

Academic Year 2024 – 2025

Question Bank

Year/Semester: III/ VI	Department :ECE	Unit : I/II/III/IV/V
Date: 21/02/2025	Subject Code/Title : ET3491 Embedded System and IOT Design	Section : Part A/B/C
	Faculty Name :Mr.P.Selvan	

UNIT I-8051 MICROCONTROLLER

PART A

1. What are the special function register?

The special function register is stack pointer, index pointer (DPL and DPH), I/O port addresses, status (PSW) and accumulator.

2. What are the uses of accumulator register?

The accumulator registers (A and B at addresses OE0h and OF0h, respectively) are used to store temporary values and the results of arithmetic operations.

3. What is PSW?

Program status word (PSW) is the set of flags that contains the status information and is considered as one of the special function register.

4. What is stack pointer (sp)?

Stack pointer (SP) is a 8 bit wide register and is incremented before the data is stored into the stack using PUSH or CALL instructions. It contains 8-bit stack top address. It is defined anywhere in the on-chip 128-byte RAM. After reset, the SP register is initialized to 07. After each write to stack operation, the 8-bit contents of the operand are stored onto the stack, after incrementing the SP register by one. It is not a top-down data structure.

5. What is data pointer (DTPR)?

It is a 16-bit register that contains a higher byte (DPH) and lower byte (DPL) of a 16-bit external data RAM address. It is accessed as a 16-bit register or two 8-bit registers. It has been allotted two addresses in the special function register bank, for its two bytes DPH and DPL.

6. Why oscillator circuit is used?

Oscillator circuit is used to generate the basic timing clock signal for the operation of the circuit using crystal oscillator.

7. What is the purpose of using instruction register?

Instruction register is used for the purpose of decoding the opcode of an instruction to be executed and gives information to the timing and control unit generating necessary signals for the execution of the instruction.

8. Give the purpose of ALE/PROG signal.

ALE/PROG is an address latch enable output pulse and indicates that valid address bits available on the respective pins. The ALE pulses are emitted at a rate of one-sixth of the oscillator frequency. The signal is valid only for external memory accesses.

9. What are addressing modes?

The various ways of accessing data are called addressing modes.

10. Give the addressing modes of 8051?

There are six addressing modes in 8051. They are

- ☐ Direct addressing
- ☐ Indirect addressing
- ☐ Register instruction
- ☐ Register specific (register implicit)
- ☐ Immediate mode
- ☐ Indexed addressing

11. What is direct addressing mode?

The operands are specified using the 8-bit address field, in the instruction format. Only internal data Ram and SFRs can be directly addressed. This is known as direct addressing mode.

It may be used for external timing or clockwise purpose. One ALE pulse is skipped during each access to external data memory.

12. Explain the two power saving mode of operation.

The two power saving modes of operation are:

- ☐ **Idle mode:** In this mode, the oscillator continues to run and the interrupt, serial port and timer blocks are active, but the clock to the CPU is disabled. The CPU status is preserved. This mode can be terminated with a hardware interrupt or hardware reset signal. After this, the CPU resumes program execution from where it left off.
- ☐ **Power down mode:** In this mode, the on-chip oscillator is stopped. All the functions of the controller are held maintaining the contents of RAM. The only way to terminate this mode is hardware reset. The reset redefines all the SFRs but the RAM contents are left unchanged.

13. Differentiate between program memory and data memory.

Program Memory

- i. It stores the programs to be executed.
- ii. It stores only program code which is to be executed and thus it need not be written, so it is implemented using EPROM. It stores the data, line intermediate results, variables and constants required for the execution of the program.

Data Memory: The data memory may be read from or written to and thus it is implemented using RAM.

Eg: Mov R0, 89H

14. What is indirect addressing mode?

In this mode, the 8-bit address of an operand is stored in a register and the register, instead of the 8-bit address, is specified in the instruction. The registers R0 and R1 of the selected bank of registers or stack pointer can be used as address registers for storing the 8-bit addresses. The address register for 16-bit addresses can only be „data pointer“ (DPTR).

Eg: ADD A, @ R0.

