

EXAM CAPSULE

FOR

O LEVEL NIELIT EXAM

IOT

INTERNET OF THINGS

COMPACT. CONCISE. COMPLETE.

Your Quick Guide to Exam Success



Exam Focused
Topic-wise coverage
as per O Level syllabus



Quick Revision
Key points, summaries
& important concepts



Practice Oriented
Solved examples &
practice questions



Real-World Ready
IoT applications,
use cases & projects



Exam Ready
Important questions
& exam tips



BASED ON
LATEST SYLLABUS



TRUSTED BY
STUDENTS



LEARN SMART
SCORE HIGH



STEP CLOSER TO
SUCCESS



INTRODUCTION TO INTERNET OF THINGS (IoT)

Applications / Devices, Protocols & Communication Model



1. INTRODUCTION - OVERVIEW OF IoT

- Internet of Things (IoT) connects physical objects to the internet enabling them to sense, collect, exchange and act on data.
- Enables smarter decisions, automation, and improved efficiency.
- IoT bridges the gap between the physical and digital world.

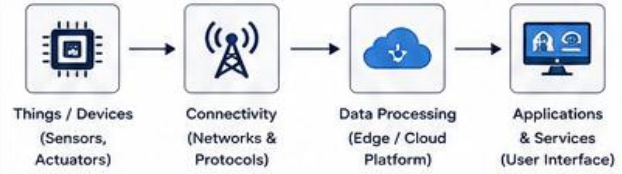


2. CHARACTERISTICS OF DEVICES AND APPLICATIONS IN IoT

- ✓ Connectivity (always connected)
- ✓ Sensing & Data collection
- ✓ Intelligence & Autonomy
- ✓ Heterogeneity & Interoperability
- ✓ Dynamic & Self-configuring
- ✓ Scalability
- ✓ Low power operation
- ✓ Security & Privacy



3. BUILDING BLOCKS OF IoT

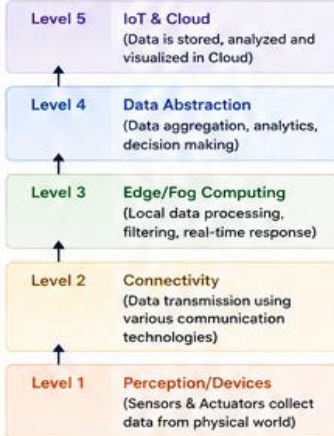


- Devices collect data from the physical world.
- Connectivity transports data.
- Data Processing stores, analyzes and makes it useful.
- Applications deliver value to users.

4. VARIOUS TECHNOLOGIES MAKING UP IoT ECOSYSTEM

- Sensors & Actuators
- Embedded Systems & MCUs
- Communication Technologies (Wi-Fi, Bluetooth, ZigBee, LoRa, Cellular, NFC, RFID, etc.)
- Cloud Computing & Storage
- Data Analytics & AI/ML
- Security Technologies
- Middleware & APIs
- User Interfaces (Web/Mobile)

5. IoT LEVELS

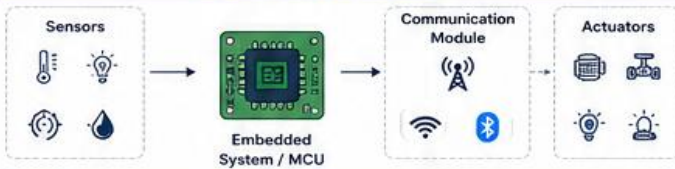


6. IoT DESIGN METHODOLOGY



- Key Considerations**
- ✓ Scalability
 - ✓ Interoperability
 - ✓ Reliability
 - ✓ Security
 - ✓ Privacy
 - ✓ Cost & Power Efficiency

7. PHYSICAL DESIGN OF IoT



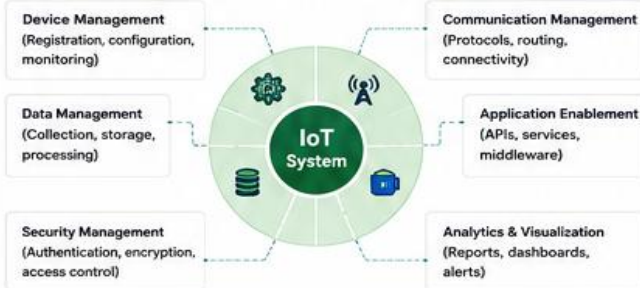
- ✓ Interfaces with real world through sensors and actuators.
- ✓ Consists of embedded controller, power supply and communication module.
- ✓ Focus on reliable data acquisition and device control.

