BITS Pilani
Pilani | Dubai | Goa | Hyderabad

WORK INTEGRATED LEARNING PROGRAMMES

M.Tech.
Software Systems

for Working Professionals

https://bits-pilani-wilp.ac.in
Call:+91-80-48767777
admission@wilp.bits-pilani.ac.in

innovate achieve lead

New age digital technologies are transforming the world and spawning a massive demand of specialists in areas like data analytics, IoT, Embedded systems, Security, Networks and cloud etc.

While specialists in data analytics are powering organisations with transformative capacities to win in their businesses, the IOT and Embedded systems specialists are revolutionising our lives and society. Massive growth in connectivity means greater need for security specialists and huge connected infrastructure needs specialists in network and cloud.

M.Tech Software Systems is a unique programme that enables working professionals to specialise 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 and a 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.

M.Tech Software Systems is a BITS Pilani Work Integrated Learning Programme (WILP). BITS Pilani Work Integrated Learning Programmes are UGC approved.

Who Should Apply?

This programme is designed for ambitious and highly-driven engineers working in software companies and wish to advance their careers in hypergrowth areas of Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud.

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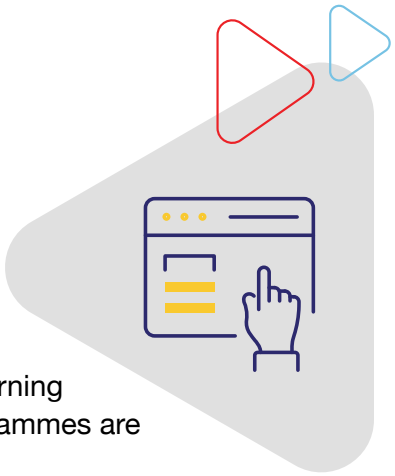
What are the Highlights of the Programme?



- M.Tech. Software Systems is a BITS Pilani Work Integrated Learning Programme (WILP). BITS Pilani Work Integrated Learning Programmes are UGC approved.
- The programme is of four semesters, with online classes conducted mostly on weekends or after business hours. You can pursue the programme without any career break.
- The programme offers a set of core courses and elective courses, allowing students to specialize in Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud.
- The programme makes use of Languages, Platforms, and Libraries. These include NS2, Net-SNMP, WireSha, R, Python, Prolog, Lisp, RStudio, Weka, Microsoft Power BI, TensorFlow, Anaconda Navigator, Python Ecosystem – NumPy, SciPi, Pandas, scikit-learn, MatplotLib; Searborn, Keras, NLTK, pgmpy etc., Keil, CCS Studio, Tossim, Cheddar, Jenkins, GitHub, SonarQube, Selenium, Tomcat, Maven, Java, Eclipse, Code::Blocks, Android Studio, Jupyter Notebooks, Spyder, Multisim, CPU-OS Simulator, SQLite, MATLAB, , Gantt Project, Open Project and XAMPP.
- Semesters 1st, 2nd, and 3rd cover four courses each. And the 4th semester covers dissertation or project work.
- The Dissertation (Project Work) in the final semester enables students to apply concepts and techniques learned during the programme in real-world situations.
- The programme uses a Continuous Evaluation System that assesses the learners over convenient and regular intervals. Such a system provides timely and frequent feedback and helps busy working professionals stay on course with the programme.
- The education delivery methodology is a blend of classroom and experiential learning. Experiential learning consists of lab exercises, assignments, case studies and work-integrated activities.
- Participants who successfully complete the programme will become members of an elite & global community of BITS Pilani Alumni
- Option to submit fee using easy-EMI with 0% interest.

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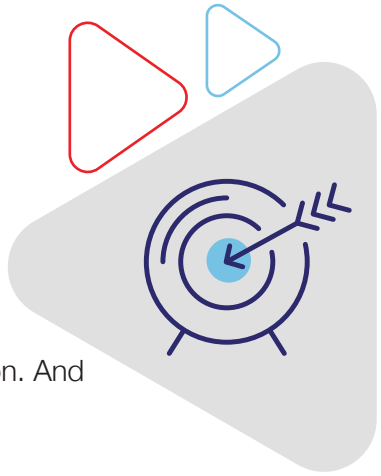
What are the programme objectives?