15. What is meant by register instructions addressing mode?

The operations are stored in the registers R0 – R7 of the selected register bank. One of these eight registers (R0 – R7) is specified in the instruction using the 3-bit register specification field of the opcode format. A register bank can be selected using the two bank select bits of the PSN. This is called as register instruction addressing mode

Eg: ADD A, R7.

16. What is immediate addressing mode?

An immediate data ie., a constant is specified in the instruction, after the opcode byte.

Eg: MOV A, #100 The immediate data 100 (decimal) is added to the contents of the accumulator. For specifying a hex number, it should be followed by H. These are known as immediate addressing mode.

17. MOV R4, R7 is invalid. Why?

The movement of data between the accumulator and Rn (for n = 0 to 7) is valid. But movement of data between Rn register is not allowed. That is why MOV R4, R7 is invalid.

18. WHAT IS SFR? (Nov/Dec2014)

In the 8051 microcontroller registers A, B, PSW and DPTR are part of the group of registers commonly referred to as special function registers (SFR).

19. What is indexed addressing? (May/June2014)

This addressing mode is used only to access the program memory. It is accomplished in 8051 for look-up table manipulations. Program counter or data pointer are the allowed 16-bit address storage registers, in this mode of addressing. These 16-bit registers point to the base of the look-up table and the ACC register contains a code to be converted using the look-up table. The look-up table data address is found out by adding the contents of register ACC with that of the program counter or data pointer. In case of jump instruction, the contents of accumulator are added with one of the specified 16-bit registers to form the jump destination address.

Eg: MOV C, A @ A + DPTR JMP @ A + DPTR

20. What are the two main features of sfr addresses?

The following two points should be noted SFR addresses.

- ☐ The special function registers have addresses between 80H and FFH. These addresses are above 80H, since the addresses 00 to 7FH are addresses of RAM memory inside the 8051.
- ☐ Not all the address space of 80 to FH is used by the SFR. The unused locations 80H to FFH are reserved and must not be used by the 8051 programmer.

21. What is the difference between direct and register indirect addressing mode?

Loop is most efficient and is possible only in register indirect addressing whereas looping is not direct addressing mode.

22 List out some compare instructions. (EE2354 May/June2014)

The compare instructions are:

- a. CJNE
- b. CLR
- c. CPL

23 Write a program to save the accumulator in r7 of bank 2.

CLR PSW – 3 SETB PSW – 4 MOV R7, A.

24. What are single bit instructions? Give example.

Instructions that are used for single bit operation are called single bit instructions

Examples: SETB bit, CLR bit, CPL bit

25. Write a program to save the status of bits p1.2 and p1.3 on ram bit locations 6 and 7 respectively.

MOV C, P1.2; save status of P1.2 on CY

MOV 06, C; save carry in RAM bit location 06 MOV C, p1.3; save status of p1.3 on CY

MOV 07, C; save carry in RAM bit location 07.

26. Write a program to see if bits 0 and 5 of register b r1. If they are not, make them so and save it in r0.

JNB OFOH, NEXT – 1; JUMP if B.0 is low

SET BOFOH; Make bit B.0 high

NEXT – 1: JNB OF5H, NEXT – 2; JUMP if B.5 is low

SETB OF5H; Make B.5 high

NEXT – 2: MOV R0, B; Save register B.

27. Mention the size of DPTR and Stack Pointer in 8051 microcontrollers.

DPTR and SP are 16-bit register.

28. What is the operation of the given 8051 microcontroller instructions: XRL A, direct (April/May2011)

XRLA, Direct Exclusive OR operation with A register content and Direct value

29. List the features of 8051 microcontrollers?

The features are

- ☐ Single supply +5-volt operation using HMOS technology.
- ☐ 4096 bytes' program memory on chip (not on 8031)
- ☐ 128 data memory on chip, Four register banks.
- ☐ Two multiple mode, 16-bit timer/counter, Extensive Boolean processing capabilities.
- ☐ 64 KB external RAM size
- ☐ 32 bidirectional individually addressable I/O lines, 8-bit CPU optimized for control applications.