8. LOGICAL DESIGN OF IoT



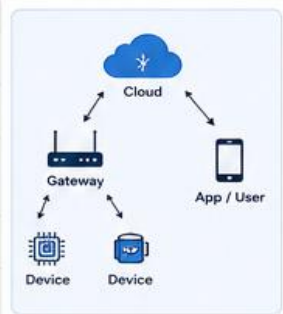
- ✓ Defines how data flows and is transformed.
- ✓ Includes rules, analytics, events and business logic.
- ✓ Maps to software services, cloud functions and databases.

9. FUNCTIONAL BLOCKS OF IoT



10. COMMUNICATION MODELS IN IoT

Model	Description	Example
Device-to-Device (D2D)	Devices communicate directly without cloud.	Bluetooth, ZigBee
Device-to-Cloud (D2C)	Devices send data to cloud for storage and processing.	Wi-Fi, Cellular
Device-to-Gateway (D2G)	Devices communicate with a local gateway for processing or forwarding.	ZigBee to Gateway, LoRaWAN
Back-End Data Sharing (Cloud-to-Cloud)	Data shared between cloud services and applications.	Cloud APIs
Device-to-Everything (D2X)	Devices communicate with people, devices and services.	IoT ecosystems, smart systems



11. DEVELOPMENT TOOLS USED IN IoT

Hardware Platforms <ul style="list-style-type: none"> • Arduino • Raspberry Pi • ESP32 / ESP8266 • BeagleBone 	Software / SDKs <ul style="list-style-type: none"> • Arduino IDE • PlatformIO • Python / MicroPython • Node-RED 	Cloud Platforms <ul style="list-style-type: none"> • AWS IoT • Microsoft Azure IoT • Google Cloud IoT • IBM Watson IoT
Simulation & Testing Tools <ul style="list-style-type: none"> • TinkerCAD • Cisco Packet Tracer • NS-3 • MATLAB/Simulink 	IoT Frameworks <ul style="list-style-type: none"> • ThingsBoard • Eclipse Kura • FIWARE • OpenHAB 	

12. KEY TAKEAWAYS

- ✓ IoT connects physical devices to the internet for intelligent decision making.
- ✓ It consists of devices, connectivity, processing and applications.
- ✓ Multiple technologies and protocols enable IoT communication.
- ✓ IoT operates across multiple levels from perception to cloud.
- ✓ Well-planned design (physical + logical) ensures reliable and secure IoT systems.
- ✓ Communication models define how data flows between entities.
- ✓ Development tools accelerate IoT prototyping and deployment.



IoT is not just about connecting things, it's about creating smarter experiences and a better future.



Connect • Sense • Think • Act
That's IoT!



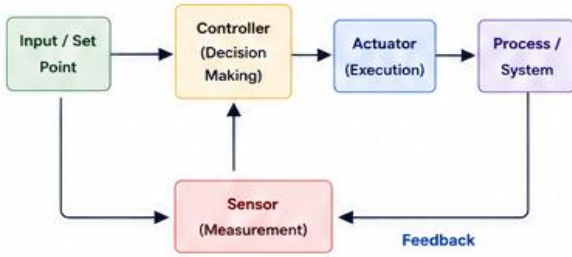
THINGS AND CONNECTIONS

IoT in Action: Systems, Connectivity & Process Flow



1. WORKING OF CONTROLLED SYSTEMS

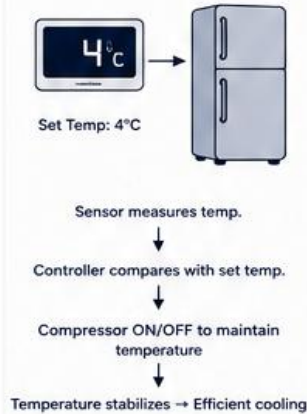
A controlled system uses sensors, a controller and actuators to monitor and control a process to achieve desired output.



