



# LJ University

University with a Difference

## Diploma Engineering Semester VI

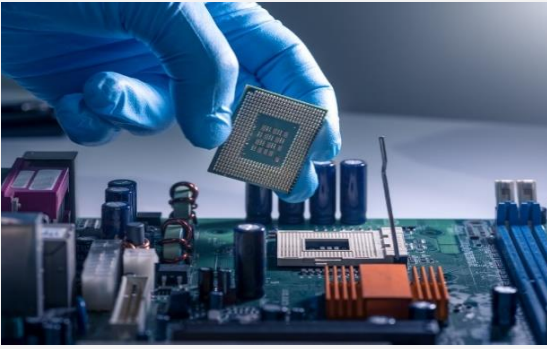


Computer, IT & AIML

# HANDBOOK

LJ Polytechnic

# An Overview of Major Computer & Technology Disciplines



**Computer Engineering** is a branch of engineering that integrates several fields of computer science and electronic engineering required to develop computer hardware and software. Computer engineers design, test, implement and maintain computer software and hardware systems.

**Information Technology (IT)** is the use of computers to store or retrieve data and information. IT is typically used within the context of business operations as opposed to personal or entertainment technologies. You can find IT specialization in every branch of education, from IT & Software, Engineering, Aviation and Medicine to MBA and even Hospitality.



**Artificial Intelligence (AI)** is intelligence demonstrated by machines, as opposed to the natural intelligence displayed by humans or animals. AI applications include advanced web search engines, recommendation systems used by YouTube, Amazon and Netflix, Siri or Alexa, Tesla, and strategic game systems (such as chess and Go).

**Cloud Computing & Big Data** is the on-demand availability of computer system resources, especially data storage (cloud storage) and computing power, without direct active management by the user. Big data is a field that treats ways to analyze, systematically extract information from, or otherwise, deal with data sets that are too large or complex to be dealt with by traditional data-processing application software.



**Gaming & Animation** is the process of developing/designing a game. The effort is undertaken by a developer, ranging from a single person to an international team dispersed across the globe. Animation is a method in which figures are manipulated to appear as moving images. Various tools available in the market today, ease out the tasks of game development and animation.

## **Disclaimer**

This handbook is compiled to provide subject information to the students. Every effort has been made to avoid errors & omissions and ensure accuracy. Any error noted may be brought to the notice of the compiler, which shall be taken care of in the updated edition of this handbook. The sources of information/material are provided in the appendix.

The information contained in this handbook is strictly for education and learning purposes and not for any commercial use.

Furthermore, The University reserves the right to unilaterally and without notice make changes to this handbook at any time.

# Evaluation Methodology

## Theory Marks

### **PA: Progressive Assessment**

Units' examinations will be conducted during the semester. Each unit examination is compulsory. Unit examination may be taken from objectives, short questions, long questions, etc.

Unit-1 Exam:	Maximum Marks 10
Unit-2 Exam:	Maximum Marks 10
Unit-3 Exam:	Maximum Marks 10
Unit-4 Exam:	Maximum Marks 10
<hr/>	
<b>Total Marks</b>	<b>40</b>

### **ESE: End Semester Exam**

End semester examination will be conducted from all Five (5) units and it is compulsory. It may be taken in the form of objectives, short questions, long questions etc.

End Semester Exam:	Maximum Marks 50
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### **CA: Continuous Assessment**

Continuous assessment will be evaluated from the activity assigned in the semester and the attendance of that particular subject.

Activity Assessment / Attendance:	Maximum Marks 10
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## Practical Marks

### **PV: Practical Viva**

Practical viva will be conducted through group task. Thereafter viva will be conducted individually based on the given task of the concerned subject.

Practical Viva:	Maximum Marks 30
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### **TW: Term Work**

Term work will be considered from the assignment and laboratory work done by the student during the semester of that particular subject.

