



**Dr. Ambedkar Institute of Technology, Bangalore – 56**

**Department of Electronics & Instrumentation Engineering**

The attached documents are valid and approved.

*[Handwritten Signature]*

Prof. & Head

5/11/22

**Professor & Head**

**Department of Electronics**

**Instrumentation Engineering**

**Dr. Ambedkar Institute of Technology**

**Bangalore - 560 056**

**Dr.Ambedkar Institute of Technology, Bangalore**  
**Department of Instrumentation Technology**

**Report on Two days (16<sup>th</sup>&17<sup>th</sup>) finishing school training program on**

**“Industrial and Process Automation”**

**By**

**Venjay Institute of Automation**  
**Program Schedule**

<b>Session</b>	<b>Topics</b>	<b>Resource Person/Trainer</b>
<b>Day 1(16<sup>th</sup> February)</b>		
<b>Morning session</b>	<ol style="list-style-type: none"><li>1.Introduction of Automation<ul style="list-style-type: none"><li>• Evolution of Automation</li><li>• Needs of Automation</li><li>• Automation Process and Steel plant, Missile manufacturing automation Technology in Industries.</li></ul></li><li>2. Input Output Modules.</li><li>3. Types of Motor.</li><li>4. PLC programming Standards.</li></ol>	Mr. Venugopal
<b>Afternoon session</b>	<ol style="list-style-type: none"><li>1. Practical knowledge of Hardware components like AC Drives, MCB, Contactor, MPCB, OLR, Relay board.</li><li>2. Wiring of the power circuit and control circuit.<ul style="list-style-type: none"><li>• Latching Circuit</li><li>• Inching Circuit</li></ul></li><li>3. Working of Motor after wiring the circuits.</li></ol>	Mrs. Jayashree & Mr.Arun Kumar

**Day 2(17<sup>th</sup> February)**

<p><b>Morning Session</b></p>	<p>1. Introduction to PLC kit.</p> <ul style="list-style-type: none"><li>• PLC architecture and Historical data.</li><li>• Explained the components of PLC board.</li><li>• Specification of the PLC board.</li></ul> <p>2. PLC programming with examples.</p>	<p><b>Mrs.Jayashree &amp; Mr.Arun Kumar</b></p>
<p><b>Afternoon Session</b></p>	<p>1.Introduction of SCADA</p> <p>2. Brief explanation about Power SCADA and Human Machine Interface.</p> <p>3.Project Activity</p>	<p><b>Mr. Venugopal</b></p>

## Department of Instrumentation Technology

Attendance of 8<sup>th</sup> sem students for Finishing school training program "Industrial and Process Automation" under TEQP-II  
On 16<sup>th</sup> & 17<sup>th</sup> Feb 2017

Sl no	USN	Student Name	Category
1	1DA13IT001	ABHISHEK N	2AG
2	1DA13IT002	AMISHA YUGA BANAVALLIKAR	1G
3	1DA13IT003	ANIL P GOWLI	3BR
4	1DA13IT004	ANKITTHA R PATIL	3BG
5	1DA13IT005	ARATI	GMK
6	1DA13IT006	BHARAT BALACHANDRA PATGAR	1G
7	1DA13IT007	CHIRANJEEVI T R	3AG
8	1DA13IT008	D YASHASWINI	2AG
9	1DA13IT011	GANESHA D S	SCG
10	1DA13IT012	GAYATHRI B M	GM
11	1DA13IT013	GEETHA T	GMR
12	1DA13IT015	HARSHITHA B	GM
13	1DA13IT016	HARSHITHA P V	2AG
14	1DA13IT017	JNANAPOORNA B S	3BG
15	1DA13IT018	K S ANUSHA	SNQ GM
16	1DA13IT019	KUSUMA N	3AG
17	1DA13IT020	KUSUMA T	2AG
18	1DA13IT021	LOKESH V	2AG
19	1DA13IT022	MADHAN KUMAR C	3AG
20	1DA13IT023	MALAPPA WALEEKAR	2AR
21	1DA13IT024	MANJUNATH T	SCG
22	1DA13IT025	MANOJ KUMAR B N	2AG

23	1DA1311027	MEENAKSHI A	
24	1DA13IT028	MEGHA S	GM
25	1DA13IT029	NARMADA S	GM
26	1DA13IT031	NIKITHA K MURTHY	2AG
27	1DA13IT032	PANCHAMI J	SCG
28	1DA13IT033	PAVITHRA J	SCG
29	1DA13IT035	PRAJWAL K V	GM
30	1DA13IT037	PREETHI K	2AG
31	1DA13IT040	PURUSHOTHAMA K R	3BG
32	1DA13IT043	RAMYA K	3AG
33	1DA13IT045	SAMELI A PAVIYA	GMR
34	1DA13IT047	SANGEETHA D	STG
35	1DA13IT048	SANGEETHA JANA S	GM
36	1DA13IT051	SRINIDHI H S	GM
37	1DA13IT052	SRI NIDHI N	MQ GM
38	1DA13IT054	SUSHMARAJ M	3AG
39	1DA13IT055	TEJASWINI B S	3BG
40	1DA13IT056	TYAGARAJ R BORJI	3BR
41	1DA13IT057	VACHANA N B	3BR
42	1DA13IT058	VAIBHAVI R	GM
43	1DA14IT401	KAVYASHREE N	3AG
44	1DA14IT402	MEGHANA CR	3AG
45	1DA14IT403	PREM SAGAR M	2AG
46	1DA14IT405	SANDEEP S KANGURI	2AG
47	1DA14IT407	SUPRIYA SHREE G	2AG
48	1DA14IT409	VAISHNAVI JADAV N	3BR

## Contact

[www.linkedin.com/in/venjay-institute-of-automation-39b9a5143](https://www.linkedin.com/in/venjay-institute-of-automation-39b9a5143)  
(LinkedIn)

## Top Skills

Programmable Logic Controller (PLC)

SCADA

HMI Design

# VENJAY INSTITUTE OF AUTOMATION

Get trained from Industry expert work on live projects  
Bengaluru, Karnataka, India

## Summary

VENJAY AUTOMATION started in 2009 by a technocrat with an abundant international experience, We are basically manufacturer of Industrial Automation [ PLC SCADA AND DCS] . We give hands on training to students who are willing to pursue their carrier in Automation.

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## Experience

Venjay Institute of Automation

Training Coordinator

June 2016 - Present (6 years 8 months)

Bangaon Area, India

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## **Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY**

(An Autonomous Institute, Affiliated to VTU, Belgaum)

Outer Ring Road, Mallathalli, Bangalore-560056.



### **CERTIFICATE OF PARTICIPATION**

This is to Certify that Mr/Miss.....a student of  
.....sem has attended Two Days Finishing school Training program on “**Industrial and Process Automation**” held on 16<sup>th</sup> & 17<sup>th</sup> Feb 2017, organized by the Department of Instrumentation Technology under TEQIP-II.

**Prof G.Devaraju**  
Dept. of IT  
Coordinator

**Prof. Soumya B.S**  
Dept. of IT  
Coordinator

**Dr. M. Meenakshi**  
Prof & Head, IT  
Chief Coordinator

**Dr. C. Nanjundaswamy**  
Principal







### Chief Patrons

Sri. S. Mariswamy, Chairman, PVPWT  
Sri. A. R. Krishnamurthy, Managing Trustee /  
Secretary, PVPWT  
Sri. P. L. Nanjundaswamy, Treasurer, PVPWT  
Dr. S. Chinnaswamy, Trustee, PVPWT  
Sri. S. Shivamallu, Trustee, PVPWT  
Dr. M. Mahadeva, Trustee, PVPWT

### Patrons

Dr. C. Nanjundaswamy, Principal.  
Dr. M.N. Hegde, Dean Academic.  
Dr. B. Ravindra HOD, ME, TEQIP Coordinator.

### Chief Coordinator

Dr.M.Meenakshi  
Prof. & Head, Dept. of EI

### Coordinators

1.G Devaraju, Asso. Prof, Dept .of EI  
2.B. S Soumya, Asst. Prof, Dept .of EI

### Organizing Committee

Faculty Department of EIE

### Address for Communication/ Registration

Dr.M.Meenakshi  
Prof. & Head,  
Dept.of EI Ph.no.9480494025  
Email:meenakshi\_mbhat@yahoo.com

### Resource Persons

1. Mr. Bhanu Prakash R  
Scientific advisor  
Science4u Analytics And Research  
Solutions Pvt. Ltd
2. Ms Manjula J, software trainer  
Science4u Analytics And Research  
Solutions Pvt. Ltd

### Course Contents

- In-depth discussion on a specific topic important to Industrial Analytical Instrumentation and their Data Analytics in general
- Concentrate on emerging research and current trends applied in the field of analytical techniques
- provide updated information on key issues that are concerned with Chemometrics to participants

Registration Fees: Nil

**Who can attend:** The final year students and faculty of department of electronics and Instrumentation engineering.

### Outcome of the program

Participants will acquire knowledge about Chemometrics software and their use in Instrumentation and Electronics industries

### Certification

Certificate of participation from the department of Electronics & Instrumentation Engineering Will be issued to all the participants. Attendance is mandatory for all the sessions on all days.