Studies have shown that senior positions in the technology industry require holistic understanding and capabilities that span across multiple technologies, critical thinking and problem-solving situations and cross-functional collaboration. And our programme aims to:

- An ability to apply the knowledge of computer theories and principles for the process of design and analysis of software systems.
- An ability to apply software architectural design and patterns for the implementation of software systems.
- An ability to design and use database systems.
- An ability to build and test distributed systems and associated communication models.
- 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.

What are the student learning outcomes?

Upon successful completion of the programme, participants will have developed:

- A strong foundation in software development methods and learnt the best practices.
- An understanding of various software technologies used to develop software systems.
- 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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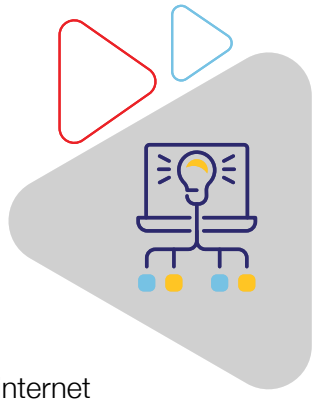
Learning methodology



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.

Classes for students admitted during the period Oct 2022 - Jan 2023 will begin in Jan 2023. 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 materials at their own pace and convenience which includes recorded lectures from BITS Pilani faculty members, course handouts and recorded lab content.

Experiential learning

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

- The Cloud based virtual lab which supports the following programming languages/tools/simulators:
- Networks: NS2, Net-SNMP and WireShark
- Data Analytics:
  - *Languages:* R, Python, ProLog, LISP
  - *Platforms:* RStudio, Power BI, TensorFlow, ANACONDA.
  - *Libraries: Python Ecosystem –* NumPy, SciPy, pandas, learn, matplotlib, seaborn, Keras, python NLTK
  - *Embedded and IOT:* KEIL Tools by ARM, TinyOS, cheddar

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- *Devops:* Jenkins, sonarqube, Selenium, Maven
- *Programming Environments:* codeblocks, Android Studio, jupyterhub, SPYDER
- *Others:* *CPU-OS Simulator,* SQLite, MATLAB, OpenProject, XAMPP

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

- Apache Hadoop
- Apache Storm
- Apache Spark
- Apache Kafka
- MongoDB
- CockroachDB
- 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 and Keil*

Case studies and assignments

Carefully chosen real-world cases & assignments are both discussed and used as problem-solving exercises during the programme.

Dissertation/Project work

The fourth semester offers an opportunity for learners to apply their knowledge gained during the programme to real-world situations. The learner is expected to demonstrate an understanding of vital principles learned during the course and their ability to successfully apply in real-world situations.

Continuous assessment

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

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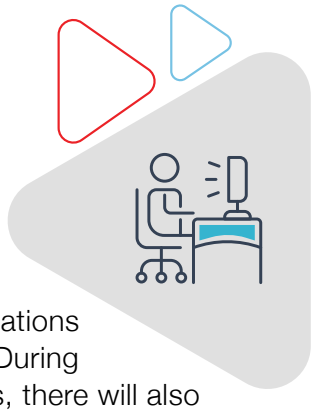
Mode of Examinations



Examinations Mode Options applicable for students admitted in Batch starting in Jan 2023

Semester 1, 2 and 3 have Mid-semester Examinations and Comprehensive Examinations for each of the course. These examinations are mostly scheduled over weekends. During these semesters, In addition to the mid-semester and comprehensive examinations, there will also be quizzes/assignments conducted online as per course plan which the students need to participate. In the Semester 4 (Final Semester), Student will be doing a dissertation (project work) as per Institution's guidelines.