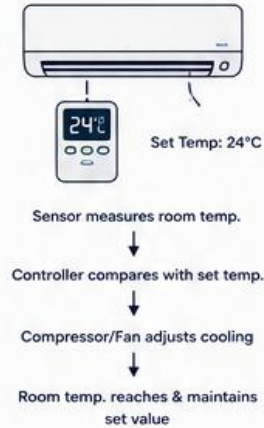
💡 Controller compares actual output with desired value and acts through actuators to minimize the error.

2. REAL-TIME SYSTEMS WITH FEEDBACK LOOP (EXAMPLES)

Thermostat in Refrigerator



Air Conditioner (AC)



Other Examples

- Smart Fan Speed Control
- Automatic Lighting
- Industrial Motor Speed Control
- Smart Water Heater
- Traffic Signal Control

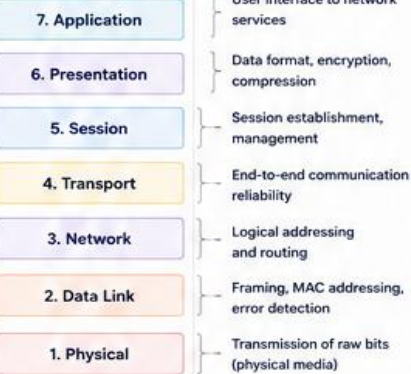
★ Feedback loop makes the system smart, efficient and responsive to real-world changes.

3. CONNECTIVITY MODELS - TCP/IP VS OSI MODEL

TCP/IP Model (4 Layers)



OSI Model (7 Layers)



💡 TCP/IP is simpler & used in Internet protocols. OSI model is a reference model for understanding networking.

4. CONNECTIVITY MODES - WIRED VS WIRELESS

Wired Modes

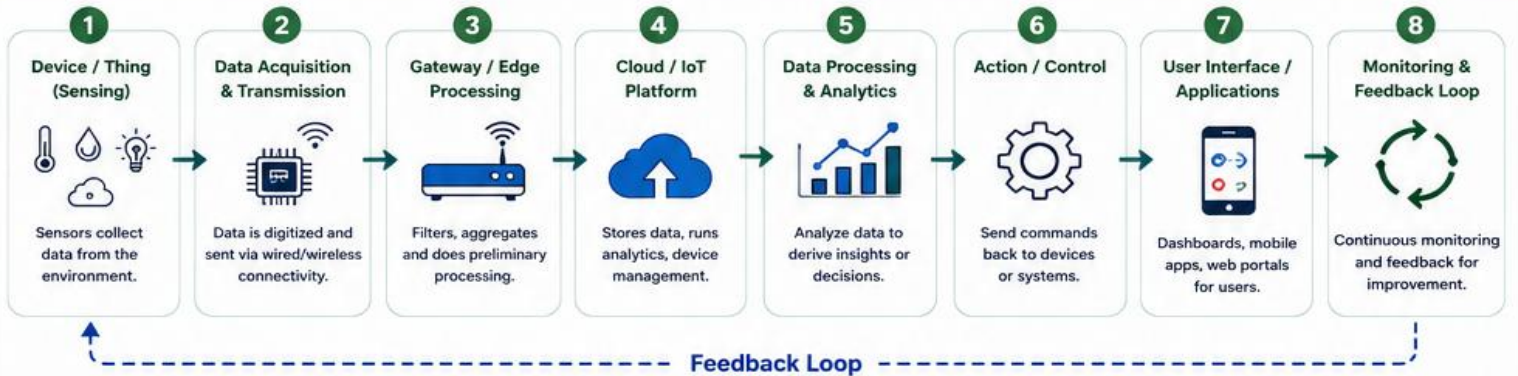


Wireless Modes



i Choice of connectivity depends on range, bandwidth, power consumption, cost and application requirements.