### Dr. Ambedkar Institute of Technology

(An Autonomous Institute Affiliated to VTU)  
Bangalore-560056



Two days finishing school training program  
On

**“Smart Sensors and Analytical  
Instrumentation in Industrial MSPC and  
Business Analytics”**

**26<sup>th</sup> and 27<sup>th</sup> March 2018**

Under Technical Education Quality  
Improvement Programme (TEQIP-III)



### Chief Coordinator

Dr. M Meenakshi

Organized by

**Department of Electronics & Instrumentation  
Engineering**

Dr. Ambedkar Institute of Technology  
Mallathahalli, Near Jnanabharathi Campus  
Bangalore, 560056, Karnataka, India

## Dr. Ambedkar Institute of Technology

Mallathahalli, Near Jnanabharathi Campus  
Bangalore, 560056, Karnataka, India

Two days finishing school training program  
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### “Smart Sensors and Analytical Instrumentation in Industrial MSPC and Business Analytics”

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### Registration Form

Name : .....

Sex:M/F.....

Semester:.....

Institution.....

Category (SC/ST/GM): .....

TEQIP/NonTEQIP Institution.....

Address for communication:  
.....  
.....  
.....

Pin code:.....

Phone:.....

Email ID.....

Dated:

Signature of  
Applicant

Signature of the  
HOD/Principal

## About the Institution

Dr.Ambedkar Institute of Technology was founded by Late Sri. M H Jayaprakash Narayan, in the year 1980 on the ideals of the great Bharatha Rathna Dr. B.R. Ambedkar, whose life was a saga of learning and uplifting the down trodden of the society. The Institution is one of the premier Government of Karnataka grant-in-aid, Managed by Panchajanya Vidya Peetha Welfare Trust, Branches (PVPWT) approved by AICTE, Autonomous Institution affiliated to VTU, Belagavi. The Institution offers ten undergraduate, eight postgraduate programmes (PG) of engineering, the PG Programmes MBA, MCA and MSc (Engg.) by research/Doctoral Programmes.

The institute is one of the beneficiaries of the World Bank Assistance under Technical Education Quality Improvement Programme (TEQIP III) through Government of India. The Institute has ISO 9001:2008 certification and all programmes are accredited by NBA, New Delhi.

### Venue:

Seminar Hall A406  
Computer lab, Dept. of EI,  
Dr. Ambedkar Institute of Technology,  
Bangalore – 560056

## About the Department

Department of Instrumentation Technology was started in the year 1986 and has well equipped laboratories to meet the needs of curriculum as well as Research activities. The department is recognized as research center under VTU Belgaum. The department has well qualified and dedicated faculties to impart fundamental and applied knowledge in the field of controls, Instrumentation, Signal Processing, Biomedical, Embedded Systems etc

### About the Training Program

The purpose of this program is to provide students with an opportunity for an in-depth discussion on a specific topic important to Industrial Analytical Instrumentation and their Data Analytics in general. It also helps to concentrate on emerging research and current trends applied in the field of analytical techniques. This workshop focuses on bridging the gap between the industry and academics and it also gives an idea about what is expected from the academicians by the industry.

The topics will be delivered by recognized experts who are well versed in the latest developments of analytical field. The workshop will provide updated information on key issues that are concerned with Chemometrics to participants

# Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

An Autonomous Institute, Affiliated to VTU, Belgaum, Aided by Govt. of Karnataka  
Near Jnanabharathi Campus, Mallathalli, Bangalore-560056.



**Cordially Welcomes the Participants of 8<sup>th</sup>  
semester students to the TEQIP-III Sponsored**



**Two Days Finishing School Training Program on  
“Smart Sensors/Analytical Instrumentation in  
Industrial MSPC and Business Analytics”**

**By**

**Science4u Analytics and Research Solutions Pvt. Ltd.**

**Date : 27<sup>th</sup> & 28<sup>th</sup> March 2018**

**Venue: Seminar Hall-A406,**

**Time: 9:00AM – 4.30 PM**

**Dr.AIT**

**Coordinators**

**Chief Coordinator**

**G.Devaraju** Assoc. Professor Dept. of EIE

**Dr. M. Meenakshi**

**Soumya B.S** Asst. Professor Dept. of EIE

**Professor & Head, Dept. of EIE**



**SCIENCE4U**

QbD and PAT/ Multivariate Data Analysis  
And Design of Experiments  
Bangalore, India

SCIENCE4U ANALYTICS AND RESEARCH SOLUTIONS PVT. LTD.

### Workshop Agenda

## **Smart Sensors and Analytical Instrumentation in Industrial MSPC and Business Analytics**

<b>Day 1</b>	
<p><b>Session 1: 9.30AM to 11.00 AM</b> Welcome Note + MVA &amp; DoE Overview</p> <p><b>Session 2: 11.15AM to 01.30PM</b> What is Experimental Design, Experimental Design in R&amp;D Projects</p>	<p><b>Session 3: 02.00PM to 03.00PM</b> Exercise 1: Design set-up Screening Designs and their Analysis</p> <p><b>Session 4: 03.30PM to 04.30PM</b> Exercise 2 : Full Factorial Analysis And Response Surface Designs with ANOVA</p>
<b>Day 2</b>	
<p><b>Session 5: 9.30AM to 11.00 AM</b> The world is multivariate, Demo PCA with real world examples, Principles of projection methods with, PCA of Instrumentation Data</p> <p><b>Session 6: 11.15AM to 01.30PM</b> Exercise PCA, Sensory Data &amp; Instrumentation Data</p>	<p><b>Session 7: 02.00PM to 03.00PM</b> Demo Regression, Principles of Regression methods, Steps in multivariate regression</p> <p><b>Session 8: 03.15PM to 04.30PM</b> Exercise regression + Conclusion Note.</p>

[www.science4u.co.in](http://www.science4u.co.in)

## **INDUSTRIAL PERSPECTIVES IN ANALYTICAL METHODS AND TRAINING ON CHEMOMETRICS**

The purpose of workshop is to provide students with an opportunity for an in-depth discussion on a specific topic important to Industrial Analytical Instrumentation and their Data Analytics in general. It also helps to concentrate on emerging research and current trends applied in the field of analytical techniques. This workshop focuses on bridging the gap between the industry and academics and it also gives an idea about what is expected from the academicians by the industry.

Chemometrics means performing calculations on measurements of chemical data. The common usage of the word refers to using linear algebra calculation methods to make either quantitative or qualitative measurements of chemical data and primarily spectra. The software is used in a range of industries and research for Exploratory Data Analysis, Descriptive Statistics, Regression Analysis, Classification & Prediction and Design of Experiments.

The topics will be delivered by recognized experts who are well versed in the latest developments of analytical field. The workshop will provide updated information on key issues that are concerned with Chemometrics to participants. The workshop will have presentations and demonstrations on Chemometrics software and their use in Instrumentation and Electronics industries.

### **About SCIENCE4U Analytics and Research Solutions Pvt. Ltd:**

SCIENCE4U is providing services and solutions in the field of Analytical Instrumentation and data analytics to many industries who are also the leading players in their respective domains like Food, Agriculture, Pharma, LifeSciences, Cosmetics, Personal Health Care, Oil & Gas, Energy etc... The companies seek solutions in implementing and running an optimized automated process to produce products that are more stable and cost effective. SCIENCE4U with provides assistance to such companies by implementing a complete MSPC(Multivariate Statistical Process Controls) in place with is basically a combination of Analytical instrumentation, Process engineering and Statistical modeling of the process for feedback and feed forward control applications.

### **Speaker Profile:**

1. Mr. Bhanu Prakash R, Scientific Advisor, SCIENCE4U Analytics and Research Solutions Pvt. Ltd., Bangalore, India.

Brief bio:

Instrumentation & Electronics Engineer, Expert in Applied Statistics for industries and expert in International business having and industry experience of over 20 years during which have worked with leading scientific software products companies like MATLAB, SPSS, SigmaPlot, PeakFit, SYSTAT and CAMO. Have worked with Chemometrics company CAMO for more than 12 years and in the field of Chemometrics for more than 15 years during which have provided training's and expert consulting services to many industries, universities and institutes.

Now at SCIENCE4U working as one of the key members of the QbD (Quality Based Design) & PAT (Process Analytical Technologies) team mostly involved with Analytical Instrumentation / Spectroscopic methods like NIR, RAMAN and hyperspectral imaging systems that uses chemometrics for various applications.

2. Mrs. Manjula J, Managing Director, SCIENCE4U Analytics and Research Solutions Pvt. Ltd., Bangalore, India.

Brief bio:

Electronics and Communications Engineer, Expert in Applied Statistics for industries and expert in International business having and industry experience of over 15 years during which have worked with leading Business Solutions providing companies like in the field of BFSI and Market Research.

Now at SCIENCE4U working as one of the key members of the QbD (Quality Based Design) & PAT (Process Analytical Technologies) team mostly involved with Analytical Instrumentation / Spectroscopic methods like NIR, RAMAN and hyperspectral imaging systems that uses chemometrics for various applications.

3. Mr. Nandish M, Senior Executive – Technical, SCIENCE4U Analytics and Research Solutions Pvt. Ltd., Bangalore, India.

Brief bio:

Instrumentation & Electronics Engineer, having a Masters in Electronics and Communications is an expert in Applied Statistics for various industries in Food , Pharma, Oil & Gas industries and having a industry experience of over 08 years during which have worked with leading industries like Reliance Telecom, Marico Ltd. and Reliance Jio Networking.