30. Compare Microprocessor and Microcontroller.

	Microprocessor	Microcontroller
1	Microprocessor contains ALU, general purpose registers, stack pointer, program counter, clock timing circuit and interrupt circuit.	Microcontroller contains the circuitry of microprocessor and in addition it has built in ROM, RAM, I/O devices, timers and counters.
2	It has many instructions to move data between memory and CPU.	It has one or two instructions to move data between memory and CPU.
3	It has one or two-bit handling instructions.	It has many bit handling instructions.
4	Access times for memory and I/O devices are more	Less access time for built-in memory and I/O devices
5	Microprocessor based system requires more hardware	Microcontroller based system requires less hardware reducing PCB size and increasing the reliability.

31. Name the five interrupt sources of 8051?

The interrupts are:

Vector address

- External interrupt 0: IE0: 0003H
 - Timer interrupt 0: TF0: 000BH
 - External interrupt 1: IE1: 0013H
 - Timer Interrupt 1: TF1: 001BH
 - Serial Interrupt
- Receive interrupt: RI: 0023H Transmit interrupt: TI: 0023H

32. List the 8051 instructions that affect the overflow flag.

ADD, ADDC, DIV, MUL, SUBB

33. List the 8051 instructions that always clear the carry flag.

CLR C, DIV, MUL

34. List the 8051 instructions that affect all the flags.

ADD, ADDC and SUBB

35. What are the different types of ADC?

The different types of ADC are successive approximation ADC, counter type ADC flash type ADC, integrator converters and voltage to- frequency converters.

36. What is the necessity of interfacing DAC with microcontroller?

In many applications, the microcontroller has to produce analog signals for controlling certain analog devices. Basically, the microcontroller can produce only digital signals. In order to convert the digital signal to analog signal a Digital to Analog Converter has to be employed.

37. Mention the number of register banks and their addresses in 8051?

There are 4 register banks. They are Bank0, Bank1, Bank2& Bank3. RAM locations from 00 to 07H for bank 0 RAM locations from 08 to 0FH for bank 1 RAM locations from 10 to 17H for bank 2 RAM locations from 18 to 1FH for bank 3

38. What is the jump range? (Nov/Dec2015)

AJMP addr11 (Absolute Jump) – Within 2K bytes of program memory.

LJMP addr16 (Long Jump) -Within 64K bytes of program memory.

SJMP Rel.addr (Short Jump) –128 to +127 of program memory.

39. What are the different ways of operand addressing in 8051?

The five addressing modes are,

1. Immediate addressing
2. Register addressing
3. Direct addressing
4. Register indirect addressing
5. Indexed addressing

Part – B & Part –C

1. With the necessary diagram of control word format, explain the various operating modes of timer in 8051 microcontroller
2. With the help of neat diagram explain the memory organization of 8051 microcontroller
3. With neat sketch explain the architecture/ functional block diagram of 8051 microcontrollers. (Apr/May 2015) (8)
4. Draw the Pin Diagram of 8051 and explain the function of various signals.
5. List the various Instructions available in 8051 microcontrollers and explain.
Data Transfer Instructions) Boolean variable Manipulation Instructions
6. (i) Explain the Data transfer instructions and Program control instructions of 8051 microcontrollers. (8)
(ii) Write an assembly language program based on 8051 microcontroller instruction set to Perform four arithmetic operations on 2, 8 bit data. (8)
7. Discuss about the organization of Internal RAM and Special function registers of 8051 Microcontroller in detail. (16)
8. Explain the arithmetic and control instructions of 8051 microcontroller. (10)
9. Explain the Interrupt structure with the associated registers in 8051 microcontrollers. (8) (April/May 2011)
10. Explain the TMOD function register and its timer modes of operations. (8)
11. Explain in detail about the special function register of 8051 in detail.)
12. Explain the different addressing modes of 8051
13. Give PSW of 8051 and describe the use of each bit in PSW.
14. Describe the functions of the following signals in 8051. RST, EA, PSEN and ALE.
15. Explain the architecture of 8051 with its diagram. (16)
16. Write an 8051 ALP to create a square wave of 66% duty cycle on bit 3 of port 1. (16)

UNIT II- EMBEDDED SYSTEMS

PART A

1. Enumerate some embedded computers that exist from the origin of the embedded systems.

Cell phones, calculators, printers, thermostats, video game consoles, CD players are some of the embedded computers that exist from the origin of embedded systems.