Term Work:	Maximum Marks 20
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## EVALUATION SCHEME

The performance of students is evaluated on the basis of continuous and semester-end examinations with letter grades O+++, O++, A++, B, etc. Which have numerical equivalents called grade points as indicated below:

Percentage		Grade Point	Grade	Class
95	100	10	O+++	First Class with Distinction
90	94	9.5	O++	
85	89	9	O+	
80	84	8.5	O	
75	79	8	A++	
70	74	7.5	A+	
65	69	7	A	First Class
60	64	6.5	B++	
55	59	6	B+	Higher Second Class
50	54	5.5	B	Second Class
45	49	5	C	
40	44	4.5	D	
35	39	4.0	E	Pass Class
less than 35		0	F	Fail

The performance of a student in a semester is indicated by a number called SPI (Semester Performance Index). The SPI is the weighted average of the grade points obtained in all the subjects taken by the student during the semester. Example: Suppose in a given semester a student has taken subjects having credits C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub>, C<sub>5</sub>..... And the numerical equivalent of grades obtained in those subjects are G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub>, G<sub>4</sub>, and G<sub>5</sub> respectively.

$$\text{Then his/her SPI} = \frac{\text{Grade Points Earned}}{\text{Total Offered Credits}} = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$$

SPI will be calculated (after re-examination, if any) up to two decimal places on the basis of the final grades.

An overall assessment from the time the student entered the course is obtained by calculating PPI (Progressive Performance Index). The PPI is the weighted average of the grade points obtained in all the subjects taken by the student since he/she entered the course. It is calculated in the same manner as the SPI. The CGPA (Cumulative Grade Points Average) is the weighted average of the grade points obtained in all the subjects in the last six semesters of the course.

### Detention:

#### Formula for conversion of equivalent percentage of PPI

An equation to find equivalence between PPI or CGPA may be obtained as follows:

Percentage Marks = (PPI or CGPA — 0.5) x 10. SPI or PPI or CGPA equivalent class shall be as follows:

Below 4.00	: Fail
4.00 – 4.49	: Pass Class
4.50 – 5.50	: Second Class
5.51 – 6.00	: Higher Second Class
6.01 – 7.49	: First Class
7.50 and above	: First Class with Distinction

For all courses, where the duration of the course is more than 2 years, the degree shall be awarded to the students on the basis of CGPA of the last six semester's performance in the exams.







In case of the courses where duration is of two years, the degree shall be awarded to students based on PPI considering the performance in all four semesters.



## About Bloom's Taxonomy

Bloom's Taxonomy is a classification of the different objectives and skills that educators set for their students (learning objectives). The taxonomy was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago. The terminology has been recently updated to include the following six levels of learning. These 6 levels can be used to structure the learning objectives, lessons, and assessments of your course.

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
2. **Understanding:** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
3. **Applying:** Carrying out or using a procedure for executing, or implementing.
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing.
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

BLOOM'S TAXONOMY DIGITAL PLANNING VERBS					
REMEMBERING	UNDERSTANDING	APPLYING	ANALYZING	EVALUATING	CREATING
					
Copying Defining Finding Locating Quoting Listening Googling Repeating Retrieving Outlining Highlighting Memorizing Networking Searching Identifying Selecting Tabulating Duplicating Matching Bookmarking Bullet-pointing	Annotating Tweeting Associating Tagging Summarizing Relating Categorizing Paraphrasing Predicting Comparing Contrasting Commenting Journaling Interpreting Grouping Inferring Estimating Extending Gathering Exemplifying Expressing	Acting out Articulate Reenact Loading Choosing Determining Displaying Judging Executing Examining Implementing Sketching Experimenting Hacking Interviewing Painting Preparing Playing Integrating Presenting Charting	Calculating Categorizing Breaking Down Correlating Deconstructing Linking Mashing Mind-Mapping Organizing Appraising Advertising Dividing Deducing Distinguishing Illustrating Questioning Structuring Integrating Attributing Estimating Explaining	Arguing Validating Testing Scoring Assessing Criticizing Commenting Debating Defending Detecting Experimenting Grading Hypothesizing Measuring Moderating Posting Predicting Rating Reflecting Reviewing Editorializing	Blogging Building Animating Adapting Collaborating Composing Directing Devising Podcasting Wiki Building Writing Filming Programming Simulating Role Playing Solving Mixing Facilitating Managing Negotiating Leading



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# INTERNET OF THINGS

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**LJ Polytechnic**

**Prepared and Compiled by  
CE & IT Department**

## Course

<b>Course Name</b>	Internet of Things					
<b>Course Type</b>	HSSC	BSC	ESC	PCC	OEC	PEC