Now at SCIENCE4U working as one of the key members of the QbD (Quality Based Design) & PAT (Process Analytical Technologies) team mostly involved with Analytical Instrumentation / Spectroscopic methods like NIR, RAMAN and hyperspectral imaging systems that uses chemometrics for various applications.

# Dr.Ambedkar Institute of Technology, Bangalore

## Department of Electronics and Instrumentation Engineering

Attendance of 8<sup>th</sup>sem students for Finishing school training program “Smart Sensors / Analytical Instrumentation in Industrial MSPC and Business Analytics” on 26<sup>th</sup> and 27<sup>th</sup> March 2018 By Science4u Analytics and Research Solutions Pvt. Ltd. Under TEQIP-III

### STUDENTS REGISTRATION

Date: 27/03/2018

Sl no	Student Name	USN
1.	Akshatha S.K	IDA14EI002
2.	Alakananda B.G	IDA14EI003
3.	Anagha Shree Pravallika A	IDA14EI004
4.	Anusha J A	IDA14EI006
5.	Ashoka M	IDA14EI007
6.	Ashwini Ramachandra Naik	IDA14EI008
7.	Chithra I Patil	IDA14EI009
8.	Chandra babu S	IDA14EI011
9.	Devraj	1DA14EI012
10	Harathi R	IDA14EI013
11	Hemavathi. S	IDA14EI015
12	Idayath A	IDA14EI016
13	K. Pratheek Parasam	IDA14EI017
14	Livedhan	1DA14EI019
15	Madhu R Kittur	IDA14EI021
16	Mohamed Nadeem H	IDA14EI024
17	Elangovan N	IDA14EI026
18	Nalini M.C	IDA14EI027
19	Pavan J	IDA14EI029
20	Rachana C Shekar	IDA14EI030
21	Rakshith G.B	IDA14EI032



22	Rakshitha S M	IDA14EI033
23	Ramya R	IDA14EI034
24	Rashmi S	IDA14EI035
25	Rudresh B.T	IDA14EI036
26	Sahana K	IDA14EI037
27	Sai Deekasha YS	IDA14EI038
28	Santosh Gouda M Patil	IDA14EI039
29	Seema P	IDA14EI040
30	Shilpa R Rimmalapudi	IDA14EI041
31	Sneha K.L	IDA14EI042
32	Sowmya S	IDA14EI043
33	Suma R.K	IDA14EI044
34	Sumangala C	IDA14EI045
35	Swathi K	IDA14EI046
36	Thanuja K.S	IDA14EI047
37	Vani S A	IDA14EI049
38	Varsha V	IDA14EI050
39	Vigneshwaran J	IDA14EI051
40	Vijayalakshmi R Joger	IDA14EI052
41	Vinyas K.S	IDA14EI054
42	Vishakha R Shastri Kodagi	IDA14EI055
43	Vinay Kumar A.N	IDA13IT059
44	Aditya N	IDA15EI400
45	Jayaram M	IDA15EI402
46	Narayana B	IDA15EI403
47	Shreenath Lamani	IDA15EI407
48	Suhas R.M	IDA15EI409
49	Vidya Bagali	IDA14IT410

**Dr. Ambedkar Institute of Technology**  
(An Autonomous Institute Affiliated to VTU)  
Bangalore-560056



A report on Two days finishing school training program  
on  
**“Smart Sensors and Analytical Instrumentation in Industrial MSPC and Business Analytics”**  
**26<sup>th</sup> and 27<sup>th</sup> March 2018**

Under Technical Education Quality  
Improvement Programme (TEQIP-III)



**Coordinators**

1. G. Devaraju Assoc. Professor, Dept. of EIE, Dr.AIT
2. B.S. Soumya Asst. Professor, Dept. of EIE, Dr.AIT

**Chief Coordinator**

Dr. M Meenakshi  
Prof. & Head, Dept. of EIE



The training program started with the inauguration function. All the guest and participants were welcomed by the Dr. M. Meenakshi, HOD, Dept. of EIE. The gathering was addressed by Dr. M.N Hegde, Dean Academic, Dr.AIT. key note address was given by the guest Mr. Bhanu Prakash R,Scientific advisor, Science4u Analytics And Research Solutions Pvt. Ltd, Bangalore.

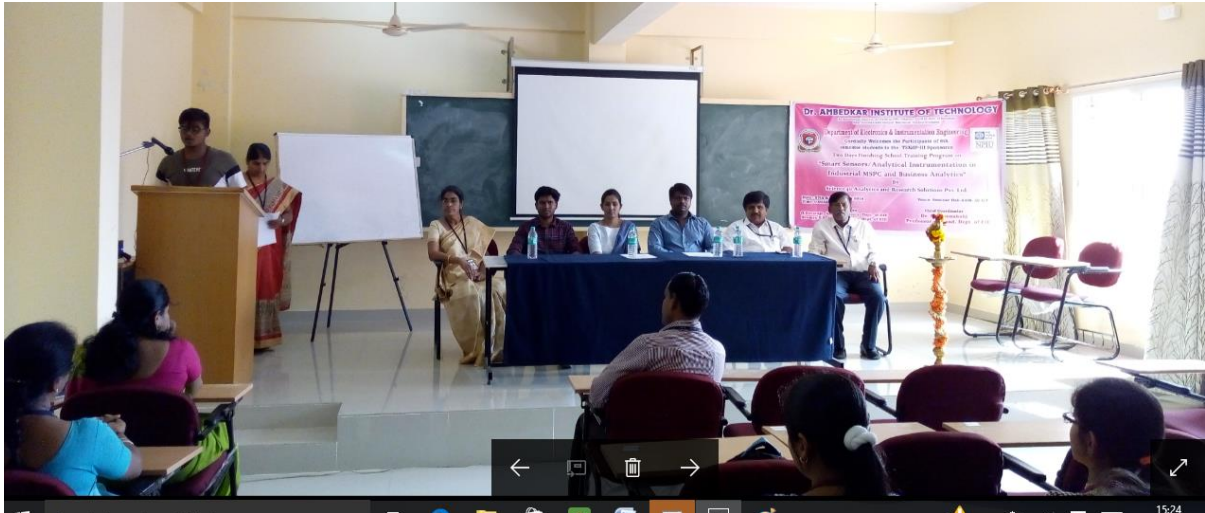


Photo: Inauguration function.



Photo: lighting the lamp by the dignitaries

## **SESSION 1**

### **INTRODUCTION TO MSPC**

**Multivariate statistical process control (MSPC)** is one of the most popular data-based methods for **process monitoring** and is widely used in various industrial areas. Effective

routines for **process monitoring** can help operators to run industrial **processes** efficiently at the same time as maintaining high product **quality**.

## **MULTIVARIATE ANALYSIS**

**Multivariate analysis** (MVA) is based on the statistical principle of **multivariate** statistics, which involves observation and **analysis** of more than one statistical outcome variable at a time. **Multivariate analysis** is a set of techniques used for **analysis** of data sets that contain more than one variable, and the techniques are especially valuable when working with correlated variables.

## **MULTIVARIATE TECHNIQUES**

- Initial step Data quality
- Multiple Regression Analysis.
- Logistic Regression Analysis.
- Discriminant Analysis.
- Multivariate Analysis of Variance (MANOVA).
- Factor Analysis.
- Cluster Analysis.
- Principle Component Analysis.

## **CALIBRATION AND VALIDATION OF MODEL**

**Model validation** is defined as the set of processes and activities intended to verify that models are performing as expected, in line with their design objectives, and business uses.

**Model calibration** is the process of adjustment of the **model** parameters and forcing within the margins of the uncertainties to obtain a **model** representation of the processes of interest that satisfies pre-agreed criteria.

## **SESSION-2&3**

### **TERMS USED IN MSPC:**

#### **1.MULTIPLE REGRESSION ANALYSIS:**

**Multiple regression** analysis is a statistical technique that uses several explanatory variables to predict the outcome of a response variable. The goal of **multiple regression** is to **model** the relationship between the explanatory and response variables.

## **2.LOGISTIC REGRESSION ANALYSIS:**

Logistic regression is a statistical method for analyzing a dataset in which there are one or more independent variables that determine an outcome. The outcome is measured with a dichotomous variable (in which there are only two possible outcomes).

## **3.DISCRIMINANT ANALYSIS:**

**Discriminant analysis** is a statistical method that is used by researchers to help them understand the relationship between a "dependent variable" and one or more "independent variables." A dependent variable is the variable that a researcher is trying to explain or predict from the values of the independent variables.

## **4.MULTIVARIATE ANALYSIS OF VARIANCE:**

**Multivariate analysis of variance (MANOVA)** is simply an **ANOVA** with several dependent variables. **ANOVA** tests for the difference in means between two or more groups, while **MANOVA** tests for the difference in two or more vectors of means.

## **5.FACTOR ANALYSIS AND CLUSTER ANALYSIS:**

**Factor analysis** is a technique that is used to reduce a large number of variables into fewer numbers of **factors**. This technique extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further **analysis**.

