



ST. ANNE'S COLLEGE OF ENGINEERING AND TECHNOLOGY

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ANGUCHETTYPALAYAM, PANRUTI – 607 106.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

SUBJECT: CS3691 - EMBEDDED SYSTEMS AND IOT

SEM / YEAR: VI/ III

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CS3691 Embedded Systems and IoT Syllabus

UNIT I 8-BIT EMBEDDED PROCESSOR

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

TEXTBOOKS

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

REFERENCES

1. Michael J. Pont, “Embedded C”, Pearson Education, 2007.
2. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, “Arm System Developer’s Guide”, Morgan Kaufman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015

PART – A

1. Define microcontroller and its applications.

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.

Application of Microcontroller

- Light sensing & controlling devices.
- Temperature sensing and controlling devices.
- Fire detection & safety devices.
- Industrial instrumentation devices.
- Process control devices.

2. Define 8051 microcontroller. and mention its applications.

8051 microcontroller is designed by Intel in 1981. It is an 8-bit microcontroller. It is built with 40 pins DIP (dual inline package), 4kb of ROM storage and 128 bytes of RAM storage, 2 16-bit timers.

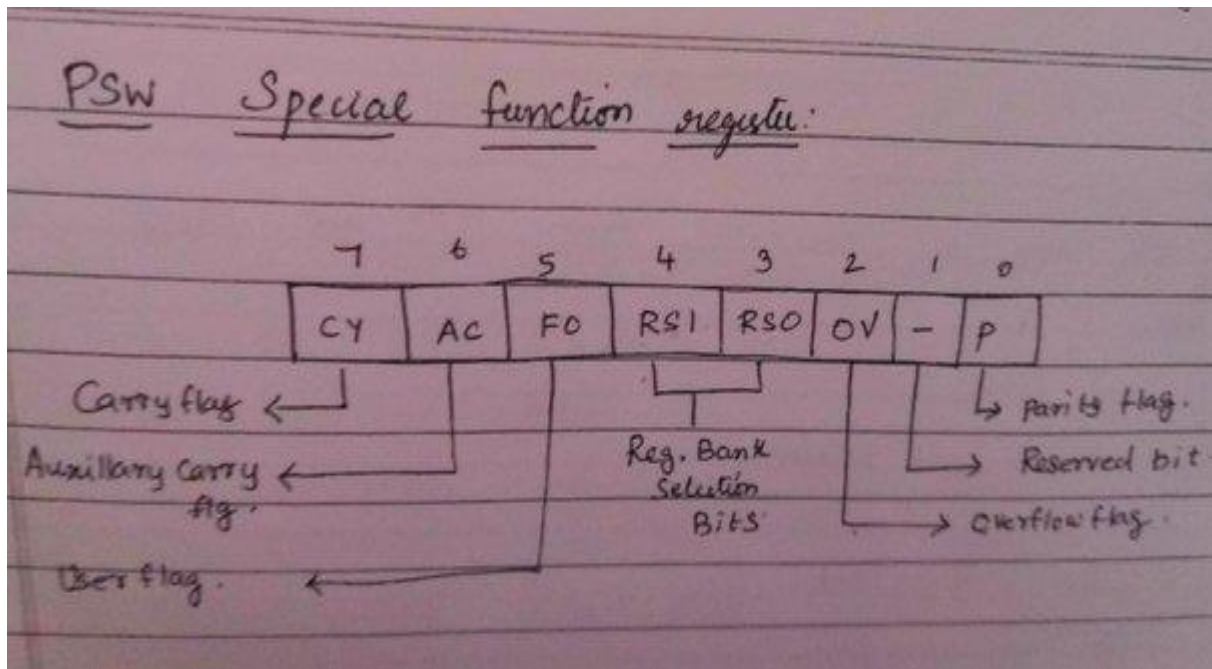
3. Compare: microprocessor and microcontroller?[NOV / DEC 2021]

S.NO	Microprocessor	Microcontroller
1.	Microprocessor is the heart of Computer system.	Micro Controller is the heart of an embedded system.
2.	It is only a processor, so memory and I/O components need to be connected externally	Micro Controller has a processor along with internal memory and I/O components.
3.	Memory and I/O has to be connected externally, so the circuit becomes large.	Memory and I/O are already present, and the internal circuit is small.