2. In what way interrupts differ from exceptions?

Interrupts are used to handle external events (serial ports, keyboard). The processor handles interrupts after finishing the current instruction. Exceptions are used to handle instruction faults, (division by zero, undefined opcode). Exceptions are used as a variation of interrupt, which requires both prioritization and vectoring.

3. What is an embedded computer system?

Any device that includes a programmable computer but is not itself intended to be a general purpose computer is called an embedded computer system.

4. Mention the challenges in embedded computing system design.

How much hardware do we need, how do we meet deadlines, how do we minimize power consumption, how do we design for upgradeability?

5. Mention the reasons that make embedded computing machines design difficult.

Complex testing, Limited observability and controllability, restricted development environments.

6. What is design flow?

The sequence of design methodology for fully and partially automated system.

7. What is bus protocol?

Bus protocol is nothing but to transfer the information from one system to the another system there are two different set of bus protocol.

8. State the importance of design methodology.

It allows us to keep a score board on a design, It allows us to develop computer aided design tools, It makes it much easier for member so far design team to communicate.

9. Why microprocessor is used in embedded system?

Microprocessors provide a very efficient way to implement an embedded system they also make it easier to design families of products that can be built to provide various feature sets at different price points.

10. What do you mean by quality and quality assurance related to embedded systems?

Quality of a product or service is how well it satisfies the intended function. Quality assurance process is vital for the delivery of a satisfactory system.

11. List the issues in hardware and software design for an embedded system.

- Choosing the right platform.
- Memory and processor sensitive software
- Allocation of addresses to memory, program segments and devices. Porting the issues of OS in an embedded platform.
- Performance and Performance Accelerators.

12. List out some of the verifications requirements and specification related to the design flow

Choosing the right platform, Memory and processor sensitive software, Allocation of addresses to memory, program segments and devices. Porting the issues of OS in an embedded platform, Performance and Performance Accelerators.

13. What is good requirement analysis?

Correctness, unambiguousness, completeness, verify ability, modifiability, traceability.

14. What are the CRC Card methodology identifiers?

Classes, responsibilities, collaborators.

Part – B & Part –C

1. Analyze the requirements for designing a GPS moving map in embedded system design process
2. Discuss the different factors involved in embedded system design process
3. Develop the conceptual specifications and detailed specifications written in UML language to design the Model Train Controller
4. Discuss in detail the design steps Model train controller with the frame format of DCC.
5. Adapt the suitable structural and behavioral description for designing an embedded system.
6. Recall the parameters to be considered while designing an Embedded System Process with an example.
7. Discuss in detail the program level embedded system performance analysis and explain the optimization of program level energy, power and program size.
8. With requirements design the Consumer Electronic architecture with an example.
9. Briefly discuss about the design methodologies for an embedded computing system
10. Examine the quality assurance process taken place in the embedded computing system

UNIT III- PROCESSES AND OPERATING SYSTEMS

PART A

1. Define tasks and processes.

Tasks are part of system functionality whose application level organization is reflected in the structure of the program. Process is a single execution of a program having its own state that includes not only its registers but also its memory.

2. Write about scheduling states present in the embedded system design. / Define the various process states.

1) A process can be in any one of these three scheduling states. They are: Waiting state- A process waiting for data from an I/O device or another process. 2) Ready state-Any process that could execute, 3) Executing- a process having all its data and ready to run and is selected by the scheduler.

3. What are the strategies used for power optimization in multi-processing?

Multiprocessing for low power embedded computing requires several processors running at slower clock rates consuming less power than a single large processor. Performance scales linearly with power supply voltage but power scales with V^2 .

4. Define kernel.

The kernel is the part of OS that determines processing time, activated by timer. The length of timer is called time quantum.

5. Define CPU utilization.

It is a measure of the efficiency of the CPU. It is the ratio of the CPU time that is being used for useful computations to the total available CPU time.

6. Define context switching.

These registers that define a process are known as its context and switching from one process register set on another is known as context switching.

7. Define rate monolithic scheduling.

It is a static scheduling policy which defines that fixed priorities are sufficient to efficiently schedule the processes in many situations.

8. Define priority inversion.

It is a situation in which the low priority process blocks the execution of a higher priority process by keeping hold of its resources.