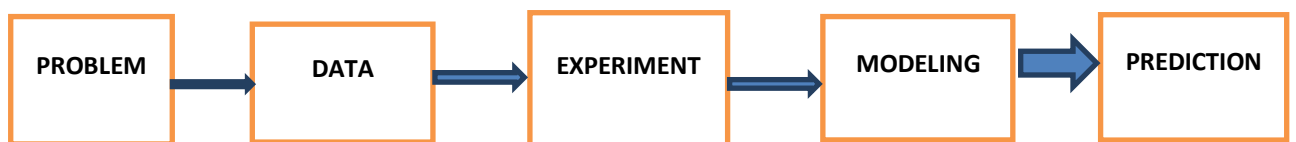
**Cluster analysis** or **clustering** is the task of grouping a set of objects in such a way that objects in the same group are more similar to each other than to those in other groups.

## **6.PRINCIPLE COMPONENT ANALYSIS:**

**Principal component analysis (PCA)** is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

## 7. REGRESSION MODELING:

A frequently applied statistical technique that serves as a basis for studying and characterizing a system of interest, by formulating a mathematical **model** of the relation between a response variable,  $y$  and a set of  $q$  explanatory variables  $x_1, x_2, \dots, x_q$ . The block diagram for spring balance technology is shown below:



**Commonly used regression types are:**

### 1. linear regression:

In statistics, **linear regression** is a **linear** approach for modelling the relationship between a scalar dependent variable  $y$  and one or more explanatory variables (or independent variables) denoted  $X$ .

A **linear regression** line has an equation of the form  $Y = a + bX$ , where  $X$  is the explanatory variable and  $Y$  is the dependent variable. The slope of the line is  $b$ , and  $a$  is the intercept (the value of  $y$  when  $x = 0$ ).

### 2. Multiple regression:

**Multiple regression** is an extension of simple **linear regression**. It is used when we want to predict the value of a variable based on the value of two or more other variables. The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). The general purpose of **multiple regression** (the term was first used by Pearson, 1908) is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable.

The general polynomial equation for regression model is given below:

$$Y=b_0+b_1*x_1+b_2*x_2+b_3*x_3\dots\dots\dots b_k*x_k$$

In matrix terms, the **formula** that calculates the vector of coefficients in **multiple regression** is:  $b = (X'X)^{-1}X'y$ .



Photo: resource person guiding the students

## SESSION -4 AND SESSION-5

### REGRESSION METHODS:

The most commonly used regression methods are:

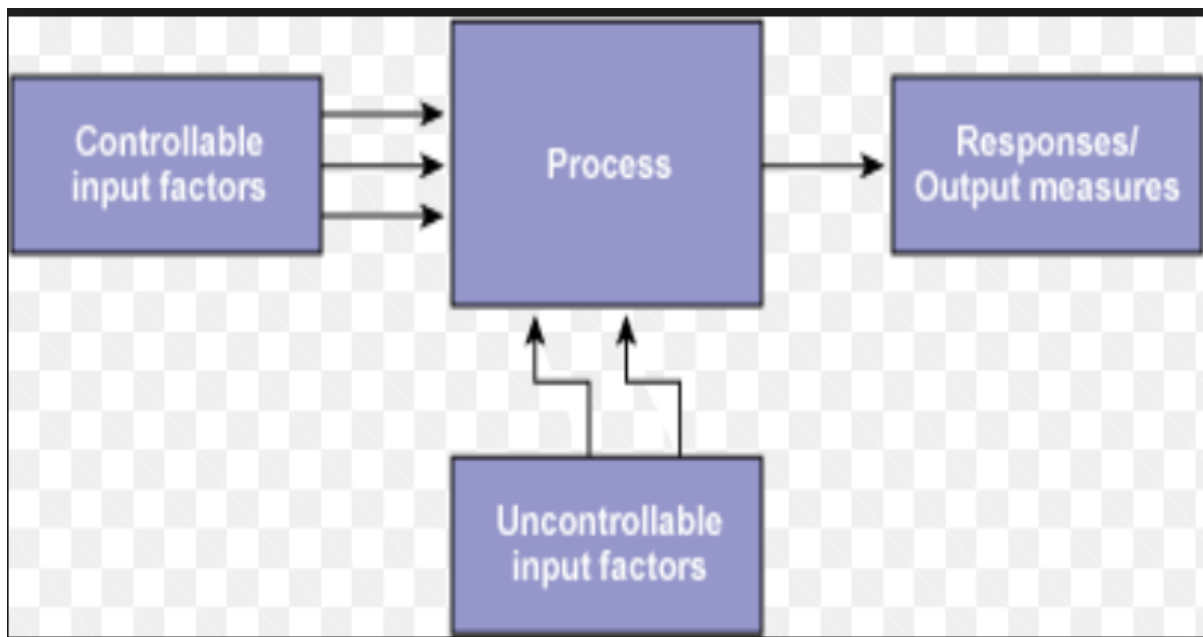
- A. Multiple linear regression.
- B. Principal component regression.
- C. Partial least square regression.

### REGRESSION MODELING STAGES:

- A. **Calibration data:** Data used to build model between predictors and responses.
- B. **Validation data:** Data used to test how the model works for new data.
- C. **Prediction data:** Data without known response values.

### DESIGN OF EXPERIMENTS(DOE):

**Design of experiments (DOE)** is a systematic method to determine the relationship between factors affecting a process and the output of that process. In other words, it is used to find cause-and-effect relationships. This information is needed to manage process inputs in order to optimize the output. Stages of DOE Designed experiments are usually carried out in five stages planning, screening, optimization, robustness testing and verification.



DOE Involves three stages namely:

1. Screening
2. Advanced screening
3. Optimization

### **Screening:**

A **screening** design of experiment (**DOE**) is a specific type of a fractional factorial **DOE**. A **screening DOE** is practical when we can assume that all factors are known, and are included, as appropriate, in the experimental design.

### **Optimization :**



An act, process, or methodology of making something (such as a design, system, or decision) as fully perfect, functional, or effective as possible. specifically the mathematical procedures (such as finding the maximum of a function) are involved.



Photo: resource person delivering his lecture

## SESSION 6&7

### SOFTWARE REQUIREMENTS :

#### UNSCRAMBLER X-CAMO SOFTWARE :

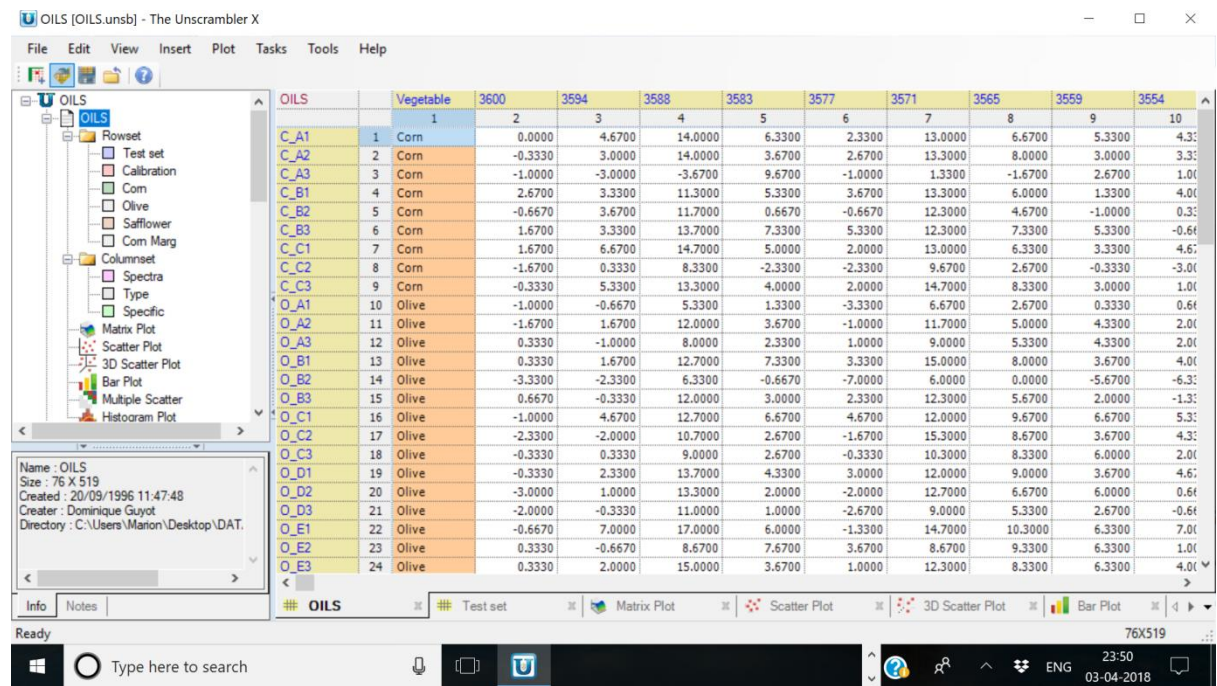
The **Unscrambler® X** is the first release of **CAMO Software's** new Generation **X (GenX)** family of products. Perform real time predictions from data obtained from laboratory or process equipment **DLL function** calls (32-bit only). The **Unscrambler software** includes exploratory data analysis, regression, classification and Design of Experiments tools.