4. Which register has the SMOD bit, and what is its status when the 8051 is powered up?. [NOV / DEC 2021]

It is 8-bit register. When 8051 is powered up, **SMOD is zero.** By setting the SMOD, baud rate can be doubled. If SMOD = 0 (which is its value on reset), the baud.

5. Give the format of the register PSW of 8051 and name each bit. [NOV / DEC 2019]



6. Define the operating model 0 of 8051 serial ports.? [NOV / DEC 2020 AND APRIL / MAY 2021]

Mode 0: In this mode, the serial port works like a shift register and the data transmission works synchronously with a clock frequency of $f_{osc}/12$. Serial data is received and transmitted through RXD. 8 bits are transmitted/ received at a time.

7. which register is used for serial programming in 8051 ? Illustrate it

SBUF register:

SBUF is an 8-bit register used for serial communication in the 8051 microcontrollers. For a byte of data to be transferred via the transmitted line, it must be placed in the SBUF Register.

8. Write a program to find the 2's complement using 8051? [NOV / DEC 2020 AND APRIL / MAY 2021]

2000 LHL D	3000H	2A	Load HL pair data from 3000h
2001		00	
2002		30	
2003			
2004 MOV	A, L	7D	Move the low-order result from reg.A TO Reg.L
2005 MOV	L, A	6F	Move the result from reg.L TO Reg.A

2006 MOV	A,H	7C	Move the higher order from reg.H to reg.A
2007 CMA		2F	compliment accumulator
2008 MOV	H,A	67	Move the result from reg.A TO Reg.H
2009 INX	H	23	Increment HL pair to find 2's compliment
200A SHLD	3002H	22	Store the result at address 3002H
200B		02	
200C		30	
200D HLT		76	HALT

OUTPUT:

1. Before execution:
2. 3000H:12H
3. 3001H:05H
4. After execution:
5. 3002H:EEH
6. 3003H:FAH

9 . What are the interrupts of 8051? And high light any two functions ? [NOV / DEC 2019, APR / MAY 2019]

Interrupt Number	Interrupt Description	Address
0	EXTERNAL INT 0	0003h
1	TIMER/COUNTER 0	000Bh
2	EXTERNAL INT 1	0013h
3	TIMER/COUNTER 1	001Bh
4	SERIAL PORT	0023h

Let's see the five sources of interrupts in 8051 Microcontroller:

- Timer 0 overflow interrupt - TF0.
- External hardware interrupt - INT0.
- Timer 1 overflow interrupt - TF1.
- External hardware interrupt - INT1.
- Serial communication interrupt - RI/TI.
- **Timer 0 overflow interrupt - TF0.**

- The TF0 bit is automatically set to 1 when Timer 0 overflows. Your code can read the TF0 bit at any time to find out if the timer has overflowed. You can also configure the Timer 0 interrupt to automatically execute code when the timer overflows.
- TF1: The TF1 stands for 'timer1' flag bit. Whenever calculating the time-delay in timer1, the TH1 and TL1 reaches to the maximum value that is “FFFF” automatically. EX: while (TF1==1)
Whenever the TF1=1, then clear the flag bit and stop the timer.

10. list the 8051 interrupts with its priority? [APR / MAY 2017]

Priority to the interrupt can be assigned by using the **interrupt priority register (IP)**

Priority	Interrupt source	Intr. bit / flag
1	External Interrupt 0	INT0
2	Timer Interrupt 0	TF0
3	External Interrupt 1	INT1
4	Timer Interrupt 1	TF1
5	Serial interrupt	(TI/RI)

11. Explain the interrupts of 8051 microcontroller?[NOV / DEC 2019]

INTERRUPT NUMBER	INTERRUPT DESCRIPTION	INTERRUPT EXPLANATION
0 & 2	External hardware interrupt - INT0 & INT1	These interrupts can be programmed to either edge-triggered or level triggered
1	Timer 0 overflow interrupt - TF0.	The TF0 bit is automatically set to 1 when Timer 0 overflows. Your code can read the TF0 bit at any time to find out if the timer has overflowed. You can also configure the Timer 0 interrupt to automatically execute code when the timer overflows.
3	Timer 1 overflow interrupt - TF1.	TF1: The TF1 stands for 'timer1' flag bit. Whenever calculating the time-delay in timer1, the TH1 and TL1 reaches to the maximum value that is “FFFF” automatically. EX: while (TF1==1) Whenever the TF1=1, then clear the flag bit and stop the timer.
4	Serial communication interrupt - RI/TI	When the last bit (stop bit) of a byte is transmitted, the TI serial interrupt flag is set, and when the last bit (stop bit) of the receiving data byte is received, the RI flag gets set.