9. State the major functions of POSIX RTOS.

It is a Linux based OS. It has a dual kernel based OS Core. It uses concepts like the Semaphores, Message Queue etc.

10. Define Multitasking.

The capability of the processor to execute multiple tasks simultaneously within during the outcome of each task with respect to time can be given as multitasking.

11. Define multi-processing systems.

System in which there reside more than one CPU is called as multiprocessing system. The simultaneous process in number of different processes by different processors at the same time is termed as multiprocessing.

14. List the advantages and limitations of Priority based process scheduling.

Advantages of Priority based scheduling can be given as

- i) Since process priorities are taken into consideration the execution slot is given to the process with the highest priority.
 - ii) Efficiency of the scheduling is greatly increased as dead slots or idle slots are removed.
- Limitations of Priority Based Scheduling

It is done as two types as static and dynamic. The static scheduling requires less hardware resources but the CPU utilization is less but dynamic scheduling uses more hardware resources but the CPU utilization is better than the other.

13. What is a distributed embedded architecture give the block diagram?

In a distributed embedded system several processing elements are connected by a network that allows them to communicate. More than one computer or group of computer and PEs are connected via network that for ms distributed embedded systems.

S – Sensors, A- Actuators

14. Distinguish multistage network from direct network.

Multistage network: Multistage network transmits messages from source to destination via some intermediate routing nodes to guide the data packets.

Direct network: Indirect network message goes from source to destination without going through any memory element or intermediate nodes.

15. Distinguish single hop network from multihop network.

In single hop network a message is received at its destination directly from the source without going through any other network node. In multihop network messages are routed through network nodes to get to their destination.

16. What is MPSoCs?

A multiprocessor system –on-chip that uses multiple cores usually targeted for embedded system.

Part – B & Part –C

1. Describe any two scheduling policies used in multiprocess environment.
2. Explain the principle of priority based context switching mechanism. Discuss about the various priority based scheduling algorithms.
3. Describe in detail about the scheduling policies with suitable examples.
4. Explain in detail rate monotonic scheduling with an example
5. Discuss about interprocess communication mechanisms
6. Explain in detail how shared memory and message passing mechanisms are used for interprocess communication.
7. Explain about inter process communication mechanism with neat sketch
8. Explain any one type of network used for embedded system design
9. Discuss in detail about distributed embedded architecture with neat sketches
10. Discuss in detail about the distributed embedded architecture

11. Write in detail about the embedded concepts in the design of video accelerator.

UNIT IV- IOT ARCHITECTURE AND PROTOCOLS

PART A

1. What is the Internet of Things (IoT)?

Internet of Things (IoT) is a network of physical objects or people called “things” that are embedded with software, electronics, network, and sensors that allow these objects to collect and exchange data. The goal of IoT is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster.

2. List layers of IoT protocol stack

Layers of IoT protocol stack are: 1) Sensing and information, 2) Network connectivity, 3) Information processing layer, 4) Application layer.

3. What are the disadvantages of IoT?

The disadvantages of IoT are:

- ☐ **Security:** IoT technology creates an ecosystem of connected devices. However, during this process, the system may offer little authentication control despite sufficient cybersecurity measures.
- ☐ **Privacy:** The use of IoT, exposes a substantial amount of personal data, in extreme detail, without the user's active participation. This creates lots of privacy issues.
- ☐ **Flexibility:** There is a huge concern regarding the flexibility of an IoT system. It is mainly regarding integrating with another system as there are many diverse systems involved in the process.
- ☐ **Complexity:** The design of the IoT system is also quite complicated. Moreover, its deployment and maintenance also not very easy.
- ☐ **Compliance:** IoT has its own set of rules and regulations. However, because of its complexity, the task of compliance is quite challenging.

4. Define Arduino

Arduino is a free electronics platform having easy to use hardware and software. It has a microcontroller capable of reading input from sensors to control the motors programmatically.