Feaures of unscrambler x-CAMO software is given below:

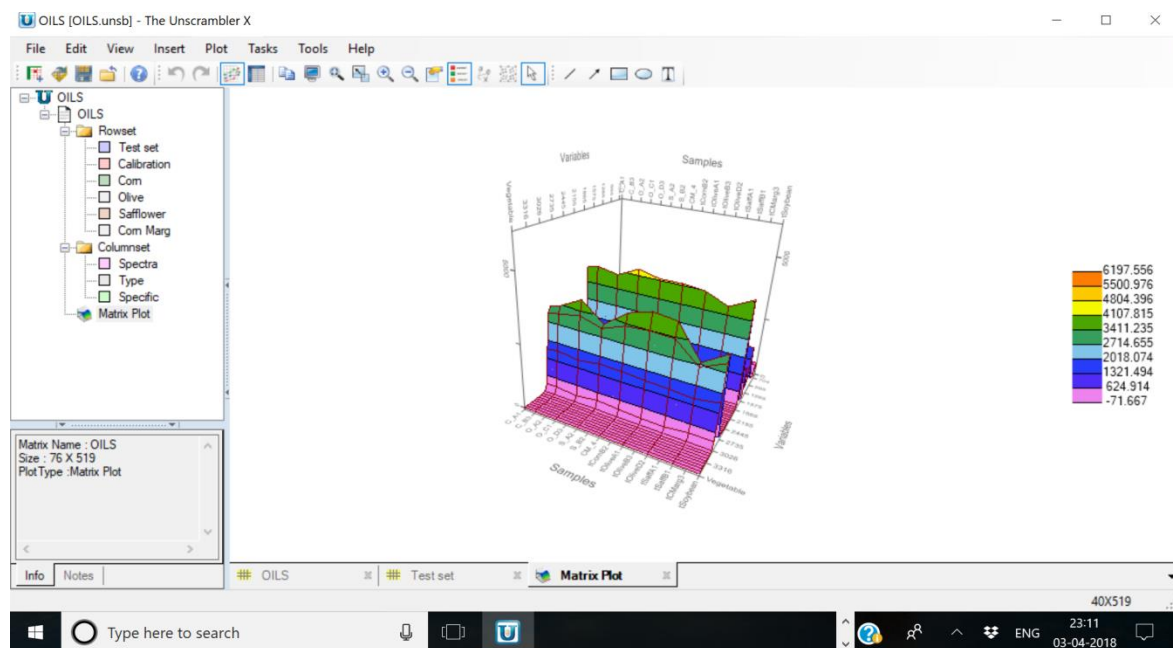
1. Powerful Multivariate Analysis methods, statistics & tests.
2. Advanced experimental designs with Design-Expert®.
3. Handles large data sets with faster, smarter & easier analysis.
4. Easy drag & drop data importing from Microsoft Excel.

5. Accepts data from a range of instruments & equipment.
6. Supports PCR and PLSR .

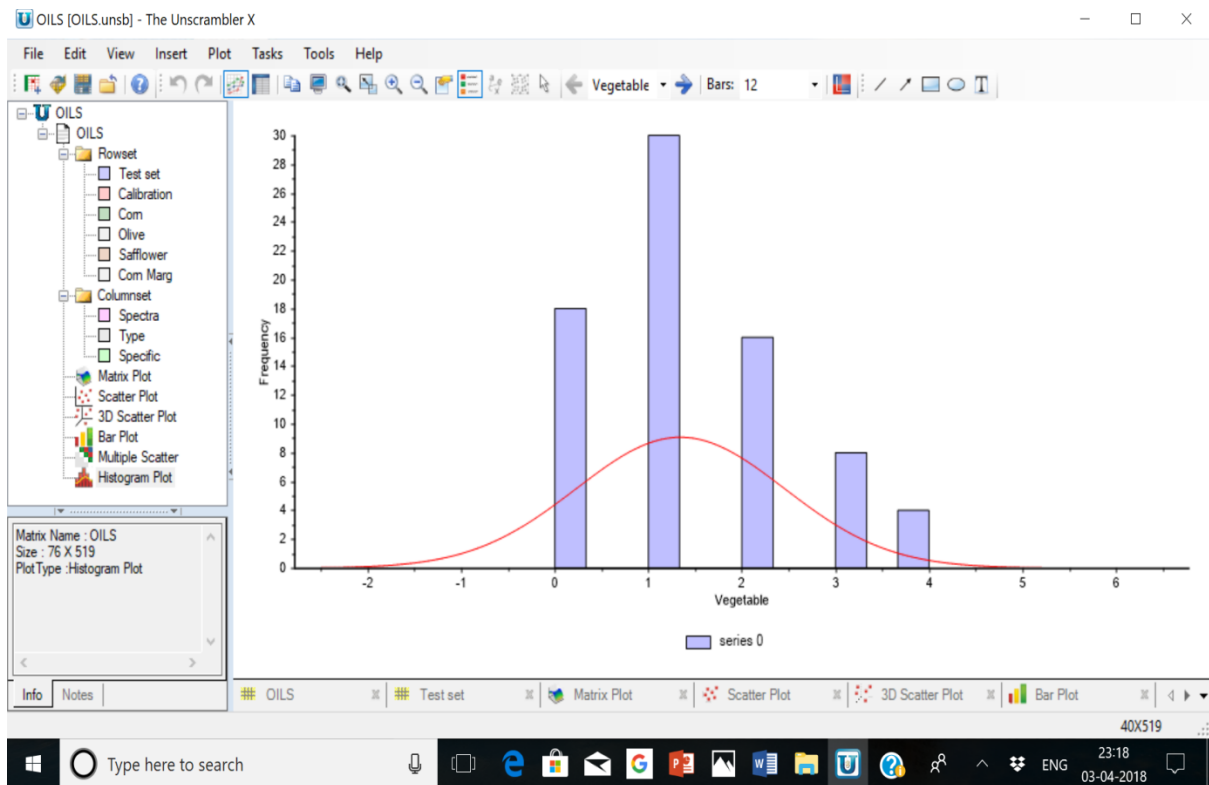
**Step no 1: Data file**



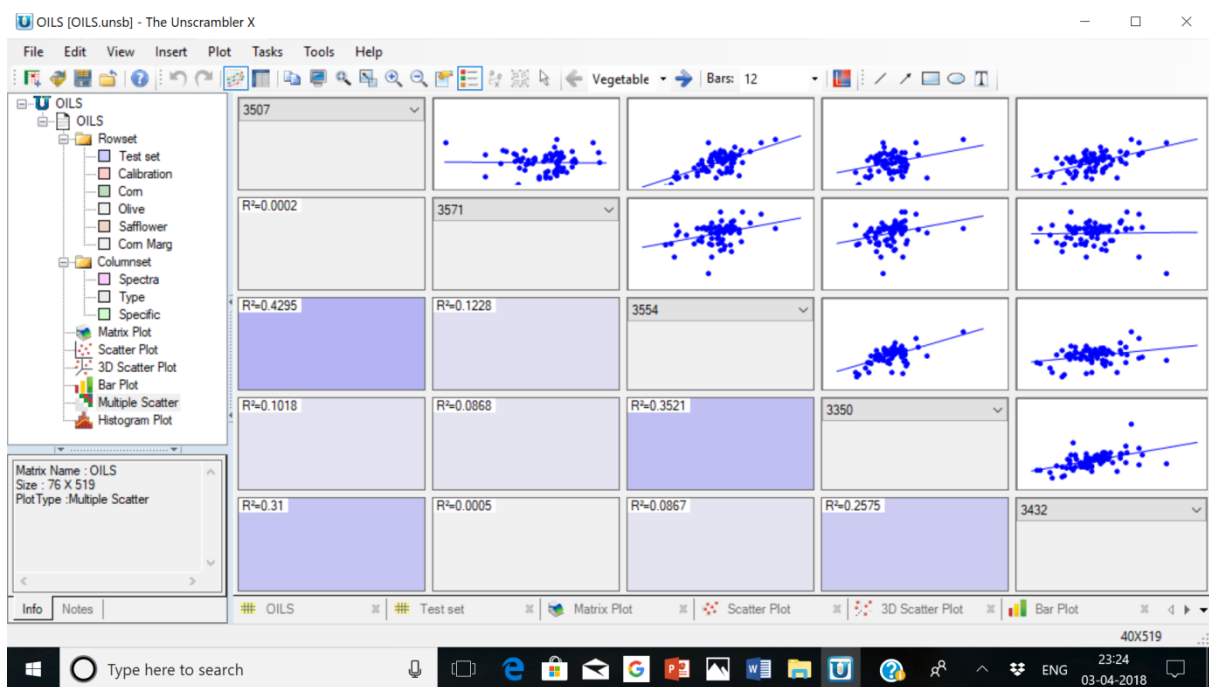
**Step no 2: Plotting matrix for a given data file.**