**Legends:** HSSC: Humanities and Social Sciences Courses

BSC: Basic Science Courses

ESC: Engineering Science Courses

PCC: Program Core Courses

OEC: Open Elective Courses

PEC: Program Elective Courses

## Teaching and Evaluation Scheme

Teaching Hours / Week				Evaluation Scheme							
				Theory Marks				Practical Marks			Total Marks
L	T	P	Total Credit	ESE	CA	PA	Total	PV	TW	Total	
3	-	4	5	50	10	40	100	30	20	50	150

**Legends:** ESE: End Semester Exam

CA: Continuous Assessment (Attendance + Activity)

PA: Progressive Assessment

PV: Practical Viva

TW: Term Work



## Contents

Unit No.	Topics	Sub-Topics	Learning Outcomes	% Weightage	Hours
1	<b>Introduction to Internet of Things</b>	1.1. Introduction of IoT 1.2. Characteristics of IoT Data (Streaming, High-volume, Semi-structured) 1.3. Models for IoT 1.4. Technology Roadmap 1.5. Benefits of IoT 1.6. Impact of IoT on the Business Landscape	<ul style="list-style-type: none"> <li>To understand basics of IoT</li> <li>To understand models of IoT</li> <li>To understand benefits and impact of IoT</li> </ul>	15	6
2	<b>IoT Architecture &amp; Challenges</b>	2.1. Architecture 2.2. IoT reference Model & Architecture 2.3. Functional, Information, Deployment & Operational View 2.4. Size & Space Considerations in IoT 2.5. Scalability & Compatibility between Different Smart Sensors	<ul style="list-style-type: none"> <li>Understand IoT architecture</li> <li>Understand different views in IoT</li> <li>To check scalability and compatibility of sensors</li> </ul>	20	8
3	<b>IoT Applications in Industries</b>	3.1. Building and Home Automation 3.2. Retail 3.3. Media 3.4. Supply Chain 3.5. Environmental Monitoring. 3.6. Infrastructure Management 3.7. Manufacturing 3.8. Pharmaceuticals and Healthcare	<ul style="list-style-type: none"> <li>To understand applications of IoT</li> </ul>	25	10

		3.9. Transportation			
4	IoT Challenges	4.1. Security & Privacy Concerns 4.2. Fragmentation of Standards 4.3. Scalability 4.4. Compatibility between Different Smart Sensors	<ul style="list-style-type: none"> <li>To understand privacy, security and governance in IoT.</li> <li>To understand data aggregation.</li> </ul>	20	10
5	Introduction to Arduino & Raspberry Pi	5.1. Architecture, Programming & Applications of Arduino. 5.2. Architecture, Programming & Applications of Raspberry Pi. 5.3. Raspberry Pi Setup & Configuration. 5.4. Raspberry Pi vs. Arduino	<ul style="list-style-type: none"> <li>To learn programming with Arduino and sensors</li> <li>To learn programming with Raspberry Pi and sensors</li> </ul>	20	8

**Total Hours**      **42**

### Suggested Specification Table with Hours

Unit No.	Chapter Name	Teaching Hours	Distribution of Topics According to Bloom's Taxonomy					
			R %	U %	App %	C %	E %	An %
1	Introduction to Internet of Things	6	40	30	20	-	5	5
2	IoT Architecture & Challenges	8	30	30	20	10	5	5
3	IoT Applications in Industries	10	20	30	30	10	5	5
4	IoT Challenges	10	20	20	20	10	15	15
5	Introduction to Arduino & Raspberry Pi	8	20	20	30	10	10	10

**Legends:**      R: Remembering      U: Understanding  
                     App: Applying      C: Creating  
                     E: Evaluating      An: Analyzing

### **Textbooks**

- 1) IoT Fundamentals, David Hence, Latest Edition, Cisco Press Publications
- 2) Internet of Things: Architecture and Design Principles, Raj Kamal, Latest Edition, McGraw Hill Education Publications
- 3) Internet of Things (A Hands-on-Approach), Vijay Madisetti and Arshdeep Bahga, Latest Edition, University Press (India) Private Limited Publications.