5. THE PROCESS FLOW OF AN IoT APPLICATION



6. KEY TAKEAWAYS

- ✓ Controlled systems use feedback to keep processes in control.
- ✓ Real-time systems respond instantly to changes (e.g., thermostat, AC).
- ✓ TCP/IP is practical for implementation; OSI helps in understanding.
- ✓ IoT devices connect using both wired and wireless technologies.
- ✓ An IoT application follows a flow from sensing to action and feedback.

7. COMMON APPLICATION AREAS



Things connect. Data flows. Intelligence grows.



Connect • Sense • Analyze • Act • Improve



(iii) SENSORS, ACTUATORS AND MICROCONTROLLERS



The Hardware Brains and Muscles of IoT Systems

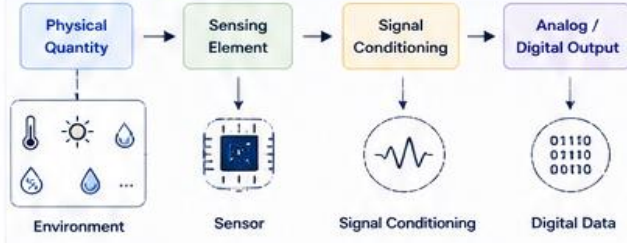
1 SENSORS – Measuring Physical Quantities in Digital World

Sensors detect changes in the physical environment and convert them into electrical signals. These signals are then converted to digital data by the controller for processing.

Common Types of Sensors

Temperature Sensor	Light Sensor	Moisture Sensor	Humidity Sensor
Pressure Sensor	Gas Sensor	Proximity Sensor	Motion (PIR) Sensor
Sound Sensor	Ultrasonic Sensor	Level Sensor	Smoke Sensor

Working of a Sensor



Examples

- Temperature sensor (LM35) measures temperature.
- Moisture sensor detects water content in soil.
- Light sensor (LDR) senses intensity of light.

Sensor Characteristics

- Accuracy
- Sensitivity
- Range
- Resolution
- Response Time
- Stability

Sensors are the "eyes" and "ears" of an IoT system.

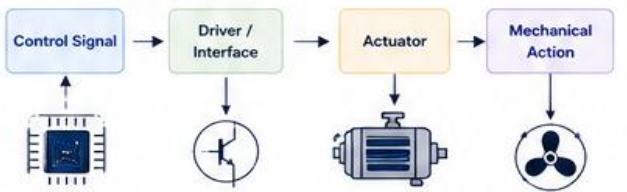
2 ACTUATORS – Moving or Controlling Systems

Actuators receive control signals from the controller and produce physical action in the real world.

Common Types of Actuators

DC Motor	Servo Motor	Stepper Motor	Solenoid
Relay	LED / Buzzer	Heater	Pump
Fan	Valve	Linear Actuator	Display (LCD/OLED)

Working of an Actuator



Examples

- DC motor rotates based on control signal (speed/direction).
- Relay switches ON/OFF high voltage devices.
- Servo motor moves to a specific angle.
- Buzzer produces sound/alert.

Actuator Characteristics

- Power Rating
- Speed / Torque
- Precision
- Response Time
- Duty Cycle
- Efficiency

Actuators are the "muscles" of an IoT system.

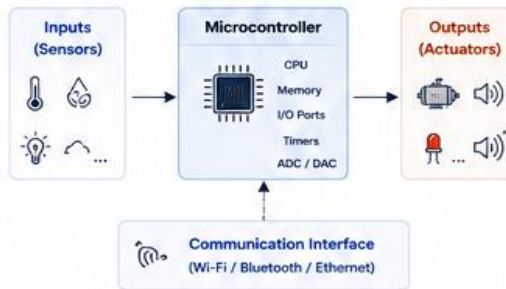
3 CONTROLLER – Role of Microcontroller as Gateway to Interfacing Sensors and Actuators

A microcontroller acts as the brain of the IoT system. It reads data from sensors, processes it, makes decisions and controls actuators. It also communicates with cloud or other devices.

Role of Microcontroller

- ✓ Interfacing with sensors (input)
- ✓ Processing data and executing logic
- ✓ Controlling actuators (output)
- ✓ Communication with cloud/other devices
- ✓ Real-time monitoring and control

Microcontroller System Architecture



Popular Microcontrollers

Arduino Uno	ESP32
Raspberry Pi Pico	NodeMCU

Interfacing Examples

Sensor	Interface	Actuator	Interface
Temperature (LM35)	ADC	DC Motor	PWM
Moisture Sensor	ADC	Relay	Digital I/O
LDR (Light Sensor)	ADC	LED	Digital I/O
Ultrasonic Sensor	Digital I/O	Servo Motor	PWM

Signals and Interfaces

- Analog Signals – Continuous values (e.g., 0–5V)
- Digital Signals – ON/OFF (0 or 1)
- Communication Protocols – I²C, SPI, UART, PWM, GPIO

Features of Microcontrollers

- ✓ Low power consumption
- ✓ Real-time processing
- ✓ Multiple I/O pins
- ✓ Built-in ADC, Timers, PWM
- ✓ Easy programming & development

Typical Data Flow in an IoT System



Applications

Smart Home	Industrial Automation	Smart Agriculture	Healthcare	Smart Cities
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KEY TAKEAWAYS
Sensors sense the environment and provide data.

Microcontroller processes data, makes decisions and acts as gateway.

Actuators perform actions in the real world.

Together, they enable smart, automated and connected IoT systems.

1 INTRODUCTION TO ARDUINO IDE

Arduino IDE is used to write, compile, debug and upload code (sketch) to Arduino board.

IDE Workflow

- Write Code (Sketch)**
Write your program in the editor.
- Compile / Verify**
Check for errors and compile the code.
- Upload**
Upload the compiled code to Arduino.
- Serial Monitor**
View output, debug and communicate with Arduino.

```

void setup() {
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
    
```

Serial Monitor Output:

```

Temperature: 28.5 °C
Humidity: 60 %
Gas Level: 120 ppm
System OK
    
```

Role of Serial Monitor

- View real-time data from Arduino (sensor values, status, messages)
- Send commands/input to Arduino
- Useful for debugging and testing

Arduino Board (Example: Uno)



Key Specs

- Microcontroller: ATmega328P
- Digital I/O Pins: 14 (6 PWM)
- Analog Input Pins: 6
- Operating Voltage: 5V
- USB powered

2 INTERFACING SENSORS – DIGITAL vs ANALOG PINS

Digital Pins (D0–D13)

- Read HIGH (5V) or LOW (0V)
- Used for digital sensors, buttons, switches, LEDs, etc.
- Example: Button, PIR, IR



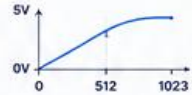
DIGITAL PINS (D0 – D13)



ANALOG PINS (A0 – A5)

Analog Pins (A0–A5)

- Read analog values (0–1023)
- Used for analog sensors that output variable voltage
- Example: LDR, MQ135



3 INTERFACING BASIC COMPONENTS

LED <ul style="list-style-type: none"> Digital Output 	Button <ul style="list-style-type: none"> Digital Input (pull-up) 	DHT11 (Temp & Humidity) <ul style="list-style-type: none"> Digital Data (1-wire) 	LDR (Light Sensor) <ul style="list-style-type: none"> Analog Input (0–1023)
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Other Sensor Examples

MQ135 (Air Quality) <ul style="list-style-type: none"> Detects: CO₂, NH₃, NO_x, Alcohol, Benzene, Smoke 	IR Obstacle Sensor <ul style="list-style-type: none"> Detects obstacle using IR reflection
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Working with Sensors

- Connect sensor to appropriate pin (Digital or Analog)
- Read the value using `digitalRead()` or `analogRead()`
- Process & display or send data

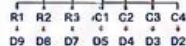
4 DISPLAY DATA ON LCD & INTERFACING KEYPAD

16x2 LCD Display (I2C)



- I2C interface uses only 2 Arduino pins (A4, A5)
- Display text, sensor data, status, messages

4x4 Matrix Keypad



- Used for user input
- Read key value using Keypad library

5 SERIAL COMMUNICATION – INTERFACING HC-05 (BLUETOOTH MODULE)

HC-05 Bluetooth Module



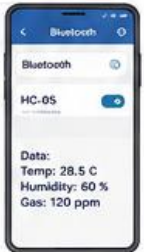
(Key)

Connection to Arduino

HC-05 Pin	Arduino Uno
VCC	5V
GND	GND
TXD	RX (D10)
RXD	TX (D11)
STATE	Not Connected
EN	5V (or Not Connected)

Features

- Wireless serial communication
- Send/receive data from mobile or PC
- Use `Serial.begin(9600);` for communication



6 CONTROL / HANDLE 220V AC SUPPLY – INTERFACING RELAY MODULE

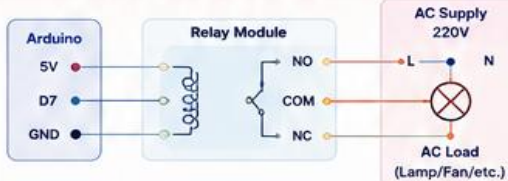
Relay Module (1 Channel)



Working

- Arduino sends HIGH/LOW signal to IN pin.
- Relay switches ON/OFF high voltage AC device.
- Provides isolation between Arduino and AC load.

Wiring Diagram (Control AC Device)



Safety Notes

- 220V AC is dangerous!
- Ensure proper insulation & enclosures.
- Do not touch live wires.
- Use opto-isolated relay modules for safety.

7 TYPICAL IoT APPLICATION FLOW



- #### Examples
- Smart Home Automation
 - Environmental Monitoring
 - Air Quality Monitoring
 - Irrigation System
 - Industrial Automation



SECURITY AND FUTURE OF IOT ECOSYSTEM



Secure Today, Smarter Tomorrow

1. NEED OF SECURITY IN IoT - WHY SECURITY?

Why Security?

- IoT devices connect the physical world to the internet.
- Large-scale connectivity increases attack surface.
- Weak security can lead to data breaches, device hijacking, privacy violations, and physical harm.
- Security builds trust and ensures reliable IoT services.



2. PRIVACY FOR IoT ENABLED DEVICES

- Collect only necessary data.
- Get user consent and be transparent.
- Store minimal data and anonymize where possible.
- Give users control over their data.
- Comply with privacy regulations (GDPR, CCPA).



Privacy by Design - Build privacy into devices and applications from day one.

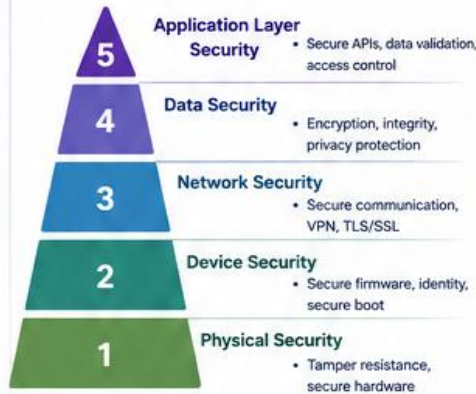
3. IoT SECURITY FOR CONSUMER DEVICES

- Change default usernames and passwords.
- Keep firmware and software up to date.
- Use strong encryption for data in transit and at rest.
- Disable unused services and ports.
- Monitor device activity regularly.
- Use secure Wi-Fi (WPA3) and network segmentation.



Small steps today, big protection every day.

4. SECURITY LEVELS IN IoT



Security is a layered approach - protect at every level.

5. PROTECTING IoT DEVICES

- Use unique device identities and certificates.
- Implement strong authentication (MFA where possible).
- Encrypt communications end-to-end.
- Apply least privilege access principle.
- Regular security updates and patch management.
- Detect and respond to threats in real-time.
- Backup and disaster recovery strategies.

Secure Device + Secure Network = Secure IoT Ecosystem

6. FUTURE IoT ECOSYSTEM - TRENDS AND INNOVATIONS

NEED OF POWERFUL CORE FOR BUILDING SECURE ALGORITHMS

- Advanced IoT applications require high computational power.
- Secure algorithms (encryption, AI models) need more processing and memory.
- Powerful cores enable real-time analytics, edge intelligence and faster decision making.
- Support for hardware security features (TPM, Secure Element, TrustZone).



- High Performance CPU/MCU
- Hardware Encryption
- Secure Boot
- Trust Zone
- Low Power Operation

Powerful + Secure Core = Intelligent and Trusted IoT

FUTURE TRENDS - AI, ML PENETRATION TO IoT

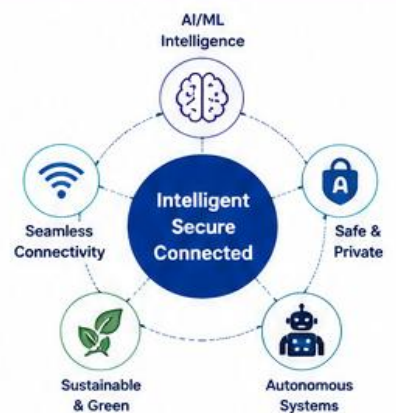
AI at the Edge Real-time decision making on devices; reduces latency and saves bandwidth.	Predictive Analytics Predict failures, optimize performance and enable proactive maintenance.	Computer Vision Smart surveillance, object detection, quality inspection and more.	Anomaly Detection ML models detect abnormal behavior and potential security threats.
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Other Emerging Trends

- Digital Twins
- 5G/6G Connectivity
- Blockchain for IoT
- TinyML
- Green IoT

AI + IoT = Smarter, Safer and More Autonomous Systems

FUTURE IoT ECOSYSTEM VISION



The future of IoT is Intelligent, Secure, Connected and Sustainable.

KEY TAKEAWAYS

Security is the foundation of a trustworthy IoT ecosystem.

Protect devices, data and privacy at every level.

Powerful cores enable secure and intelligent IoT applications.

AI/ML will drive the next wave of innovation in IoT.



SOFT SKILLS - PERSONALITY DEVELOPMENT

Develop Within, Communicate Well, Lead Everywhere



1. PERSONALITY DEVELOPMENT

Personality is the unique pattern of thoughts, feelings and behaviors that makes you who you are.

Determinants of Personality

- Self-Awareness**
Understand your strengths, weaknesses, values and emotions.
- Motivation**
Set goals and stay inspired to achieve them.
- Self-Discipline**
Control your actions, stay focused and be consistent.
- Positive Attitude**
Think positively, stay optimistic and handle challenges.
- Values & Beliefs**
Strong values shape your decisions and behavior.

Building a Positive Personality



Gestures Matter



Good gestures create a positive impression and build strong relationships.

2. SELF-ESTEEM AND SELF-MANAGEMENT

Self-Esteem



Respect yourself and believe in your abilities.

Self-Efficacy



Have confidence in your ability to succeed in specific tasks.

Self-Motivation



Drive yourself to take action and stay committed to goals.

Time Management



- Set clear goals
- Prioritize tasks
- Plan your day
- Avoid procrastination
- Use time wisely

Good time management leads to productivity and success.

Stress Management



- Identify stressors
- Stay calm and positive
- Practice relaxation techniques
- Exercise regularly
- Maintain work-life balance

Manage stress, stay healthy and perform better.

Etiquettes & Manners



Good manners reflect respect and build strong interpersonal relations.

3. COMMUNICATION AND WRITING SKILLS

Communication

The process of sharing ideas, thoughts, feelings and information.

Objectives of Communication

- To inform
- To express
- To persuade
- To motivate
- To build relationships



Attributes of Good Communication

- Clarity
- Conciseness
- Completeness
- Correctness
- Courtesy
- Consideration
- Confidence



Categories of Communication

Verbal

(Spoken Words)



Non-Verbal

(Body Language, Gestures)



Written

(Email, Letter, Reports)



Visual

(Charts, Slides, Images)



Formal

(Official, Structured)



Informal

(Casual, Unstructured)



Barriers to Communication

- Physical
- Semantic
- Psychological
- Organizational
- Cultural
- Poor Listening
- Technological

Effective communication removes barriers and builds understanding.