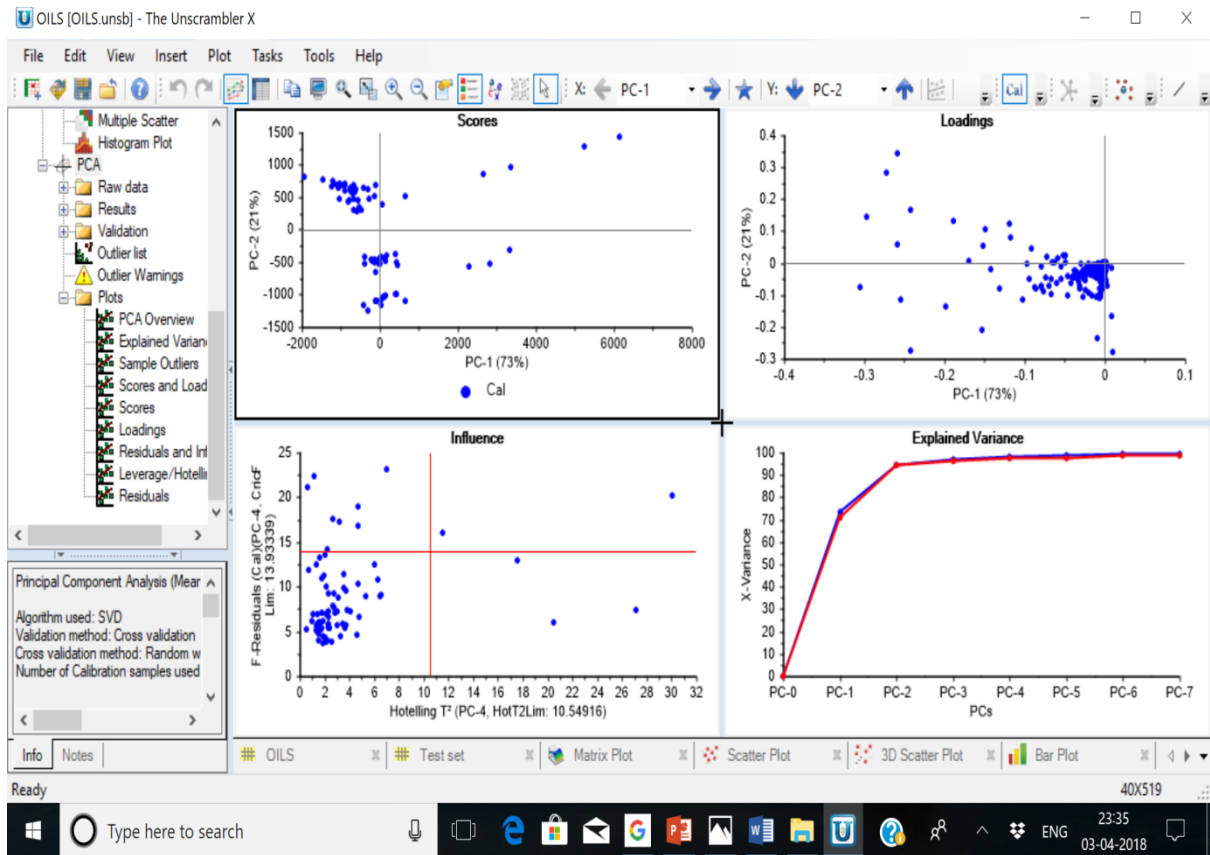
**Step no 3: Histogram plot for a given data file.**



**Step no 4: Multiple scatter plot for a given data file.**



**Step no 5:PCA Model for a given data file.**



### Step no 6: PLS Model for a given data file.

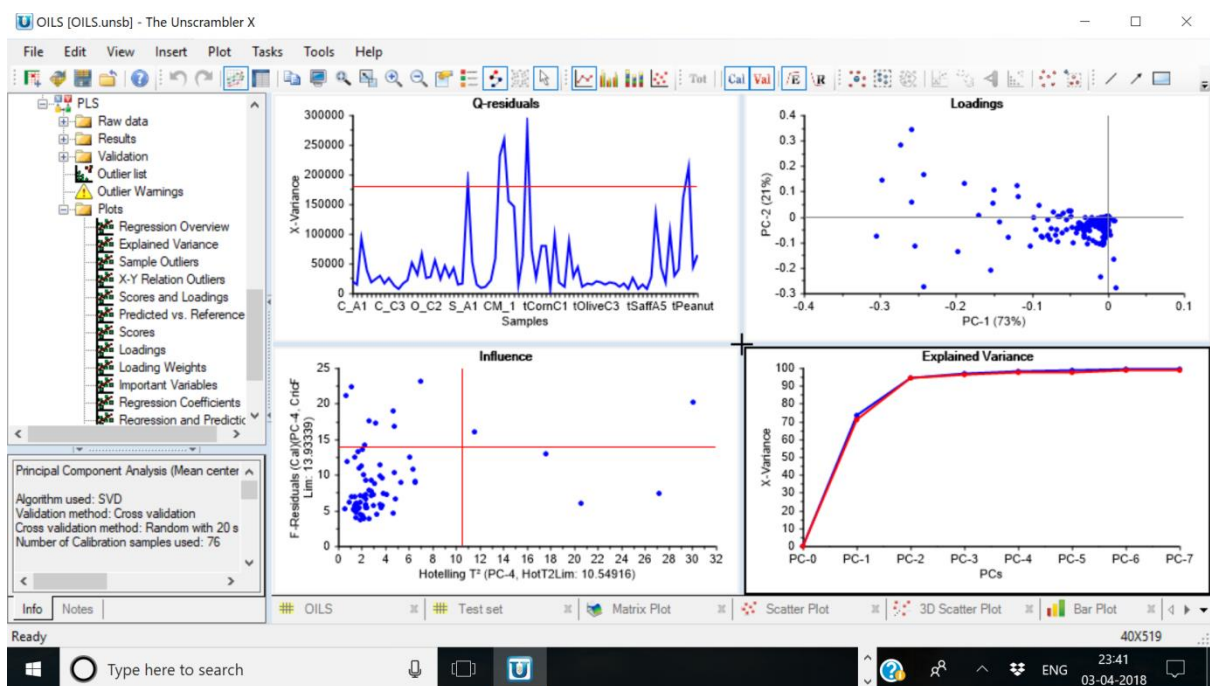




Photo: the recourse persons were formally thanked from the department.



# LOGINWARE GLOBAL LEARNING

(A learning initiative by Loginware Softtec Pvt.Ltd)

**Proposal for  
on campus workshop**

**ON**

## **“Design and Development Of IOT Based Embedded System Using Raspberry Pi”**

***Organized by***

Loginware Softtec Pvt. Ltd.

#40/163, 1st Floor, Opp. Bharathi Associates,

Boovanahalli , BM Bypass Road

Hassan , Karnataka

573201

**25th to 29th September 2018**

**Contact Details:**

**Web:** [www.loginwaresofttec.com](http://www.loginwaresofttec.com)

**Email :** [info@loginwaresofttec.com](mailto:info@loginwaresofttec.com)

**Phone:** 7996990246 / 7996990247



## *A little about us :*

*Loginware Sofftec Pvt. Ltd. (A registered private limited company under Ministry of Corporate Affairs, Govt. of India) is knowledge-driven company that values cutting edge technology practices and provides comprehensive solutions to help our customers achieve their goals. Loginware is changing the world by changing the way knowledge can be shared. Loginware has the dedicated young minds striving to connect individuals with each other and with technology. We offer a wide array of solutions for a range of key verticals and horizontals with its excellent domain competencies in verticals such as Hardware, Firmware, Embedded and system software development and training. Our learning programs, whether designed for a global organization or an individual professional, help businesses close skills gaps and foster an environment of continuous talent development.*

## *Loginware Global Learning : (A learning initiative by Loginware Sofftec Pvt .Ltd)*

*LGL is our flagship program to share the knowledge and build the vibrant learning network. We focus on sharing the knowledge and connecting the knowledge seekers with technology. The aim of this workshop is to provide a platform to the students to explore the cutting edge developments in the embedded domain and exchange ideas, information techniques and applications in the field of Real Time Embedded Systems. It provides Academic-Industry interaction and fosters collaborative research.*

### **Contact Details:**

**Web:** [www.loginwaresofttec.com](http://www.loginwaresofttec.com)

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## Overview and Highlights of the workshop

### Overview of the workshop:

"IOT (**Internet of things**) is a computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices".

This workshop aims at design and development of IOT based embedded system using an ARM architecture based embedded platform "Raspberry Pi".

The **Raspberry Pi** is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

This five days workshop helps the students to understand and work with Raspberry Pi and various hardware peripherals, devices and sensors to create an embedded application.

This workshop includes both brainstorming and hands on experience to get more insights of IOT and embedded systems.

This workshop enhances the technical competency of the students required to work in the real time projects on going in the embedded industry.

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## DAY 1

### Module Name: Embedded Systems in a Nutshell

#### Morning Session

##### Session 1:

**Speaker: Mr. Thejesh P**

- 1) Fundamentals of embedded systems and its Significance.
- 2) Layered Architecture and Design of embedded systems.

- Hardware
- Firmware
- System software
- Application Software

- 3) Building blocks of embedded systems.

- Central Processing unit
- Memory ( RAM and ROM)
- I/O Devices
- Communication Interfaces

##### Session 2:

**Speaker: Mr. Darshan S**

- 1) Getting familiar with Programming tools like terminal emulator.
- 2) Introduction to Python language and hands-on on basic and advanced concepts on python

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## **Afternoon Session**

### **Session 1:**

**Speaker: Mr. Vinay Kumar**

- 1) Introduction to Raspberry Pi - ARM Microprocessor based system.
- 2) Introduction to Ports and GPIO Pins of Raspberry Pi.
- 3) Installing Raspbian operating system on Raspberry Pi
- 4) Working with Indicators with RPI
- 5) Experimenting various patterns with number of LED's

## **DAY 2**

### **Module name: Embedded Systems : A Practical approach**

#### **Morning Session :**

##### **Session 1:**

**Speaker : Mr. Thejesh P**

- 1) Introduction to IO Pins of Raspberry Pi and Various IO Peripherals.
- 2) Interfacing Push button Switch, Relay, Buzzer with Raspberry Pi.

##### **Session 2:**

**Speaker : Mr. Darshan S**

- 1) Interfacing Seven Segment Display with RPi.
- 2) Experimenting various patterns with Seven Segment Display with Switch.

## **Afternoon Session**

### **Session 1:**

**Speaker : Mr. Vinay Kumar**

- 1) Introduction to DC motor and its principle of operation.
- 2) Interfacing DC motor and L293D DC motor driver.

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## **DAY 3**

### **Module name: Embedded Systems : A Practical Approach**

#### **Morning Session**

##### **Session 1:**

**Speaker : Mr. Thejesh P**

- 1) Introduction to Display Devices and its principal of operation.
- 2) Interfacing Display Device (LCD) to Raspberry Pi.

##### **Session 2:**

**Speaker : Mr. Darshan S**

- 1) Displaying Custom characters on LCD display
- 2) Working on different patterns on LCD Display.

#### **Afternoon Session**

##### **Session 1:**

**Speaker : Mr. Vinay Kumar**

- 1) Introduction to Sensorsonics.
- 2) Interfacing digital sensors like fire sensor, IR sensor, float sensor, LDR sensor to raspberry Pi. and LCD Display

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## **DAY 4**

### **Module Name: Embedded Systems : A Practical Approach**

#### **Morning Session**

##### **Session 1:**

**Speaker : Mr. Thejesh P**

- 1) Introduction and Interfacing of analog sensors like Temperature sensor, humidity sensor, and Ultrasonic sensor to Raspberry Pi.
- 2) Introduction to SPI Interfacing SPI based RFID device

##### **Session 2:**

**Speaker : Darshan S**

- 1) Introduction to Serial Communication.
- 2) Interfacing various serial communication devices like bluetooth.

#### **Afternoon Session**

##### **Session 1 :**

**Speaker : Mr. Vinay Kumar**

- 1) Introduction to GSM and GPS
- 2) Interfacing of GPS and GSM devices to RPi.

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## **DAY 5 Module Name: Internet of Things**

### **Morning Session**

#### **Session 1:**

**Speaker : Mr. Thejesh P**

- 1) Introduction to Internet of things.
- 2) Introduction to IOT architecture, various IOT levels and IOT Platforms.

#### **Session 2:**

**Speaker : Mr. Darshan S**

- 1) Introduction to UBDOTS.(A Cloud IOT Platform).
- 2) Experiencing IOT with UBDOTS and controlling of embedded peripherals.

### **Afternoon Session**

#### **Session 1:**

**Speaker : Mr. Vinay Kumar**

- 1) A group event to present a solution to a real time problem using learnt/used resources and technologies.
- 2) Creating a working prototype to present a solution to real time problem using Raspberry pi and various hardware peripherals and IOT Concept.
- 3) The main aim of this event is to make the budding engineers think out of the box to find a solution to the problem using the cutting edge technologies.

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## **TAKE HOME**

### ***Amenities provided from the company for the students :***

<b>SL No.</b>	<b>Materials</b>
1	Study Kit ( File , Notepad and a Pen)
2	Loginware Global Learning Certificate

### ***Who can attend the Workshop ?***

Students of ECE, EEE, CSE, ISE, IT and TCE branch can attend the workshop.

### **NOTE :**

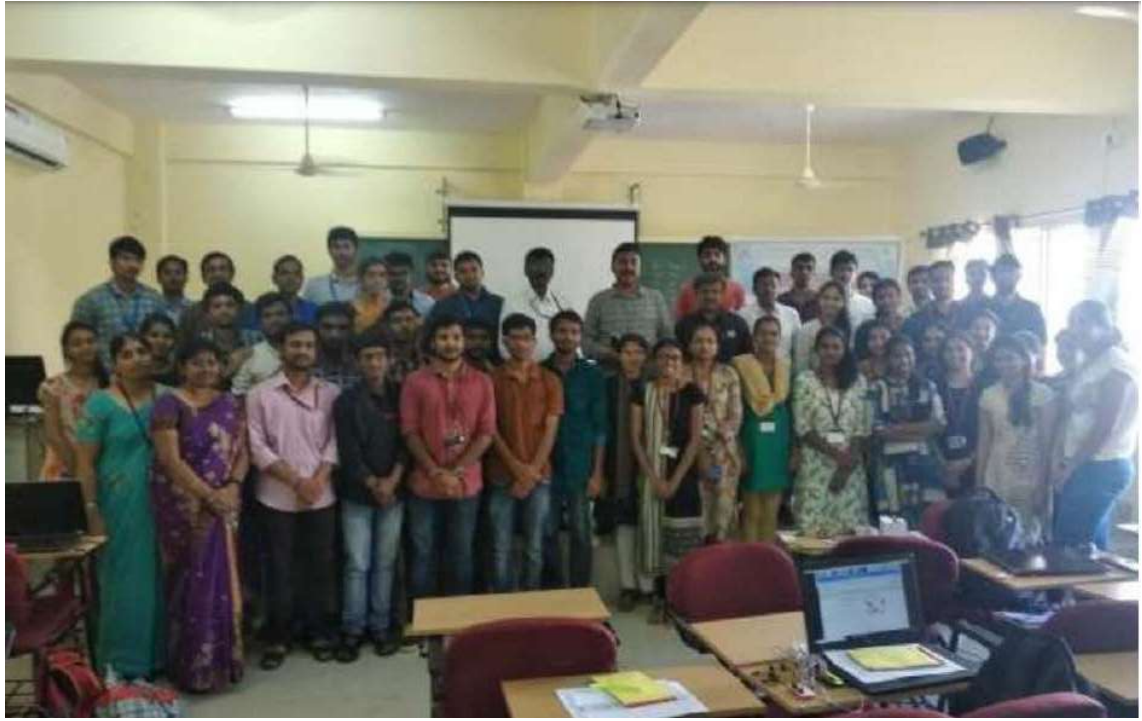
*All the modules are designed according to the trending technology standards. Any modifications in the course contents are appreciated and redesigned accordingly.*

### **Contact Details:**

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**Phone:** 7996990246 / 7996990247



## Contact

[www.linkedin.com/in/thejesh-p-b4918881](https://www.linkedin.com/in/thejesh-p-b4918881) (LinkedIn)

## Top Skills

Microsoft Office  
Management  
Microsoft Excel

## Publications

study and reduction of reflection coefficient of a rectangular microchip patch antenna at 7Ghz

# Thejesh p

Co founder at Loginware Softtec Private Limited  
Bengaluru, Karnataka, India

## Experience

Loginware softtec private limited  
Chief Technology Officer  
June 2016 - Present (6 years 8 months)  
Bengaluru, Karnataka, India

---

## Education

SJB institute of technology  
Mtech in VLSI and EMBEDDED SYSTEMS, VLSI AND EMBEDDED SYSTEMS · (2015 - 2016)



# REPORT ON IOT BASED RASPBERRY PI WORKSHOP

DAY 1(25<sup>th</sup> September 2018):

The session begun with the discussion on embedded systems.

Embedded systems are a combination of computer hardware and software, which are programmable and designed for specific functions. They can control many devices, consume low power and are cost effective. The architecture of an embedded system is a layered architecture comprising of the Hardware, then the Operating System and the Application Software.

The session further continued with the discussion on Microprocessor v/s Microcontroller system design.

Raspberry Pi is an ARM based microprocessor which has an Raspbian OS. It is a computer capable of interpreting high level language. In Raspberry Pi the Pi stands for Python i.e the source code for operation is written using Python programming language. It is a 40 pin processor with a HDMI pin for display and a MicroUSB port for power supply. The 40 pins constitute of:

- 2 pins are of 3.3V
- 2 pins are of 5V
- 8 pins are Ground
- 26 pins for GPIO
- 2 pins for EEPROM

Some basic commands used on the prompt screen:

- ls – list the current directory contents
- ctrl +L – to clear the prompt screen
- mkdir – to make directory
- cd - to change directory
- rmdir – to remove directory
- cd.. – to come out of the current directory
- pwd – to see the present working directory

Some basic command related to files:

- To create file: nano filename.py
- To save file: ctrl + X, then press Y, then enter
- To delete file: rm filename.py
- To execute file: python filename.py
- To abort file:Ctrl +Z

In Python programming there are no parenthesis to indicate a block but blocks are indicated using intendation. Also there is no necessity to declare the datatype of the variable being used, the compiler assigns the datatype to the variable based on the value it holds implicitly.For example: a,b,c = 1,2,3.

Although Python is programmer friendly it is case sensitive.

The if and else ladder is formed as:

if(condition):

    Statement 1

elif(condition):

    Statement 2

else:

    Statement 3

The input is obtained from the user by using the function input().For example:  
c=input('enter string')

On the operator front Python has 3 logical operators – and,or,not; 3 bitwise operators - &(and),|(or),~(not).

Python has 2 loops – for and while.The syntax is as follows:

while(condition):

    statement block

for i in range(initial,final):

    statement block

Single line comments are given using # and block line comments using “” “”

Increment operator ++ and decrement operator -- are not present in Python if one wants to use them it is given as,

```
a=a+1
```

```
b=b-1
```

Functions in python are given as,

```
def funcname(arguments):
```

```
    function block
```

```
funcname(arguments)
```

Python have lists that have same or different datatypes. Deletion in the list is done using: `del.llest(location)` ,the list can be appended at the last location of the list using: `list.append(value)`, insertion in the list is done using:  
`list.insert(location,value)`

The library files needed in the interfacing programming are included using the keyword `import`.For example:To indicate the usage of the GPIO pins in the pi it is given by,

```
import RPi.GPIO as GPIO
```

```
GPIO.setmode(GPIO.BOARD)
```

 in order to use the pin description within the box

```
GPIO.setmode(GPIO.BCM)
```

 in order to use the pin description outside the box

```
GPIO.setup(pinno,GPIO.X)
```

 in order to set the GPIO pin where X can be OUT for the pin to act as output or X can be IN for the pin to act as input.

The interfacing programming begun with LEDs. The LEDs programming was done for blinking the LEDs and to blink the LEDs alternatively.

---

## DAY 2(26<sup>th</sup> September 2018):

The session begun with interfacing of a 16x2 LCD. The LCD display has 13 pins:

- Pin 1: Gnd
- Pin 2: Vcc
- Pin 3: RS – Register Select – RS=0 for command, RS=1 for data
- Pin 4: R/W – Read/Write – R/W=0 for write, R/W=1 for read
- Pin 5: EN – Enable – high to low pulse is given to enable to display something on the LCD
- Pin 6 to 13: D0 to D7- 8 data lines

The LCD has an operating voltage of 5V. The address of the first line of display is from 0x80 to 0x8F and second line of display is from 0xC0 to 0xCF. Each grid is a 5x8 matrix. The LCD can display upto 40 characters per line

The LCD programming involves 5 functions: `enable()`, `command()`, `data()`, `initial()` and `string()`. The interfacing involved displaying a string, displaying 2 strings on 2 separate lines, displaying a string Right to Left, Scrolling the string on the LCD. One can also display customized characters on the LCD.

The session continued with interfacing of a Push Button switch. The push button switch has 2 pins:

- GPIO
- GND

When the switch is not pressed the status of the GPIO is 1, but when the switch is pressed the status of the GPIO is 0. While programming the push button one needs to account for the Debounce in the switch. The switch programming was done to turn ON/OFF the LED on pressing of the push button.

The session moved on with the interfacing on an IR sensor. IR sensor has 3 pins:

- Vcc
- GND

- GPIO

The status of the GPIO pin is 1 if an object is not detected and the status of the GPIO pin is 0 if an object is detected. The interfacing programming was done to display the status of an IR sensor on LED, then on LCD.

The session ended with the discussion on the Fire sensor. The fire sensor had 4 pins:

- AO – Analog output
- DO – Digital output
- GND
- Vcc

The fire sensor detects if there is a fire if the bud like end is heated. If the bud gets heated it internally causes the status to go 0 otherwise the status remains 1. The indication of Fire or No Fire is done using a LCD display.

---

## DAY 3(27<sup>th</sup> September 2018):

The session begun with the discussion on Relays. A relay comprises of 2 parts – Primary and Secondary but there is no connection between them. The relay has 6 pins:

Input:

- Vcc
- GND
- IN

Output:

- NC
- COM
- NO

The relay is supplied with an input of 3.3V. The primary part is connected to the microprocessor or microcontroller and the secondary part is connected to AC or DC devices. When there is no supply voltage the COM points to NC and when there is a supply voltage is provided the COM points to NO.

The relay interfacing was done to blink the LED based on the status of the relay.

The session continued with the discussion on motors. There are 2 types of motors: AC and DC. The type of motor to be used is decided on the basis of the voltage and current ratings and also on the load it has to drive.

The DC motor was interfaced with the pi using L293 motor driver. L293 has 16 pins and can drive 2 motors. There are 4 control lines: in1, in2 for Motor1 and in3, in4 for Motor2. The inputs on the control lines are as:

in1   in2   output

0   0   stop the motor

0   1   rotate the motor in clockwise direction

1    0    rotate the motor in anticlockwise direction

1    1    stop the motor

The motor was interfaced to rotate in clockwise and then anticlockwise direction, also the motor was rotated on the pressing on a push button switch.

The session continued with the discussion on DHT-11 sensor. The DHT-11 sensor is used to find the temperature and humidity and works on 1 wire protocol. The sensor has 3 pins:

- Vcc
- DATA
- GND

The DATA pin is connected to GPIO4 pin of the raspberry pi and the DHT-11 is interfaced to find the real time temperature and humidity.

Then the discussion continued with the interfacing of Ultrasonic sensor HS04. HS04 has 4 pins:

- Vcc
- Trig
- Echo
- GND

The sensor was interfaced to find the distance, also different LEDs were glowed based on the distance measured by the ultrasonic sensors.

The session continued with the discussion on Bluetooth protocol. In order to use Bluetooth it requires Bluetooth serial controller. The Bluetooth module has 6 pins:

- State
- Rx
- Tx

- GND
- +5V
- EN

The Bluetooth controller is paired with the built in Bluetooth of the raspberry pi.

Upon interfacing 2 functions were perform: reading data from Bluetooth device and writing data to the Bluetooth device. Also the LED was turned ON/OFF based on the data sent from the Bluetooth device.

The session ended with the discussion on RFID. The RFID uses SPI based protocol. The transmitter is the RFID tags which have an in built chip that contain the id number and the receiver is a RFID\_RC522 which has 8 pins:

- 3.3V
- RST
- GND
- IRQ
- MISO
- MOSI
- SCK
- SDA

The interfacing of the RFID tags were first done to find the id numbers and the one id was considered valid and the other was considered invalid.

---



## DAY 4(28<sup>th</sup> September 2018):

The session begun with the discussion on GSM module which follows serial protocol. The communication depends on AT commands, which are passed from the Raspberry pi to the GSM.

The GSM module was interfaced to call from the module to the number provided in the program, to send message from the module. Also to programmatically cut or receive call the GSM.

The session continued with the discussion on GPS. GPS follows serial communication protocol. It contains an antenna which provides the real time data from which the latitude and longitude is retrieved. This retrieval is based on Signal triangulation.

The session moved on with the discussion on clouds. Clouds are remotely accessible servers. They are of 2 types: Public and Private. The stored data is accessed using the Internet.

The session ended with the discussion on IoT. IoT is an abbreviation for Internet of Things, which revolves around linking devices with Internet. It requires a client server say Ubidots through which either data is sent to control the devices connected to the raspberry pi or it stores the data obtained from the raspberry pi. All this communication occurs wirelessly.

---

DAY 5(29<sup>th</sup> September 2018):

The last day of the 5 day workshop concluded with the implementation of the real time applications using Raspberry pi.

Mini projects were demonstrated to implement the device interfacing learnt over the past 4 days.





# Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

An Autonomous Institute, Affiliated to VTU, Belgaum ,Aided by Govt. of Karnataka  
Near Jnanabharathi Campus, Mallathalli, Bangalore-560056



***Cordially Welcomes you for the Inauguration of***  
***TEQIP-III Sponsored Workshop on***  
**“Embedded Systems and Its Applications on  
Robotics”**

**From 29<sup>th</sup> January to 2<sup>nd</sup> February 2019**

**Date : 29-01-2019      Venue: Seminar Hall-A406, Dr.AIT      Time: 9:30AM**

**Organised By**  
**Department Of Electronics & Instrumentation Engineering**

**Cordinators :**  
**Shubha.P**  
**Dr.Ganapathi V Sagar**  
**Dept. of EIE**

**Chief Coordinator :**  
**Dr. M.Meenakshi**  
**Professor & Head, Dept. of**  
**EIE**







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Dean, Continuing Education  
IIT Kharagpur

Sep-Oct 2020  
(4 week course)

**Prof. Debjani Chakraborty**  
Coordinator, NPTEL  
IIT Kharagpur



Indian Institute of Technology Kharagpur





# GREAT EXPERIMENTS IN PSYCHOLOGY

## **PROF. RAJLAKSHMI GUHA**

Department of Humanities and Social Sciences

IIT Kharagpur

**PRE-REQUISITES** : None – but preferably with a background in Psychology

**INTENDED AUDIENCE** : Psychology, Humanities and Social Sciences, Management, Computer Science

**INDUSTRIES APPLICABLE TO** : Any company has to manage its services. Hence, any company will recognize/value this online course.

## **COURSE OUTLINE :**

Psychology as a subject interests many but what is popularly known are the common views that humans hold about their race. Over the century, the subject's endeavour to establish itself as a science through various experiments remains unknown to many.

The present course attempts to share the most important experiments in the history of Psychology that has helped shape its identity. It aims to aid students' understanding of how to design experiments with human subjects and assist the student to understand Psychology with a scientific eye.

## **ABOUT INSTRUCTOR :**

Prof. Rajlakshmi Guha is an Assistant Professor in the Centre for Educational Technology, IIT Kharagpur. Her areas of interest are Perception, Attention, Memory processes, Physiological basis of emotion, student mental health.

## **COURSE PLAN :**

**Week 1:** History and genesis of Psychology as a Science

**Week 2:** Classic studies in Cognitive and Social Psychology

**Week 3:** Famous studies in Clinical and Health Psychology

**Week 4:** Experiments in Individual differences and cultural diversity