### **Reference Books**

- 1) Internet of Things, Vasudevan, Nagrajan and Sundaram, Latest Edition, Wiley India Publications
- 2) IoT Based Projects, Rajesh Singh, Latest Edition, BPB Publications

### **Open Sources (Website, Video, Movie)**

- 1) <https://www.microsoft.com/en-us/internet-of-things/>
- 2) <https://online.stanford.edu/courses/xee100-introduction-internet-things>
- 3) <https://www.coursera.org/learn/introduction-iot-boards>
- 4) [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

## Introduction

Internet of Things plays an important role in connecting the things i.e. variety of devices through the internet. The IoT has emerged as a cutting-edge technology with applications in manufacturing, healthcare, agriculture, transport, mining, smart cities and many more. This subject covers the fundamentals of IoT with its architecture, protocols and applications. It also covers the overview and programming of two widely used IoT platforms Arduino and Raspberry Pi.

## Objectives

- ✓ The theory should be taught and practiced in such a way that students are able to achieve different learning outcomes in the cognitive, psychomotor and affective domains to demonstrate the following learning outcomes.
- ✓ Understand how IoT is used in day to day life.
- ✓ Learn architecture of IoT.
- ✓ Various applications and challenges of IoT.
- ✓ Working with Arduino and Raspberry Pi.

## Subject's Learning Outcomes

- ✓ This course is aimed to make students aware of Internet of Things.
- ✓ Upon successfully and thoroughly going through this course will serve as a stepping stone for the learner in the world of IoT.
- ✓ The course highlights the basics of IoT, models of IoT, benefits and impacts of IoT.
- ✓ The course further equips students with architecture and applications of IoT.
- ✓ The course provides an understanding of the data aggregation.
- ✓ The course helps students to learn programming with Arduino and sensors as well as Raspberry Pi and sensors.





# Introduction to Internet of Things

## Short Questions

<b>Q. No.</b>	<b>Sample Questions</b>	<b>Bloom's Taxonomy</b>
1.	Define IoT.	Remember
2.	List out various characteristics of IoT.	Understand
3.	List out names of various models of IoT.	Understand
4.	Define Sensor.	Remember
5.	Which are the fundamental components of IoT system?	Remember

## Long Questions

<b>Q. No.</b>	<b>Sample Questions</b>	<b>Bloom's Taxonomy</b>
1.	In IoT, things can be put into how many categories? Explain them in detail.	Understand
2.	Explain the Request Response Model and Publisher Subscriber Model of IoT with neat diagrams.	Understand
3.	Explain the Push Pull Model and Exclusive Pair Model of IoT with neat diagrams.	Understand

## Essential Assignments

1. List out and explain various characteristics of IoT in detail.
2. Explain various models of IoT in detail.
3. What are the impacts of IoT on Business Landscape?
4. Explain various benefits of IoT.
5. Explain the approach for developing Technology Roadmap in detail.

## Desirable Assignments

1. List out various IoT Enabling Technologies and explain any one of them in detail.

2. How does IoT affect in our everyday life?
3. With a neat sketch, explain IoT Stack with appropriate example of each layer.

### Activities

1. List out some popular companies that are working on IoT and how they are working on same.
2. Prepare case study on how IoT is used in real life?

### Learning Outcomes

- ❖ Better understanding of basics of IoT, models of IoT, benefits and impacts of IoT will be acquired.





# IoT Architecture & Challenges

## Practical List

1. Sketch the architecture of IoT Toolkit and prepare report of each entity in brief.

## Short Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	List out various views of IoT Reference Architecture.	Remember
2.	What do you mean by Smart Sensor?	Remember
3.	List out various most commonly used Smart Sensors.	Understand
4.	What is the use of Operational View?	Understand

## Long Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What are the advantages and disadvantages of Smart Sensors?	Understand
2.	Explain the working of Smart Sensor.	Understand
3.	Explain Functional View in detail.	Remember
4.	Explain Information View in detail.	Remember

## Essential Assignments

1. Explain IoT Reference Model in brief with necessary diagram.
2. Explain IoT Reference Architecture in brief with necessary diagram.
3. Explain Size and Space Considerations in IoT.
4. Explain the working of Temperature Sensors in brief.
5. Explain the working of Humidity Sensors in brief.

### **Desirable Assignments**

1. How are Smart Sensors different from Base Sensors?
2. What are the scalability and compatability issues in Temperature Sensor and how can it be solved?