5. List mostly used sensors types in IoT

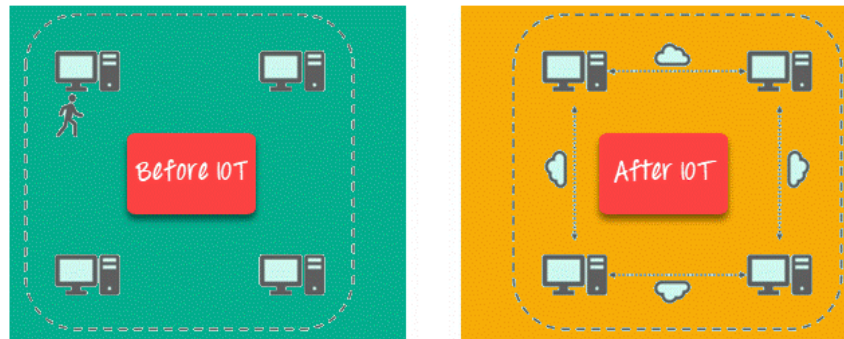
Mostly used sensor types in IoT are:

- ☐ Smoke sensor
- ☐ Temperature sensors
- ☐ Pressure sensor
- ☐ Motion detection sensors
- ☐ Gas sensor
- ☐ Proximity sensor
- ☐ IR sensors

6. Mention the basic difference between IoT and sensor businesses?

A sensor business does not need an active internet connection to work. Internet of Things requires a control side to work.

7. What are the advantages of IoT?



Key benefits of IoT technology are as follows:

- ☐ **Technical Optimization:** IoT technology helps a lot in improving techniques and making them better. For example, with IoT, a manufacturer is able to collect data from various car sensors. The manufacturer analyses them to improve its design and make them more efficient.
- ☐ **Improved Data Collection:** Traditional data collection has its limitations and its design for passive use. IoT facilitates immediate action on data.
- ☐ **Reduced Waste:** IoT offers real-time information leading to effective decision making & management of resources. For example, if a manufacturer finds an issue in multiple car engines, he can track the manufacturing plan of those engines and solves this issue with the manufacturing belt.
- ☐ **Improved Customer Engagement:** IoT allows you to improve customer experience by detecting problems and improving the process.

8. What is Bluegiga APX4 protocol?

The Bluegiga APX4 is a solution that supports both the WiFi and BLE platform, and it is based on a 450MHz ARM9 processor.

9. Mention applications of PWM in IoT

Applications of PWM in IoT are controlling the speed of DC motor, Controlling the direction of a servo moto, Dimming LED, etc.

10. What are mostly used IoT protocols?

The mostly used IoT protocols are:

- ☐ XMPP
- ☐ AMQP
- ☐ Very Simple Control Protocol (VSCP)
- ☐ Data Distribution Service (DDS)
- ☐ MQTT protocol
- ☐ WiFi
- ☐ Simple Text Oriented Messaging Protocol(STOMP)
- ☐ Zigbee

11. What are IoT publishers?

- ☐ IoT Publishers are sensors that send real-time data to intermediate devices or middleware.

12. What are various types of CAN Frame?

Various types of CAN frames are: 1) data frame, 2) request frame, 3) error frame, and 4) overload frame.

13. What is the main difference between floating CPU and fixed-point CPU?

Floating CPU can take floating value directly, whereas fixed CPU is converted to integer format. Thereby, it leads to the loss of some resolution.

14. Define GPIO

GPIO is a programmable pin that can be used to control input or output pins programmatically.

15. Explain Android things

Android things is an Android-based OS that is built for embedded devices.

16. What is the aim of airflow sensors?

The main aim of airflow sensors is to measure the air level in the soil. This sensor enables one to measure it dynamically, from one location, or multiple locations of the garden.

17. Mention suitable databases for IoT

Suitable databases for IoT are:

- ☐ influx DB
- ☐ Apache Cassandra
- ☐ RethinkDB
- ☐ MongoDB
- ☐ Sqlite

18. Why use the scheduler in RTOS?

Scheduler in RTOS is used for switching one task to another.

19. What is Zigbee?

Zigbee is the same like Bluetooth. It is used in a complex system for low power operation, robustness, and high security.

20. What is Z-Wave?

Z-Wave is an IoT technology that uses low power RF communication. It is designed for home automation products like lamp controllers and sensors.