Writing Skills

Good writing is clear, concise, correct and complete.

Types of Written Communication

- 📄 Resume / CV - Present your skills and achievements
- ✉ Letters - Formal, Informal, Business letters
- 📄 Reports - Factual and well-structured reports
- ✉ Emails - Professional and to the point
- 📄 Proposals - Persuasive and goal-oriented
- 📄 Presentations - Slides with clarity and impact

Key Principles

- Know your purpose
- Know your audience
- Organize your ideas
- Use simple and correct language
- Review and revise

4. INTERVIEW SKILLS AND BODY LANGUAGE

Interview Skills

- ✓ Research the organization and role
- ✓ Understand the job description
- ✓ Prepare and practice common questions
- ✓ Highlight your strengths with examples
- ✓ Be honest, confident and positive
- ✓ Ask relevant questions
- ✓ Thank the interviewer at the end

Body Language Tips



- ✓ Maintain good posture
- ✓ Make appropriate eye contact
- ✓ Offer a firm handshake
- ✓ Use natural hand gestures
- ✓ Sit straight and be attentive
- ✓ Smile appropriately
- ✓ Avoid fidgeting

Dos and Don'ts in Interviews

DO'S

- Be punctual
- Dress appropriately
- Listen carefully
- Answer clearly
- Stay calm and confident
- Show enthusiasm

DON'TS

- Don't be late
- Don't interrupt
- Don't speak negatively
- Don't exaggerate
- Don't use fillers (um, uh, etc.)

THE POWER OF SOFT SKILLS



Builds Confidence



Improves Relationships



Enhances Career Growth



Creates Positive Impression



Leads to Lifelong Success



Soft skills are the key that unlocks your true potential and opens doors to success.



Know Yourself



Manage Yourself



Communicate Well



Connect Better



Succeed Everywhere



OUR COURSES

Career-Focused Learning. Future-Ready You.



Scan to Visit
Our Website



Office & Online
Classes Available



Get Practical
Learning Exposure



One to One Classes
Available

CERTIFICATION COURSES

Course Name	Duration
CCC	3 Months
BCC	3 Months
O Level	6 Months / 1 Year

BASIC COURSES

Course Name	Duration
CCA	3 Months
DCA	6 Months
DFA	6 Months
ADCA	1 Year
DOAP	1 Year
DIT	1 Year
DTP	3 Months
Tally Prime	3 Months
Advance Excel	2 Months

SPECIAL TRAINING COURSES

Course Name	Duration
Full Stack Web Development Using PHP & MYSQL	6 Months
Full Stack Web Development Using Python Django	5 Months
Diploma in Digital Marketing	3 Months
Python Data Science	6 Months
Data Analytics Using Python	4 Months
Python for AI	6 Months
Cyber Security	3 Months

UNIVERSITY COURSES

Course Name	Duration	Fees (Per Sem)
BCA	3 Years	12800/-
BBA	3 Years	12800/-
MCA	2 Years	17000/-
MBA	2 Years	17000/-
B.COM	3 Years	6500/-
M.COM	2 Years	9000/-
MSW	2 Years	9000/-
M.SC(Math)	2 Years	10000/-
BA.	3 Years	5500/-
MA	2 Years	9000/-

TECHNICAL COURSES

Course Name	Duration
C Language	2 Months
C++	3 Months
PYTHON	3 Months
DSA	2 Months
Java (Class- IX, X, XI, XII)	3-6 Months
Core Java	4 Months
HTML	1 Months
HTML & CSS	2 Months
Java Script	1 Months
SQL/MYSQL	1 Month



EXPERT FACULTY
Learn from Industry
Professionals



PRACTICAL APPROACH
Hands-on Training
& Live Projects



CERTIFIED COURSES
NIELIT & Industry
Recognized



CAREER SUPPORT
Placement Assistance
& Guidance



OFFICE:
G. R. COMPLEX (1ST FLOOR)
PREETAM NAGAR, (BESIDE RAJASTHAN SWEETS),
DHOOMANGANJ, PRAYAGRAJ U.P 211011



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