### **Activities**

1. Prepare case study on Smart Wearable Sensors.
2. Prepare case study on the use of sensors for Smart Water Management.

### **Learning Outcomes**

- ❖ Better understanding of IoT Reference Architecture and IoT Reference Model will be acquired by the students.
- ❖ Knowledge regarding various types of Smart Sensors and how they are actually used will be aquired.



# IoT Applications in Industries

## Practical List

1. Prepare a report on how IoT has been helpful during COVID pandemic.
2. Prepare a case study on car featuring IOT.
3. Prepare a case study on Smart City.

## Short Questions

<b>Q. No.</b>	<b>Sample Questions</b>	<b>Bloom's Taxonomy</b>
1.	List out applications of IoT.	Understand
2.	Explain the term "Smart City" in IoT.	Understand
3.	List out name of components that can be used in Home Automation.	Understand
4.	What are the challenges of IoT in Healthcare?	Understand

## Long Questions

<b>Q. No.</b>	<b>Sample Questions</b>	<b>Bloom's Taxonomy</b>
1.	What are the advantages of IoT in Transportation Sector?	Understand
2.	What are the applications of IoT in Smart Cities?	Understand
3.	What are the advantages of IoT in Healthcare?	Understand
4.	Which devices are used for IoT based Environmental Monitoring?	Understand

## Essential Assignments

1. Explain basic steps of Environmental Monitoring using IoT in detail.
2. Explain various applications of IoT in Transportation in detail.
3. Explain various applications of IoT in Healthcare in detail.
4. How does IoT help in Infrastructure Management?

5. How does IoT help in Supply Chain Management?

### **Desirable Assignments**

1. What is the use of IoT in Manufacturing Industry?
2. What is the use of IoT in Media? Explain briefly.
3. How IoT can be used in Home Automation System? Explain briefly.

### **Activities**

1. Prepare case study on the economic impacts of the increased applications of IoT.
2. Prepare case study on how IoT helps in Smart Locking System.

### **Learning Outcomes**

- ❖ Knowledge related to various applications of IoT and their actual implementation in real world will be gained.

## 4

# IoT Challenges

## Practical List

1. Prepare case study on sensing temperature with temperature sensor.
2. Prepare case study on sensing humidity with humidity sensor.

## Short Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What are challenges or risks associated with IoT?	Understand
2.	What are the top security challenges for IoT?	Understand
3.	What are IoT testing approaches?	Remember
4.	Define Scalability in terms of IoT.	Remember

## Long Questions

Q. No.	Sample Questions	Bloom's Taxonomy
1.	What are the top challenges in IoT and how to solve those challenges?	Understand
2.	Which are some of the biggest security vulnerabilities that comes with IoT?	Understand
3.	Which type of testing approaches are recommended for IoT?	Understand
4.	Why Scalability is important in IoT?	Understand

## Essential Assignments

1. What are the main challenges of IoT? Explain them in brief.
2. Describe security and privacy concerns in IoT briefly.
3. Explain standard fragmentation in IoT challenges.
4. What steps can an organization take to protect IoT system and devices? Explain in detail.

5. Explain compatibility between different smart sensors.

### Desirable Assignments

1. Which different kind of tests should be carried out on IoT system?
2. Should the customers be worried about the security and protection issues considering the measure of information IoT gathers?
3. List out different Smart Sensors. What is the compatibility between different Smart Sensors?

### Activities

1. Prepare case study to check out different types of testing being performed on IoT system to ensure security and privacy.
2. Prepare case study to identify which top company uses IoT in which field and which database is used to store the confidential data by those companies?

### Learning Outcomes

- ❖ Better understanding of security, privacy and governance in IoT.
- ❖ Knowledge related to how data aggregation can be used in IoT will be gained.





# Introduction to Arduino & Raspberry Pi

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## Practical List

1. Familiarization with Raspberry Pi and perform necessary software installation.
2. Prepare a case study on working with Raspberry Pi.
3. Prepare a case study on working with Arduino.
4. Set up and operate the Arduino.
5. Design a code that blinks LED using Arduino.
6. Design a code that blinks 2 LEDs using Arduino.
7. Create a code that rotates the servo from 0 to 360 degrees and then returns to 0 degrees.
8. Create a code that controls the motor both clockwise and anticlockwise.
9. Create a toy car that will move forward, backward, left, right and in any direction.