Part – B & Part –C

1. Explain the steps involved in the IoT system design methodology.

2. Explain functional view specification step of IoT system design methodology consider smart IoT-based home automation system as an example.3)

3. Explain service specification step of IoT system, design methodology, consider smart IoT based home automation system as an example4)

4. Explain operational view specification step of IoT system design methodology consider smart IoT-based home automation system as an example5)

5. What is the importance of service specification in IoT design methodology ?6)

6. Explain purpose and requirement specification step of IoT system design methodology, consider smart IoT-based home automation system as an example.
7. Explain domain model specification step of IoT system design methodology, consider smart IoT-based home automation system as an example.
8. With the help of diagram list and briefly explain the steps involved in the IoT system design methodology9)
9. Explain process specification for home automation IoT system10)
10. Explain the operational view specification step of IoT system design

UNIT V- IOT SYSTEM DESIGN

PART A

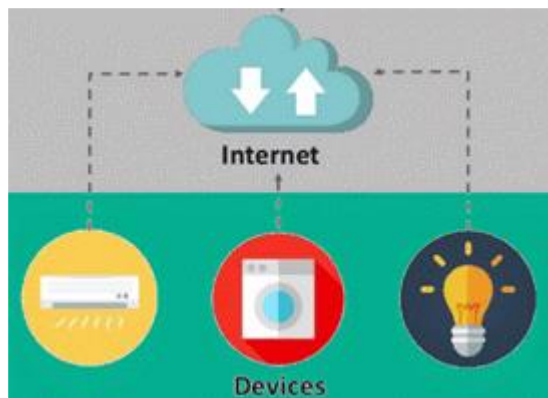
1. Explain Raspberry Pi

Raspberry Pi is a computer which is capable of doing all the operations like a conventional computer. It has other features such as onboard WiFi, GPIO pins, and Bluetooth in order to communicate with external things.

2. How to run Raspberry pi in headless mode?

Raspberry pi in headless mode can be run by using SSH. The latest operating system has an inbuilt VNC server that is installed for taking remote desktop on Raspberry Pi.

3. What are the fundamental components of IoT?



The four fundamental components of an IoT system are:

- ❑ **Sensors/Devices:** Sensors or devices are a key component that helps you to collect live data from the surrounding environment. All this data may have various levels of complexities. It could be a simple temperature monitoring sensor, or it may be in the form of the video feed.
- ❑ **Connectivity:** All the collected data is sent to a cloud infrastructure. The sensors should be connected to the cloud using various mediums of communications. These communication mediums include mobile or satellite networks, Bluetooth, WI-FI, WAN, etc.
- ❑ **Data Processing:** Once that data is collected, and it gets to the cloud, the software product performs processing on the gathered data. This process can be just checking the temperature, reading on devices like AC or heaters. However, it can sometimes also be very complex, like identifying objects, using computer vision on video.
- ❑ **User Interface:** The information needs to be available to the end-user in some way, which can be achieved by triggering alarms on their phones or sending them notification through email or text message. The user sometimes might need an interface which actively checks their IoT system.

4. What is the difference between IoT and IIoT?

The difference between IoT and IIoT is:

IoT	IIoT
The full form of IoT is the Internet of Things.	The full form of IIoT is the Industrial Internet of Things.
A service model is human-centric.	A service model is machine-centric.
It supports customer-oriented applications.	It supports industry-oriented applications.
Communication transportation is done through wireless devices.	Communication transportation is done through both wired and wireless devices.
The quality of data is medium to high.	The quality of data is high to very high.
Criticality is not severe.	Criticality is severe.

5. What are the most common IoT applications?



The most common IoT applications are:

- ☐ **Smart Thermostats:** Helps you to save resources on heating bills by knowing your usage patterns.
- ☐ **Connected Cars:** IoT helps automobile companies handle billing, parking, insurance, and other related stuff automatically.
- ☐ **Activity Trackers:** Helps you to capture heart rate patterns, calorie expenditure, activity levels, and skin temperature on your wrist.
- ☐ **Smart Outlets:** Remotely turn any device on or off. It also allows you to track a device's energy level and get custom notifications directly into your smartphone.
- ☐ **Parking Sensors:** IoT technology helps users to identify the real-time availability of parking spaces on their phones.
- ☐ **Connect Health:** The concept of a connected healthcare system facilitates real-time health monitoring and patient care. It helps in improved medical decision-making based on patient data.