Two Options on Mode of Examinations during Semester 1 & 2:

Institution offers a choice between taking the examination **online** or taking them at a designated examination centre. The student will choose one of the option depending on his or her own preference and circumstances. Both options are explained below:

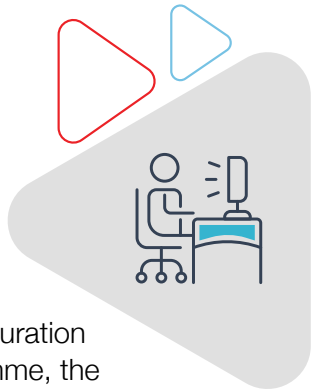
Online Examinations:

Students choosing this option can take the examinations online from any location e.g. office or home. To take an online examination, student must possess a laptop or desktop **with two web cams (One Web Cam for students frontal face view and second Web Cam for student's full side profile view),** a smart phone and good internet connectivity. As per the examination schedule, the student is expected to login to the institution's online examination platform and take the examinations in compliance with institution's defined guidelines and rules announced before the examinations. For full details about hardware, software and connectivity requirements to take online examination, Click here.

Examinations at Designated Examination Centers:

Students choosing this option will need to appear in person for taking the examinations at institution's designated examination centers. These designated examination centers are at the following locations: **Bangalore, Chennai, Hyderabad, Pune, Mumbai, Goa, Delhi NCR, Pilani** and **Kolkata.** In addition to these location, Institution also has a designated examination center at **Dubai**.

Please note that offering of examinations at designated examination centers is subject to institution's assessment of the safety conditions as per prevailing pandemic conditions and also subject to a required minimum number of students preferring this option. The institution may choose to not offer this option, if as per its own assessment the safety situation due to pandemic conditions is not conducive to conduct examinations at designated examination centers or if as per its assessment, adequate no of students have not preferred for this option. In circumstances as explained, Institute will then conduct the examinations only in the online mode.



Important:

The option of taking Online Exams for Semester 1& 2 will remain available for normal duration of the programme. However, in case a student chooses to take a break in the programme, the options on the mode of examination available will be as prevailing at the time the student resumes the programme. Also, if a student has backlog course/s to successfully complete and due to which he/she needs to register in additional semester/s over and above the normal duration of the programmes, the options on the mode of examination available will be as prevailing at the time when student registers for an additional semester.

Also note that The Institute regularly takes actions to optimize its examination system and hence the Hardware, software, equipment and connectivity requirements, instructions and rules associated with online and physical mode examination may change at Institute's discretion. All students will need to 100% comply with any such changed specification announced by the Institute..

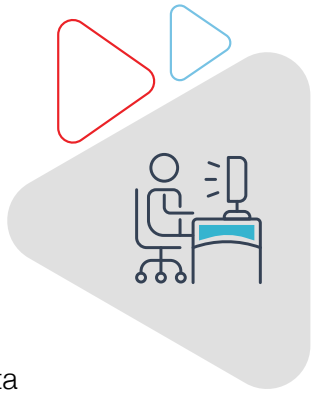
Mode of Examinations for Semester 3:

One or both of the options on the mode of the examination as listed above for Semester 1 & 2 will be made available as per discretion of the institution. Institution decision on mode of examinations will take into account its assessment of the pandemic situation and any other feasibility constraints associated with each mode. The Institution's decision on mode of examination to be offered to the student will be as per its sole discretion and students must comply by the institution's decision.

Mode of Evaluation for Semester 4 (Final Semester):

During Semester 4, students will be required to register for a full semester Dissertation (Project work). Each submission required for Dissertation as per institution's guidelines can be made **ONLINE** on a BITS Pilani's approved and managed online assessment platform.

What is the Eligibility Criteria?



The minimum eligibility to apply: Employed professionals holding B. Tech., B.E, M.Sc., MCA or equivalent in relevant disciplines with at least 60% aggregate marks and minimum one year of work experience in relevant domains.

The programme is designed for enthusiastic and ambitious engineers working in the software industry and who wish to advance their careers in hyper-growth areas of Data Analytics, Internet of Things, Embedded Systems, Security, Networks and Cloud.

Fee Structure

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

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

0% Easy-EMI Option

Instant EMI option with 0% interest is now available that allows you to pay programme fee in an easy and convenient way.

- Instant online approval in seconds
- No Credit Cards/ CIBIL score required
- Easy & Secure online process using Aadhaar and PAN number
- Anyone with a Salary Account with Netbanking can apply
- Option to submit fee using easy-EMI with 0% interest.

Click here to learn more

Important: For every course in the program institute will recommend textbooks, students would need to procure these textbooks on their own.

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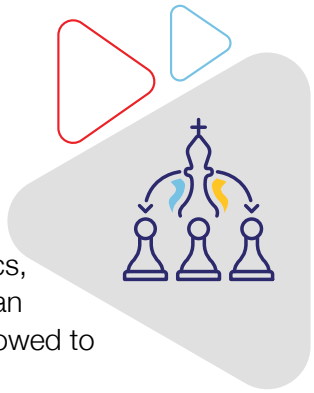
Programme Curriculum



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

Second Semester

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

Third Semester

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

Fourth Semester

- Dissertation

General Pool of Electives

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

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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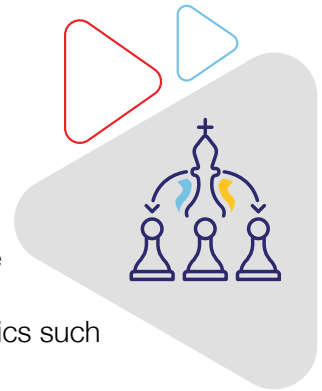

01 Specialisation in Data Analytics

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

02 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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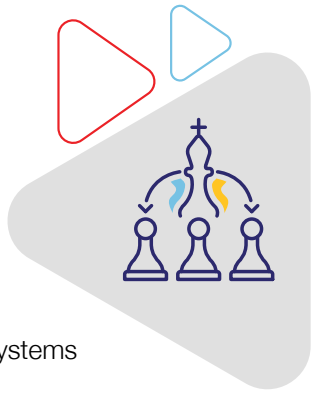
Pool of Electives

- 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



03 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.

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.

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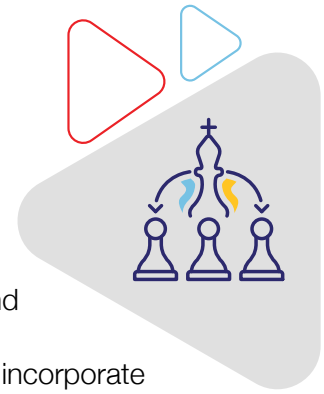


04 Specialization in Security

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

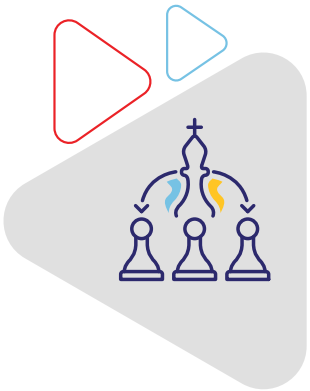
Pool of Electives

- 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

05 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.

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 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

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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How to apply

- Click here to visit the BITS Pilani Online Application Center. Create your login at the Application Center by entering your unique Email id and create a password of your choice.
- Once your login has been created, you can anytime access the online Application Center using your email ID and password. Once you have logged in, you will see a screen showing 4 essential steps to be completed to apply for the programme of your choice.
- 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.
- Take the next step by clicking on Step 2 - 'Download Application PDF Copy'. This will download a pdf copy of the application form on your computer.
- Now, click on Step 3 - 'Pay Application Fee' to pay INR 1,500/- using Net banking/ Debit Card/ Credit Card.
- Take a printout of the downloaded Application Form and note down the Application Form Number that appear on the top-right corner of the first page. This Application Form Number should be referred in all future correspondence with BITS Pilani.
- In the printout of the downloaded Application Form, you will notice on page no. 3 a section called the Employer Consent Form. Complete the Employer Consent Form. This form needs to be signed and stamped by your organisation's HR or any other authorised signatory of the company.

Important: In view of work-from-home policies mandated by many organisations, a few candidates may not be able to get the physical forms signed by their HR/ other authorised organisational representative. Such candidates may instead request an email approval to be sent to their official email ID by the HR using the format available through this link.

- Further on page no. 4 of the printed Application Form is a section called the Mentor Consent Form. The Mentor Consent Form needs to be signed by the Mentor.

Important: In view of work-from-home policies mandated by many organisations, a few candidates may not be able to get the physical forms signed by their Mentor. Such candidates may instead request an email approval to be sent to their official email ID by the Mentor using the format available through this link.

Who is a mentor:

Candidates applying to Work Integrated Learning Programmes must choose a Mentor, who will monitor the academic progress of the candidate, and act as an advisor & coach for successful completion of the programme.

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How to apply

Candidates should ideally choose the immediate supervisor or another senior person from the same organisation. In case a suitable mentor is not available in the same organisation, a candidate could approach a senior person in another organisation who has the required qualifications. Wherever the proposed Mentor is not from the same employing organization as that of the candidate, a supporting document giving justification for the same should be provided by the candidate's employer.

Candidates applying to B.Tech. programmes should choose a Mentor who is an employed professional with B.E./ B.S./ B.Tech./ M.Sc./ A.M.I.E./ Integrated First Degree of BITS or equivalent. Candidates applying to M.Tech., M.Sc., MBA, M.Phil programme should choose a Mentor who is an employed professional with:

- B.E./ M.Sc./ M.B.A./ M.C.A./ M.B.B.S. etc. and with a minimum of five years of relevant work experience

OR

- M.E./ M.S./M.Tech./ M.Phil./ M.D./ Higher Degree of BITS or equivalent

★ Further on page no. 5 of the downloaded Application Form, is a Checklist of Enclosures/ Attachments.

- Make photocopies of the documents mentioned in this Checklist
- Applicants are required to self-attest all academic mark sheets and certificates

★ Finally, click on Step 4 - 'Upload & Submit All Required Documents'. This will allow you to upload one-by-one the printed Application Form, Mentor Consent Form, Employer Consent Form, and all mandatory supporting documents 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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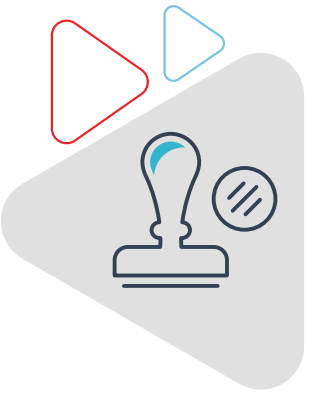

UGC Approval

BITS Pilani is an Institution of Eminence under UGC (Institution of Eminence Deemed to be Universities) Regulations, 2017. The Work Integrated Learning Programmes (WILP) of BITS Pilani constitutes a unique set of educational offerings for working professionals. WILP are an extension of programmes offered at the BITSPilani Campuses and are comparable to our regular programmes both in terms of unit/credit requirements as well as academic rigour. In addition, it capitalises and further builds on practical experience of students through high degree of integration, which results not only in upgradation of knowledge, but also in up skilling, and productivity increase. The programme may lead to award of degree, diploma, and certificate in science, technology/engineering, management, and humanities and social sciences.

On the recommendation of the Empowered Expert Committee, UGC in its 548th Meeting held on 09.09.20 has approved the continued offering of BITS Pilani's Work Integrated Learning programmes.

https://bits-pilani-wilp.ac.in

Call:+91-80-48767777

admission@wilp.bits-pilani.ac.in