## Short Questions

<b>Q. No.</b>	<b>Sample Questions</b>	<b>Bloom's Taxonomy</b>
1.	What is Arduino?	Remember
2.	What is Raspberry Pi?	Remember
3.	What are some key components for an Arduino project?	Remember
4.	What are the advantages of Arduino?	Remember
5.	How is Raspberry Pi used in IoT?	Understand

## Long Questions

<b>Q. No.</b>	<b>Sample Questions</b>	<b>Bloom's Taxonomy</b>
1.	Explain various features of Arduino.	Understand
2.	Explain various applications of Arduino.	Understand
3.	Explain various features of Raspberry Pi.	Understand
4.	Explain various applications of Raspberry Pi.	Understand

### Essential Assignments

1. Explain Arduino Architecture with suitable diagram.
2. Explain Raspberry Pi Architecture with suitable diagram.
3. Write down difference between Arduino and Raspberry Pi.
4. Explain Raspberry Pi setup and configuration stepwise.

### Desirable Assignments

1. Which functions are used to read analog and digital data from a sensor in Arduino?
2. List out available models of Raspberry Pi and explain them in detail.
3. Explain stepwise how to install new library in Arduino.

### Activities

1. Write Raspberry Pi code to blink LED ON and OFF.

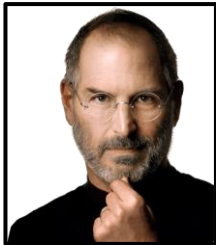
### Learning Outcomes

- ❖ Knowledge about basics, architecture, applications, setup and configuration of Arduino will be gained.
- ❖ Knowledge about basics, architecture, applications, setup and configuration of Raspberry Pi will be gained.
- ❖ Programming with Arduino and sensors as well as Raspberry Pi and sensors will be learnt by the students.

# Quotes from Pioneers

*"The advance of technology is based on making it fit in so that you do not really even notice it, so it is part of everyday life."*

**- Bill Gates, Co-Founder, Microsoft.**



*"Have the courage to follow your heart and intuition. They somehow already know what you truly want to become. Everything else is secondary."*

**- Steve Jobs, Co-Founder, Apple Inc.**

*"Success breeds complacency. Complacency breeds failure. Only the paranoid survives."*

**- Andy Grove, Former Chairman & CEO, Intel.**

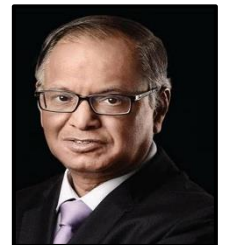


*"If you are changing the world, you are working on important things. You're excited to get up in the morning."*

**- Larry Page, Co-Founder, Google & Alphabet Inc.**

*"Progress is often equal to the difference between mind and mindset."*

**- N. R. Narayana Murthy, Chairman Emeritus, Infosys.**

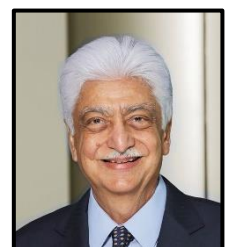


*"The only way to learn new programming language is by writing programs in it."*

**- Dennis Ritchie, Co-Creator of C Programming.**

*"Success is achieved twice. Once in the mind and the second time in the real world."*

**- Azim Premji, Founder Chairman, Wipro.**



*"The digital world has power because it has dynamic information, but it's important that we stay human instead of being another machine sitting in front of a machine."*

**- Pranav Mistry, President & CEO of STAR Labs.**



# LJ Polytechnic



## Offers Diploma in

- ❖ Artificial Intelligence & Machine Learning
- ❖ Electronics & Communication Engineering
- ❖ Cloud Computing & Big Data
- ❖ Architectural Assistantship
- ❖ Automation & Robotics
- ❖ Gaming & Animation
- ❖ Automobile Engineering
- ❖ Mechanical Engineering
- ❖ Information Technology
- ❖ Computer Engineering
- ❖ Electrical Engineering
- ❖ Civil Engineering



[info\\_poly@ljk.edu.in](mailto:info_poly@ljk.edu.in)



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9687010057  
9228010057



**LJ Campus,**  
**Near Sarkhej-Sanand Circle, Off. S. G. Road, Ahmedabad, Gujarat-382210**