures
- Elective 2
- Elective 3
- Elective 4

Fourth Semester

- Dissertation

Choice of Electives is made available to enrolled students at the beginning of each semester. A limited selection of Electives will be offered at the discretion of the Institute.

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Specialisation in Data Analytics

Participants who earn a specialisation in Data Analytics will learn how to apply principles behind modern Data Analytics techniques; apply statistical and machine learning methods to real data; evaluate their performance and effectively communicate the results; and build expertise in advanced Artificial Intelligence topics such as Deep Learning and Natural Language Processing.

Specialization objectives

- To be able to understand and apply principles behind modern data analytics techniques.
- To be able to apply statistical and machine learning methods to real data, evaluate their performance and effectively communicate the results.
- Enable students to specialize in advanced artificial intelligence topics like deep learning and natural language processing.

Pool of Electives

- Advanced Statistical Techniques for Analytics
- Applied Machine Learning
- Metaheuristics for Optimization
- Data Mining
- Data Warehousing
- Deep Learning
- Information Retrieval
- Mathematical Foundations For Data Science (Mandatory Course for Specialization)
- Natural Language Processing

Specialization in Embedded Systems

Participants will gain expertise in key areas of Application (Domain) Specific System Design such as the scope of a Processor (Embedded processors, Desktop systems, Servers, and Supercomputers), the target application (general-purpose versus domain-specific), the characteristics of the design objectives (Speed, Power consumption, Cost, Reliability, Availability, and Re-configurability), and the measurement and analysis of resulting designs.

Specialization objectives

To enable learners to gain expertise in key areas of Application (Domain) Specific System Design - such as.

- The scope of a processor (embedded processors, desktop systems, servers, and supercomputers).
- The target application (general-purpose versus domain-specific).
- The characteristics of the design objectives (speed, power consumption, cost, reliability, availability, and reconfigurability).
- The measurement and analysis of resulting designs.

Choice of Electives is made available to enrolled students at the beginning of each semester. A limited selection of Electives will be offered at the discretion of the Institute.

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Pool of Electives

- Embedded Middleware Design
 - Embedded System Design (Mandatory Course for Specialization)
 - Fault-tolerant Embedded System
 - Hardware-software Co-Design
 - Networked Embedded Applications
- Parallel Embedded Architectures
 - Real-Time Scheduling
 - Real-Time Systems
 - Software for Embedded Systems

Specialization in Networks and Cloud

Participants will build expertise in how to design, and manage software and hardware that control digital networks; conceptualize and solve engineering problems with reference to wireless and mobile networks effectively and arrive at the feasible optimal solution, individually and in teams; master formal techniques for network analysis, design and operate data centers; Network Security aspects Storage Area Networks, Virtualizations, and Cloud Computing Concepts which has great scope and opportunities in the industry; apply advanced software engineering techniques (e.g. software-defined networks, containerization, etc.) to compute, improve and master the development of distributed networks.

Specialization objectives

- To design, and manage software and hardware that control digital networks.
- To conceptualize and solve Engineering problems with reference to wireless and mobile networks, effectively and arrive at the feasible optimal solution, individually and in teams.
- To master formal techniques for network analysis, design and operate data centers.
- Network Security aspects Storage Area Networks, Virtualizations, and Cloud Computing Concepts which has great scope and opportunities in Industry.
- To apply advanced software engineering techniques (e.g., software-defined networks, containerization, etc.) to compute, improve and master the development of distributed networks.

Choice of Electives is made available to enrolled students at the beginning of each semester. A limited selection of Electives will be offered at the discretion of the Institute.

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Pool of Electives

- Advanced Computer Networks
- Cloud Computing (Mandatory Course for Specialization)
- Computer Networks (Mandatory Course for Specialization)
- Data Storage Technologies and Networks
- Design and Operation of Data Centers
- Edge Computing
- Mobile Networks
- Network Programming
- Network Security
- Software-defined Networks
- Wireless and Mobile Communication
- Middleware Technologies

Choice of Electives is made available to enrolled students at the beginning of each semester. A limited selection of Electives will be offered at the discretion of the Institute.

Specialization in Security

Participants will build expertise in the implementation of core software engineering principles and the best cybersecurity practices in terms of policies, models and mechanisms; gain knowledge about securing computer networks and systems; learn to examine secure software design and development practices in cybersecurity; understand the prevalent network and distributed system attacks; incorporate approaches for incident response and security risk management; understand the key concepts in domain-specific security.

Specialization objectives

- To understand and implement the core software engineering principles and the best cyber security practices in terms of policies, models, and mechanisms.
- To gain knowledge about securing computer networks and systems.
- To examine secure software design and development practices in cyber security.
- To be able to understand the prevalent network and distributed system attacks.
- To incorporate approaches for incident response and security risk management.
- To understand the key concepts in domain specific security.

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Pool of Electives

- Cyber Security (Mandatory Course for Specialization)
- Cryptography
- Network Security
- Ethical Hacking
- Identity and Access Management Technologies

- Cyber Crimes, Forensics and Incident Handling
- Cloud, IoT and Enterprise Security
- Secure Software Engineering
- Blockchain technologies & Systems
- AI and ML techniques in Cyber Security

Choice of Electives is made available to enrolled students at the beginning of each semester. A limited selection of Electives will be offered at the discretion of the Institute.

Specialization in the Internet of Things

Participants will build expertise in the building blocks of IoT technology and explore the vast spectrum of IoT applications; assess, select and customize technologies for IoT applications; connect the cyber world with the physical world of humans, automobiles and factories; integrate geographically distributed devices with diverse capabilities; design and implement IoT applications that manage big data.

Specialization objectives

- Understand the building blocks of IoT technology and explore the vast spectrum of IoT applications
- Assess, select and customize technologies for IoT applications
- Connect the cyber world with the physical world of humans, automobiles and factories
- Integrate geographically distributed devices with diverse capabilities
- Design and implement IoT applications that manage big data

Pool of Electives

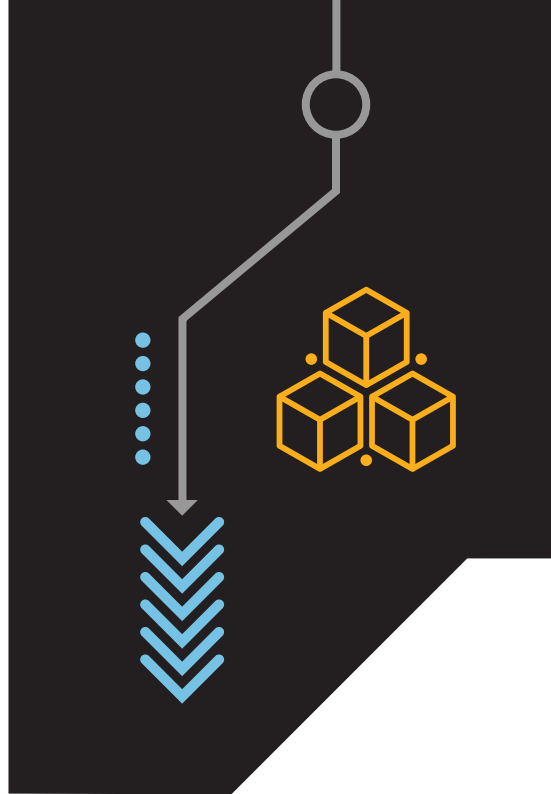
- Embedded Systems Design (Mandatory Course for Specialization)
- Cyber-physical Systems (Mandatory Course for Specialization)
- Networked Embedded Applications
- Cross-platform Application Development

- Cloud Computing (Mandatory Course for Specialization)
- Data Management for IoT
- Stream Processing and Analytics
- Embedded Network Security

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HOW TO APPLY

- ▶ [Click here](#) to visit the Online Application Center. 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



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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.

HCL_07/12/2023