6. List available wireless communications boards available in Raspberry Pi?

Wireless communications boards available in Raspberry Pi are 1) WiFi and 2) BLE/Bluetooth.

7. What are the functions used to read analog and digital data from a sensor in Arduino?

Functions used to read analog and digital data from a sensor in Arduino are: `digitalRead()` and `digitalWrite()`.

8. What is Bluetooth Low Energy?

Bluetooth Low Energy is a wireless PAN (Personal Area Network) technology. It uses less power to transmit long-distance over a short distance.

9. Define Micro Python

Micro Python is a Python implementation, which includes a small subset of its standard library. It can be optimized to run on the Mode MCU microcontroller.

10. List available models in Raspberry Pi

Models of Raspberry Pi are:

- ☐ Raspberry Pi 1 Model B
- ☐ Raspberry Pi 1 Model B+
- ☐ Raspberry Pi 1 Model A
- ☐ Raspberry Pi Zero
- ☐ Raspberry Pi 3 Model B
- ☐ Raspberry Pi 1model A+
- ☐ Raspberry Pi Zero W

11. What are the challenges of IoT?

Important challenges of IoT are:

- ☐ Insufficient testing and updating
- ☐ Concern regarding data security and privacy
- ☐ Software complexity
- ☐ Data volumes and interpretation
- ☐ Integration with AI and automation
- ☐ Devices require a constant power supply which is difficult

Interaction and short-range communication

12. Differentiate between Arduino and Raspberry pi

The difference between Arduino and Raspberry pi is: **Arduino** **Raspberry pi**

Arduino	Raspberry Pi
One can build own Arduino from scratch or with specifications as per one's need	Development environment includes anything with Linux support
Less powerful clock speed (16 MHz)	Significantly more powerful (900 MHz)
Projects are not made to run videos	Has graphics port and can run videos
It can run only one program at a time	Multitasking in a program is possible
0.002MB and no external memory support	512MB with external memory support
Large support network online to assist	Has a more fragmented community
Arduino UNO R3 board cost < Rs1500	Raspberry Pi B costs around Rs3000

13. What is a library in Arduino?

Arduino library is a collection of code that is already written for controlling module or sensor.

14. Mention some of the wearable Arduino boards

Wearable Arduino boards are:

- ☐ Lilypad Arduino main board
- ☐ Lilypad Arduino simple
- ☐ Lilypad Arduino simple snap
- ☐ Lilypad Arduino USB

15. What is replication?

Replication is the act of syncing data between two or more servers.

16. What is IoT Thingworx?

Thingworx is a platform for the fast development and deployment of connected devices. It is a collection of integrated IoT development tools that support analysis, production, property, and alternative aspects of IoT development.

17. What is Sales force IoT Cloud?

The Sales force IoT Cloud is an online platform for storing and processing IoT information.

It is an assortment of various application development elements, which are called lightning.

This program gathers information from websites, devices, customers, and partners. It then triggers actions for period responses.

18. Explain IoT GE-PREDIX

GE or General Electric Predix is software for the information assortment from industrial instruments. It offers a PaaS which allows users performance management and operation optimization facility. It connects instrumentation, people, and information in an exceedingly conventional technique.

19. List out Some popular companies are working on IoT

Popular companies working on IoT are: 1) Philips, 2) LG, 3) Google, 4) Apple and 5) Samsung.

20. Mention real-time usage of Raspberry pi

- ☐ Home a
- ☐ Portable webserver
- ☐ manipulating the robots
- ☐ Internet radio

Part – B & Part –C

1. Explain the basic building blocks of an IOT device.
2. Explain the IOT architecture with the example.
3. Explain in detail about the Raspberry PI.
4. Explain LINUX on Raspberry.
5. Explain how to program raspberry PI with Python.
6. Write the program to control LED with Raspberry.
7. Write the program to interface an LED and switch with Raspberry PI.
8. Explain the home automation with example.
9. Explain the home smart cities with example
10. Explain the environment and agriculture with example.

Faculty Incharge

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Head of the Department

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HoD Remarks: