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DEPARTMENT OF ELECTRONICS, TIST

SPAN – Skill Planning and AcquisitioN Cell

SPAN – Skill Planning and AcquisitioN Cell continued its activities in the even semester of the academic year 2023-24 to meet its objectives.

SPAN ACTIVITIES - EVEN SEMESTER (2023-2024)

S. NO.	DATE	PROGRAM	BATCH	NUMBER OF STUDENTS
1	1.2.2024 to 2.2.2024	Industrial Workshop on Embedded Systems and IoT - Srishti Robotics	S4 ECE	24
			S4 RA	40
2	29.2.2024 to 4.3.2024	Research Methodology Training on RF Microwave Design and Mixed Signal Processing at ACARR ,CUSAT	S6 ECE	9

INDUSTRIAL WORKSHOP ON EMBEDDED SYSTEMS AND IoT BY SRISHTI ROBOTICS

SPAN in association with Srishti Robotics, IETE Toc H and IEEE Toc H organized a two-day industrial workshop on 1st and 2nd February 2024. The event was attended by a total of 24 students from S4 Electronics and Communication Engineering and 40 students from S4 Robotics and Automation. The program started at 9:00 am on 1st, February with an exploration of Robotics, the Arduino and Node MCU platforms. The program covered a spectrum of sensors and the hands-on experiments with Arduino Uno

and Node MCU made complex concepts easier. The hands-on exercises DC Motors and Control were not just informative but also enjoyable. There was a session on stepper motors which bridged the gap between theory and hands-on implementation.

The second day of the workshop provided a comprehensive overview of servo motors and their applications. This was followed by hands on training in IoT and its applications in the field of Robotics. Blynk and Thingspeak, the IoT platforms covered in the program, were presented in depth. The integration of ESP32 with Blynk for remote control and monitoring opened up a world of possibilities. Real-time data visualization became not just a concept but a skill student could confidently apply to future projects.

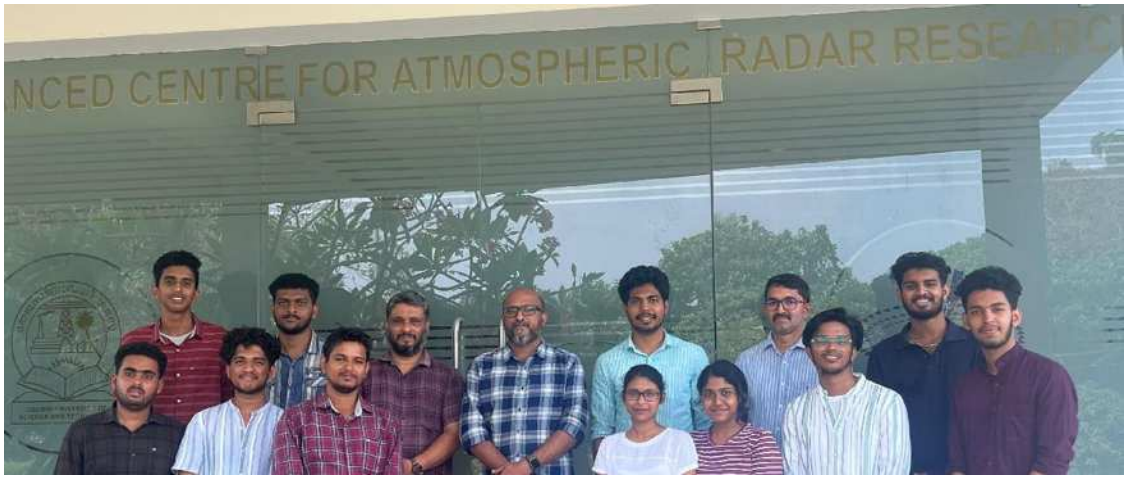
The hands-on approach was a key factor in making the learning experience engaging and impactful. The program has equipped students to embark on their own embedded systems and IoT projects in the Project Based Learning Activity introduced by SPAN this semester.

RESEARCH METHODOLOGY TRAINING ON RF MICROWAVE DESIGN AND MIXED SIGNAL PROCESSING AT ACARR, CUSAT

Two batches of third-year students from the Department of Electronics and Communication Engineering (ECE) have completed a successful 5-day Internship Program from 29th Feb 2024 to 4th March 2024 on RF and Microwave Design using HFSS and Mixed Signal Processing at the Advanced Centre for Atmospheric Radar Research (ACARR), Cochin University of Science and Technology (CUSAT).

The training program imparted hands-on practice on mastering the art of antenna design, its simulation in HFSS and application of various signal processing techniques on atmospheric signals. Students

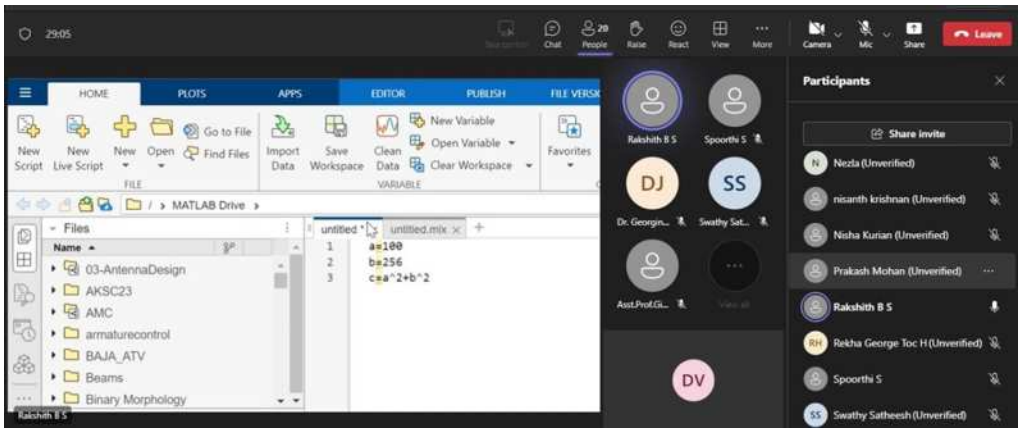
navigated through the intricacies of HFSS modelling and mastering techniques essential for antenna optimization and analyses with the help of experienced guides. The experience proved to be highly beneficial, blending academic knowledge with industry insights to foster effective learning and skill development.

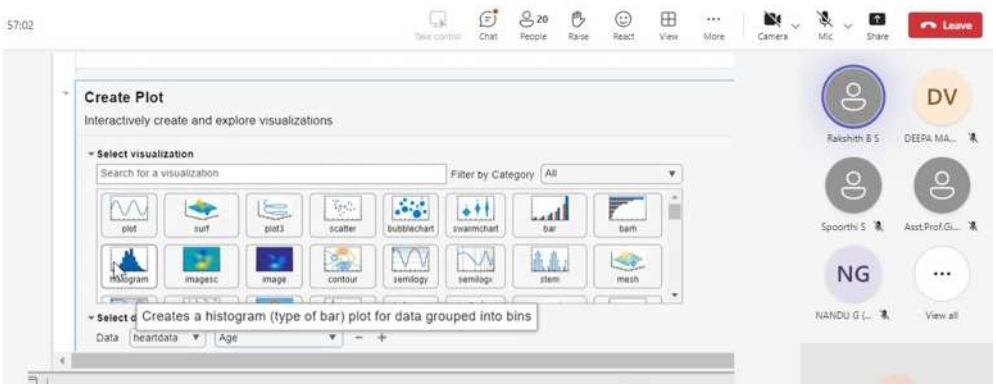


S. NO.	DATE	PROGRAM	Attended by
SPAN Programs for TIST Faculty			
1	14.5.2024	Matlab and Simulink For Current Trends, CoreEL Technologies	Faculty and Lab Instructors, DoE (ECE, RA, EEE, SFE)

MATLAB AND SIMULINK FOR CURRENT TRENDS

The program started with an introduction to MATLAB Online and MATLAB Drive for easy development of applications. In the latest versions, the script format called Live Script (.mlx file extension) can be leveraged for application development in several ways. Code documentation features are available in Live Script. Automation of Workflows was demonstrated with an example of using a numerical slider for inputting a range of values as well as inputting data from a file (csv, xlsx files). Interactive visualization plot creation and domain specific tasks were explained. Automated Tuning of PID Controller using the PID Controller app was demonstrated. Robotics System Toolbox, UAV Toolbox, ROS Toolbox, Hardware Connectivity for multiple types of robots (Github Awesome-Matlab-Robotics) and Curriculum structure were familiarized. Support for Multi domain applications using Simscape was also discussed.

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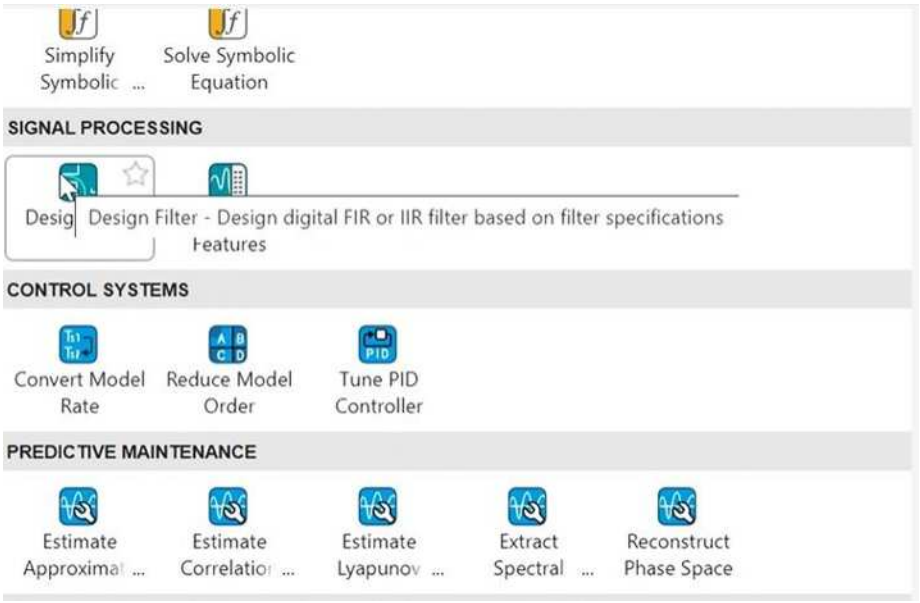
Simplify Symbolic ...
Solve Symbolic Equation
SIGNAL PROCESSING
Design Filter - Design digital FIR or IIR filter based on filter specifications
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CONTROL SYSTEMS
Convert Model Rate
Reduce Model Order
Tune PID Controller
PREDICTIVE MAINTENANCE
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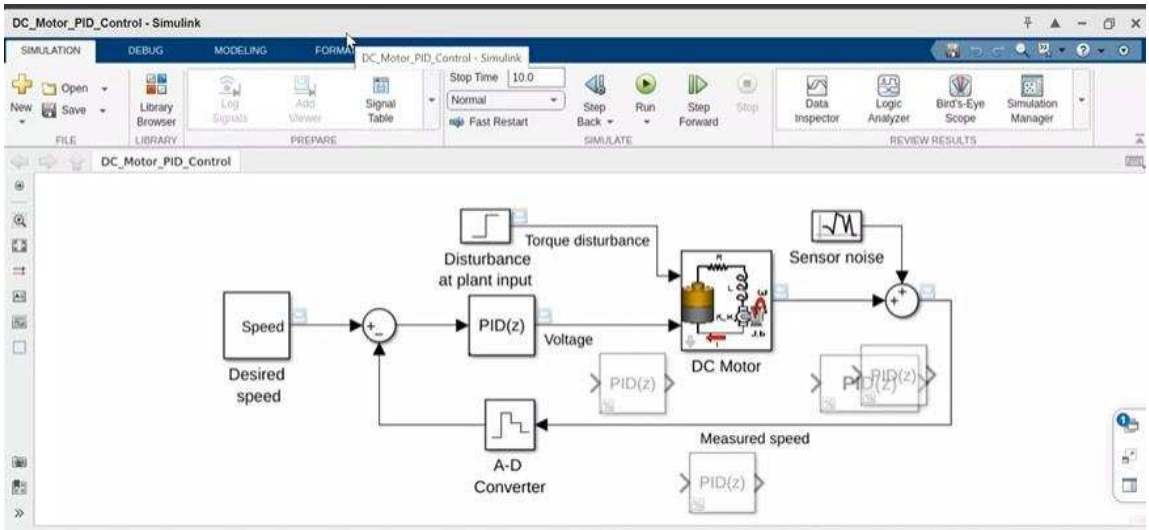
DC_Motor_PID_Control - Simulink
SIMULATION
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Logic Analyzer
Bird's-Eye Scope
Simulation Manager
FILE
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PREPARE
SIMULATE
REVIEW RESULTS
DC_Motor_PID_Control
Disturbance at plant input
Torque disturbance
Sensor noise
Speed
Desired speed
PID(z)
Voltage
DC Motor
PID(z)
PID(z)
Measured speed
A-D Converter
PID(z)

PROJECT BASED LEARNING PBL

S. NO.	DATE	PROGRAM	BATCH	NUMBER OF STUDENTS
1	25.1.2024 to 23.2.2024	Electronic Circuits Projects	S2 ECE	46
			S2 RA	51
2	25.1.2024 to 23.2.2024	CAD and 3D Printing Projects	S4 RA	49
3	3.2.2024 to 22.3.2024	IoT and Embedded Systems Projects	S4 ECE	31
			S4 RA	49

SPAN introduced **Project Based Learning** as a tool to enhance the skills and confidence level of students. Through the successful implementation of these projects, **students will be able to think creatively, apply concepts learnt in theory, debug problems faced, use manufacturer's data sheets, implement products, and evaluate choices in materials, methods and components.** Projects were designed based on specific skills emphasized by industry through our **Industry Institute collaborations and MoUs**.

Electronic Circuits Projects

Students of the second semester of BTech Electronics and Communication Engineering and BTech Robotics and Automation implemented projects in **Electronic Circuits**. Circuits were required to be soldered onto general purpose PCBs or specially designed PCBs. In addition, the circuits had to be implemented using discrete analog and/or digital components and ICs without the use of Microcontrollers so that skills in handling and understanding these electronic devices could be enhanced. Projects were implemented in areas of **Office, Home and Factory Automation, Vehicle Automation, Automated Security Systems, Fire Safety Systems, Agricultural Automation, Smart Cities and Smart Transport.**

CAD and 3D Printing Projects

Students of the fourth semester of BTech Robotics and Automation implemented projects in **CAD and 3D Printing**. Projects focused on design, CAD Modeling and 3D printing of **claw and parallel grippers, gear boxes, linear actuators and guide rails, robotic manipulator parts, fixtures, mobile robot chassis, indexing tables and drone propellers and ducts.**

IoT and Embedded Systems Projects

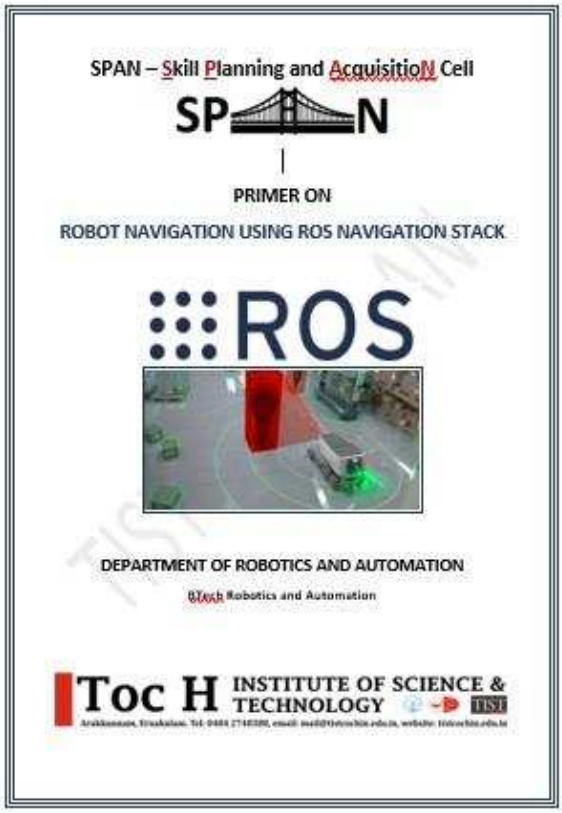
Students of the fourth semester of BTech Electronics and Communication Engineering and BTech Robotics and Automation implemented projects in IoT and Embedded Systems. The projects focused on the development of **Embedded Systems with IoT capability and Mobile App development** for application areas in **Smart Homes, Smart Factories and Machines, Smart Warehouses, Smart Agriculture, Smart Cities, Smart Transportation and Traffic Management, Smart Inventory Management, Smart Parking and Security Systems.**

NAVIGATION USING ROS – PRIMER

A Primer consolidating the various steps to implement robot navigation using ROS Navigation Stack was prepared for easy reference by students. The various steps covered include:

Set Up a Workspace, Install Dependencies, Create a Package, Configure Costmaps, Configure Planners, Create Launch Files, Launch Navigation Stack, Visualize in RViz, Test Navigation, Refinement and Tuning, Integration.

Explanations enabling students to make informed choices and sample Python and YAML codes were used to illustrate the different steps.



GUIDANCE FOR SKILL DEVELOPMENT THROUGH MOOC COURSES

In order to guide students in developing skills through Massive Open Online Courses MOOC, SPAN developed a plan to guide students of BTech Electronics and Communication Engineering and BTech Robotics and Automation to select and complete MOOC courses from the second semester to the eighth semester. The areas requiring skill development over and above the syllabus specified by the University are identified and a set of courses are suggested to students for each semester. Course selection considerations include both theoretical and practical contents of the course.

PROGRAMMING SKILLS

Recognizing that programming skills are essential to excel in any field, SPAN has taken the initiative to guide students to enhance their programming skills through self-learning. Suitable websites for tutorials in C and Online Coding Tests were identified. C programming was assigned for students of Semester 2 and Semester 4 and students are encouraged to undertake coding challenges periodically for them to understand the expectations of employers.

SPAN ACTIVITIES – ODD SEMESTER (2023-2024)

S. NO.	DATE	PROGRAM	BATCH	NUMBER OF STUDENTS
1	11.9.2023 to 16.9.2023	Training and Internship at Bosch Rexroth-GPTCK Centre of Competence in Automation Technologies	S5 RA	42
			S7 RA	46

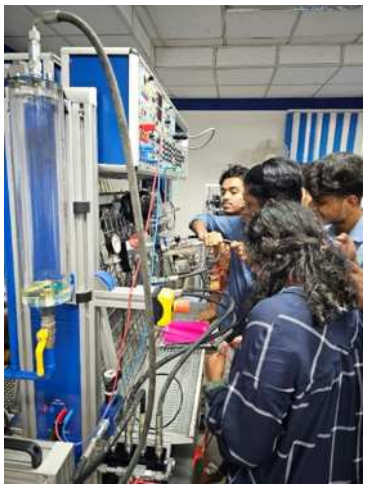
TRAINING AND INTERNSHIP AT BOSCH REXROTH-GPTCK CENTRE OF COMPETENCE IN AUTOMATION TECHNOLOGIES

Bosch Rexroth – GPTCK, Centre of Competence in Automation Technologies held a training and internship for the fifth and seventh semester B.Tech Robotics and Automation students of Toc H Institute of Science and Technology from 11th September to 16th September 2023.

Topics covered in the PLC (Programmable Logic Controller) Lab included the fundamental components, software used and Bosch PLC. Circuit logic for PLC applications like sustained PLC circuit, lighting control

and motor control were designed and tested. The training also covered fundamentals of Industrial Automation – drives, controllers, sensors. In the Sensors Lab, experiments with various sensors – inductive, capacitive, magnetic, photoelectric, etc. were conducted. Lift logic was executed on Bosch PLC - PLC circuit to move from each floor to all other floors in a 3 level lift.

Various aspects of hydraulics and pneumatics were covered. The theory and practice on hydraulic and pneumatic systems imparted practical knowledge in an effective manner. Control of extension and retraction of a cylinder was done directly and indirectly using directional control valves. In the Applications Lab, integration of all systems was described. A mini assembly line model involving hydraulics and pneumatics controlled by PLC was studied.



S. NO.	DATE	PROGRAM	Attended by
SPAN Programs for TIST Faculty			
1	4.1.2024 to 5.1.2024	Industrial Training on PLC, VFD and SCADA	Faculty and Lab Instructors, DoE (ECE, RA)
2	10.1.2024	Faculty Development Program on Texas Instruments TMS320C6748 Fixed and Floating Point DSP	Faculty and Lab Instructors, DoE (ECE, RA)

INDUSTRIAL TRAINING ON PLC, VFD and SCADA

A two-day Industrial Training Program on PLC, VFD and SCADA was conducted by Mr. S. Raja and Mr. Kesav of Silicon Systems, Coimbatore for the faculty of the Department of Electronics (ECE and RA). The program covered PLC hardware and programming. Ladder Logic Programming for applications targeted to Delta PLC AS218TX were developed in ISPSoft software and tested in online mode. These programs were then downloaded to the PLC to implement the application in the PLC.

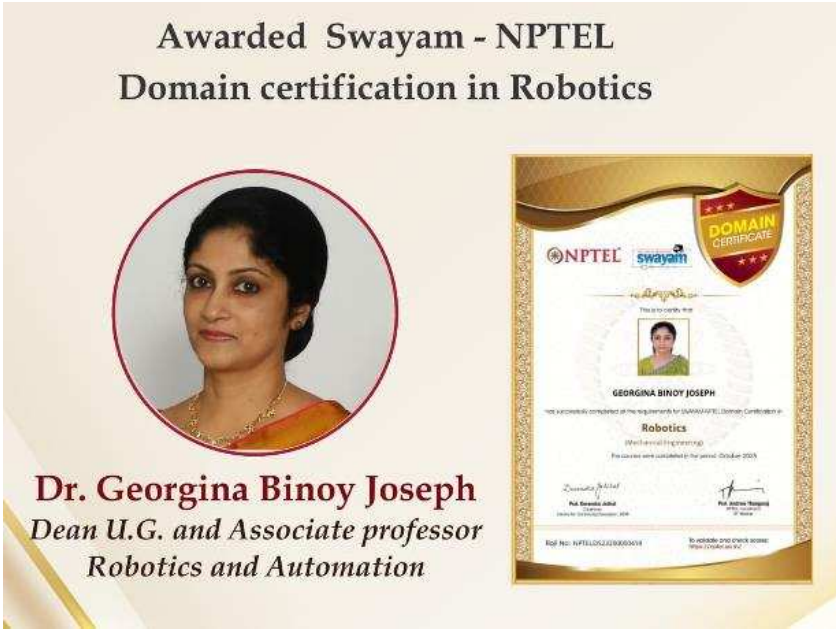
Training on the Variable Frequency Drive VFD interfaced with DVP14SS2 Delta PLC was also done. Various modes by which the speed of a 3 phase induction motor could be controlled by the VFD were implemented. Interfacing of Human Machine Interface HMI with the AS218TX PLC using DoPSoft HMI Tool was also covered through various hands on applications. Lastly, SCADA software DIAView Development and DIAView Runtime were used to acquire and analyze real-time data and to control the PLC by giving various inputs.

FACULTY DEVELOPMENT PROGRAM ON TEXAS INSTRUMENTS TMS320C6748 FIXED AND FLOATING POINT DSP

An FDP was conducted to train faculty to use the TMS320C6748 DSP Processor for various applications including filtering, audio acquisition and real-time signal processing. The TMS320C6748 fixed and floating point DSP is a low-power applications processor based on C674x DSP core. Code Composer Studio which is an integrated development environment (IDE) for TI's controllers and processors was used to develop and debug these applications.

FACULTY SKILL UPGRADATION

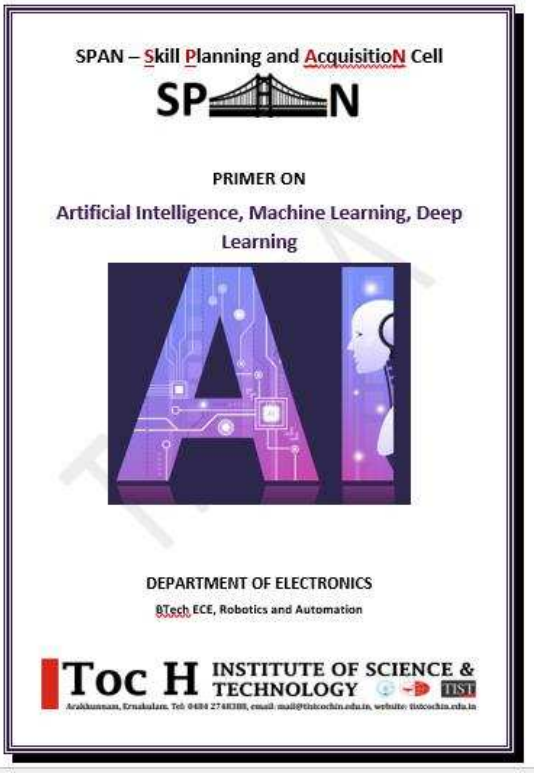
Faculty are encouraged to upgrade their skills and develop potential to work in cutting edge technologies through various platforms.



ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, DEEP LEARNING PRIMER

Recognizing the need for incorporating Artificial Intelligence into various aspects of the learning process, a Primer on Artificial Intelligence, Machine Learning, Deep Learning for easy reference of students was developed and for final year students to enable them to prepare for projects, internships and placements.

The primer is in the form of frequently asked questions FAQs and answers are given to enable the students to understand concepts and quickly prepare for viva, selection tests and interviews.



GUIDANCE FOR SKILL DEVELOPMENT THROUGH MOOC COURSES

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PROGRAMMING SKILLS

Recognizing that programming skills are essential to excel in any field, SPAN has taken the initiative to guide students to enhance their programming skills through self-learning. Suitable websites for tutorials in Python and Online Coding Tests were identified. Python programming was assigned for students of Semester 1 and Semester 3 and coding challenges were given to them periodically for them to understand

the expectations of employers. A skill assessment test related to this will be conducted in the beginning of the next semester.

INDUSTRY PROJECTS

Skill development based on the real time industry projects is the most effective way of keeping up with fast changing technologies. SPAN gives support for skill development through industry based projects. The process for this involves identifying students for undertaking such projects through industry specific technical tests, interacting with industry for the student and project selection, preparation for technical tests and interviews, and providing technical support during the course of the project.

These projects have resulted in job offers for all four students in Centelon, IoT and Robotics wing.

S. NO.	NAME OF INDUSTRY/ORGANISATION	NAME OF STUDENT
1	Centelon IT Solutions LLP (IoT and Robotics), Trivandrum	1. Adarsh VS, S7 RA 2. Gautam Sunil, S7 RA 3. Jedin Jebi Mathew, S7 RA 4. Justin Paul Cherian, S7 RA
2	SFO Technologies, NEST Group (Test and Automation) , Kochi	1. Akshay Kannan, S7 RA 2. Aswin P Nair, S7 RA 3. Grigari T Jose, S5 RA
3	Telekinesis (Robotics), Germany	1. Alikha Balan, S5 RA