12. How does 8051 differentiate between bit and byte addresses in its internal ram ? [NOV / DEC 2019] .

The 8051 has a bit-addressable area of 16 bytes from byte addresses 20H to 2FH in internal RAM as shown in fig b, forming a total of 128 addressable bits (i.e., 16-byte location $\times$ 8 bits). Each bit can be accessed by its bit addresses from 00H to 7FH for the byte address location 20H to 2FH in RAM.

13. Give the format and list the function of the instruction DJNZ for 8051. [NOV / DEC 2019, APR / MAY 2017]

An instruction DJNZ reg, label is used to perform a Loop operation. In this instruction, a register is decremented by 1; if it is not zero, then 8051 jumps to the target address referred to by the label. The register is loaded with the counter for the number of repetitions prior to the start of the loop.

14. Explain the operating mode 0 of 8051 ports. [MAY / JUNE 2016]

Mode 0: In this mode, the serial port works like a shift register and the data transmission works synchronously with a clock frequency of $f_{osc}/12$. Serial data is received and transmitted through RXD. 8 bits are transmitted/ received at a time.

15. List features of 8051 microcontroller? [MAY / JUNE 2016]

- 4KB bytes on-chip program memory (ROM)
- 128 bytes on-chip data memory (RAM)
- Four register banks.
- 128 user defined software flags.
- 8-bit bidirectional data bus.
- 16-bit unidirectional address bus.
- 32 general purpose registers each of 8-bit.
- 16 bit Timers (usually 2, but may have more or less).

16. What is the significance of EA and PSEN pin in 8051 microcontroller? [NOV / DEC 2019]

Pin 29 – This is PSEN pin which stands for Program Store Enable. It is used to read a signal from the external program memory. Pin 30 – This is EA pin which stands for External Access input. It is used to enable/disable the external memory interfacing.

17 . List the advantages and disadvantages of parallel communication over serial communication in 8051? [MAY / JUNE 2016].

Serial mode offers the advantage of fewer traces on the pc board, and fewer pins on the devices. Parallel offers the advantage of transferring 8 data bits per I/O clock cycle, but at the disadvantage of many more pins required on the devices.

18. Define baud rate of 8051? [MAY / JUNE 2016].

Baud Rate is defined as the data transmission rate that determines the symbols per second for serial communication. It is the number of symbols transmitted per second. It is also known as symbol rate and is denoted by s .
Baud rate in 8051 is 11.0592 MHz

19. Which port is used as multi function port ? [APR / MAY 2017]

Pins 10 to 17 form the PORT 3 pins of the 8051 Microcontroller. PORT 3 also acts as a bidirectional Input / Output PORT with internal pull-ups. Additionally, all the PORT 3 Pins have special functions multifunctional for the 8051 microcontrollers. The port 3 signals are (RXD), (TXD), (INT0), (INT1), T0, T1, (RD), (WR)

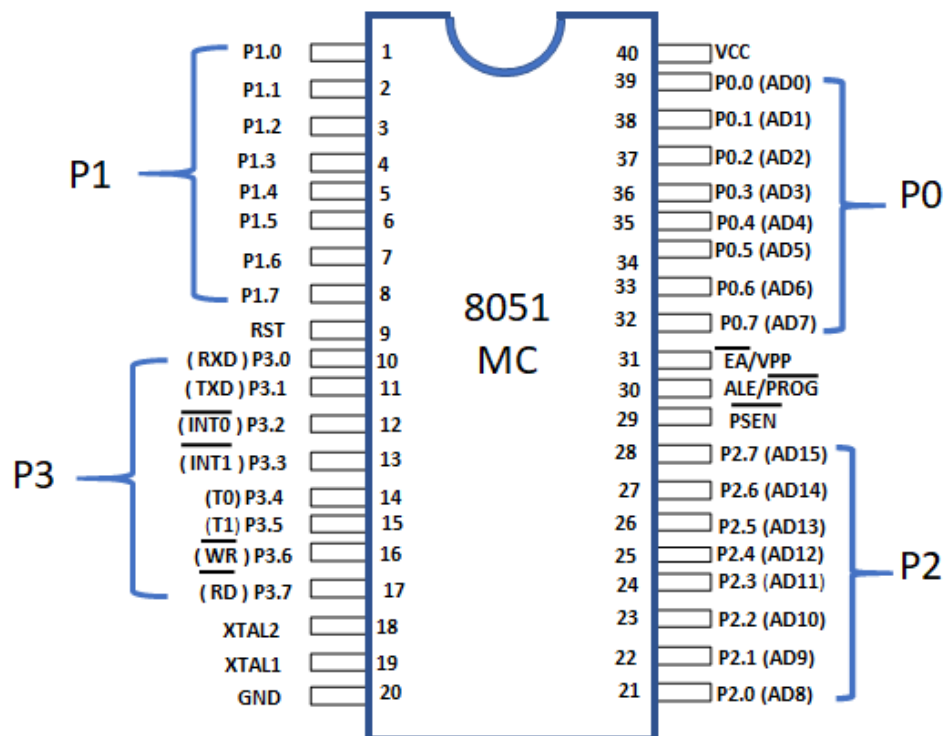
20. Difference between maskable and nonmaskable interrupt ? [NOV / DEC 2019]

Maskable interrupt is a hardware Interrupt that can be disabled or ignored by the instructions of CPU. A non-maskable interrupt is a hardware interrupt that cannot be disabled or ignored by the instructions of CPU

21. Illustrate cjne instruction? [APRIL / MAY 2017]

The CJNE instruction compares the first two operands and branches to the specified destination if their values are not equal. If the values are the same, execution continues with the next instruction.

22. Draw the pin diagram of 8051 ? [NOV/DEC 2019]



23. What are bit manipulation instructions give two examples ?[APRIL / MAY 2017]

The bit related operations that will be performed on that data, are as follows –

- Complement bit b₂
- Move b₅ to b₄
- OR b₀ and complement of b₁ and store to C (b₇)
- Set b₆
- Reset bit b₃

Input is AEH

BitPosition	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀
Value	1	0	1	0	1	1	1	0

Output

BitPosition	b ₇	b ₆	b ₅	b ₄	b ₃	b ₂	b ₁	b ₀
Value	0	1	1	1	0	0	1	0

The output will be 72H

Program

```
MOV24H,10H;Copy item from 10H to 24H
CPL24.2;Complement bit b2
MOVC,24.5;Copy b5 to C
MOV24.4,C;Move C to b4
MOVC,24.0;Make copy of b0 to C
ORLC,/1;OR C and complement of b1
SETB24.6;Set bit b6
CLR24.3;Reset bit b3
MOV30H,24H; Store the result at 30H
HALT: SJMP HALT
```

24. What is the different modes in which timer 2 can operate?

The Mode 2 operation is the 8-bit auto reload timer or counter. In the following diagram, we are using Mode 2 for Timer1. In this case every event for counter operations or machine cycles for timer operation, the TL1 register will be incremented by 1.

25.list the modes of timer in 8051?

In Intel 8051, there are two 16-bit timer registers. These registers are known as Timer0 and Timer1. The timer registers can be used in two modes. These modes are Timer mode and the Counter mode.

26. state how baud rate is calculated for searial adta transfer in mode 1? [NOV/DEC 2019]

Serial data is received and transmitted through RXD. 8 bits are transmitted/ received at a time. Pin TXD outputs the shift clock pulses of frequency $f_{osc}/12$, which is connected to the external circuitry for synchronization. The shift frequency or baud rate is always $1/12$ of the oscillator frequency.

27. how to program 8051 timers?

Load the TMOD value register indicating which timer (Timer 0 or Timer 1) is to be used and which timer mode (0 or 1) is selected. 2. Load registers TL and TH with initial count values 3. Start the timer.

28. Difference between Timer and counter ? draw the diagram of TCON in 8051? [NOV/DEC 2019]

S.no	TIMER	COUNTER
1	A timer uses the frequency of the internal clock, and generates delay.	A counter uses an external signal to count pulses.
2	These enable to precisely time processes, generate signals and count events	A counter converts the number of input cycles to a binary value using an array of triggers.

TCON Register:



- ☐ TF1: Timer 1 overflow flag.
- ☐ TR1: Timer 1 run control bit.
- ☐ TF0: Timer 0 overflow flag.
- ☐ TR0: Timer 0 run control bit.
- ☐ IE1: External interrupt 1 edge flag.
- ☐ IT1: External interrupt 1 type flag.
- ☐ IE0: External interrupt 0 edge flag.
- ☐ IT0: External interrupt 0 type flag.

29. what is the significance of EA pin

Pin 30 – This is EA pin which stands for External Access input. It is used to enable/disable the external memory interfacing. Pin 31 – This is ALE pin which stands for Address Latch Enable. It is used to demultiplex the address-data signal of port.

PART –B

1. Explain the Block diagram of 8051 ? or Explain the architecture of 8051? [MAY/ JUNE 2016 , NOV / DEC 2016, NOV / DEC 2017 ,APRIL/ MAY 2018, , NOV / DEC 2021, APRIL/ MAY 2018, APRIL/ MAY 2021,]
2. What are the vectored interrupt of 8051? [NOV / DEC 2019]

3. Explain the Data transfer , Arithmetic and branch instructions with examples . **[MAY/ JUNE 2019]**.
4. Explain the Serial Port Programming with examples .**[MAY/ JUNE 2016]** (or). Illustrate the serial communication in 8051 , with its special function register.
[NOV / DEC 2017]
5. Describe the different modes of operation of Timer/Counter in 8051 with its associated registers (or)Explain the timer modes of 8051 microcontroller ? **[NOV / DEC 2016, APRIL/ MAY 2017,APRIL/ MAY 2018, NOV / DEC 2019]**.
(Or) Illustrate the options available with Timer Mode (TMOD) register of 8051.
[NOV / DEC 2021]
6. Discuss the ports and its circuits of 8051 ?**[NOV / DEC 2017]**
7. List the various instructions available in 8051 microcontroller. **[APRIL/ MAY 2021, NOV / DEC 2017]**
8. For microcontroller discuss the following :
 - a) How RAM is organized and addressed ?
 - b) How many register banks are present in RAM and how is bank switching executed ? **[NOV / DEC 2019]**

UNIT 2- EMBEDDED C PROGRAMMING

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

PART-A

1. What is embedded C programming?

Embedded C is an extension of C language and it is used to develop micro-controller-based applications. The extensions in the Embedded C language from normal C Programming Language are the I/O Hardware Addressing, fixed-point arithmetic operations, accessing address spaces, etc..

2, Define memory device interfacing?

Memory Interface means an interface, or portion thereof, between a logic integrated circuit and a memory integrated circuit, whereby interface shall mean an electrical bus or other similar information path between integrated circuits that is capable of transmitting and/or receiving information between two or more.

3. Define I/O device interfacing

I/O interfaces are the mediums in which data are sent from internal logic to external sources and from which data are received from external sources. The interface signals can be unidirectional or bidirectional, single-ended or differential and could follow one of the different I/O standards.

4. Define Watch dog ?

A watchdog timer (WDT) is a timer that monitors microcontroller (MCU) programs to see if they are out of control or have stopped operating. It acts as a “watchdog” watching over MCU operation.

5. List the advantages and limitations of Priority based process scheduling. [NOV/DEC 2017]

S.NO	ADVANTAGES	DISADVANTAGES
1.	Good way to ensure processes with higher priorities are handled first	Processes with lower priority may be starved
2.	Good when the resources are limited and priorities for each process are defined beforehand	Difficult to objectively decide which processes are given higher priority

6. Define context switching in RTOS ? [APR/MAY 2018]

Context Switching involves storing the context or state of a process so that it can be reloaded when required and execution can be resumed from the same point as earlier. This is a feature of a multitasking operating system and allows a single CPU to be shared by multiple processes

7. List the memory devices used in the design of embedded system ? or What are the memory devices used in the design of embedded system ? [NOV/DEC 2018, NOV/DEC 2017]

Types of Memory , Volatile Memory, Random Access Memory (RAM) Static Random Access Memory (SRAM) , Dynamic Random Access Memory (DRAM), Non-volatile memory. EEPROM, . Flash memory ,SD card.

8. How does priority scheduling improve multitask execution ? [APR/MAY 2019]

Following are the benefits of priority scheduling method:

1. Easy to use.
2. Processes with higher priority execute first which saves time.
3. The importance of each process is precisely defined.
4. A good algorithm for applications with fluctuating time and resource requirements.

10. What is the concept of multitasking ? what does it signify . [NOV/DEC 2018]

Multitasking, the running of multiple programs (sets of instructions) in one computer at the same time. Multitasking is used to keep all of a computer's resources at work as much of the time as possible .

signify :

Multitasking is the act of doing more than one thing at the same time. Multitasking helps you save time and money in some cases, though trying to do more than one challenging task at a time may also decrease overall productivity.

12. What are the basic types of memory components that are commonly used in embedded systems ? [NOV/DEC 2019]

The main types involved in embedded systems are primary and secondary memory. The primary memory involves RAM which is a data memory and secondary memory involves an program memory called ROM. Data memory is classified as SRAM DRAM and SDRAM..

11. Bring out the difference between multiple process and multiple task ? [NOV/DEC 2019]

S.NO	Multi-tasking	Multiprocessing
1.	The execution of more than one task simultaneously is known as multitasking.	The availability of more than one processor per system, that can execute several set of instructions in parallel is known as multiprocessing.
2.	The number of CPU is one.	The number of CPUs is more than one.
3.	In this, one by one job is being executed at a time.	In this, more than one process can be executed at a time.

13. Define Embedded Programming? [APR/MAY 2019]

An embedded programming language is a programming language that developers use in embedded systems. In general, the languages offer low-level access to the device hardware. Developers use several common programming languages for embedded systems. Some people also call these embedded coding languages.

14. What is RTOS ?

An RTOS will often be used when there are more interrupt sources, more functions, and more standard communications interfaces that need to be supported. If the application is <64KB in size, an RTOS is not necessary. Conversely if, the applications is 1 MB, an RTOS will likely be used.

15. Define multitasking.

Multitasking is the process of scheduling and switching the CPU between several tasks. A single CPU switches its attention between several sequential tasks.

It maximizes the utilization of the CPU and also provides modular construction of application.

16. . What are the application of RTOS?

A Real time operating system is a multitasking operating system for response time controlled and event controlled process which has real time programming .

17.. When RTOS necessary and when it is not necessary in the Embedded system?

An RTOS is necessary when scheduling of Multiple processors

An RTOS is must to monitor the processors that are response controlled and event controlled processors.

18. What is Variable Scope?

Variables in C programming language, which Arduino uses, have a property called scope. A scope is a region of the program and there are three places where variables can be declared

19. What are Arduino – Operators?

An operator is a symbol that tells the compiler to perform specific mathematical or logical functions. C language is rich in the following types of operators –

- Arithmetic Operators
- Comparison Operators
- Boolean Operators

- Bitwise Operators
- Compound Operators

20. Define Sketch.

. A *sketch* is the name that Arduino uses for a program. It's the unit of code that is uploaded to and run on an Arduino board.

PART-B

1. Explain about I/O Devices, Timers and Counters, Watchdog Timers **APR/MAY 2017]**

2. Explain in detail about earliest deadline first scheduling ? **[APR/MAY 2017]**

3. Compare RMS and EDF ? **[NOV / DEC 2018]**

4. Explain the context switching mechanism for moving the CPU from one executing process to another with an example ? **[NOV / DEC 2019]**

5. Briefly explain the Multiple Tasks and Processes?

6. Explain the Priority Based Scheduling Policies?

7. Describe the Programming Embedded Systems in C .

8. Briefly explain the Multiple Tasks and Processes?

9. Explain the Priority Based Scheduling Policies?

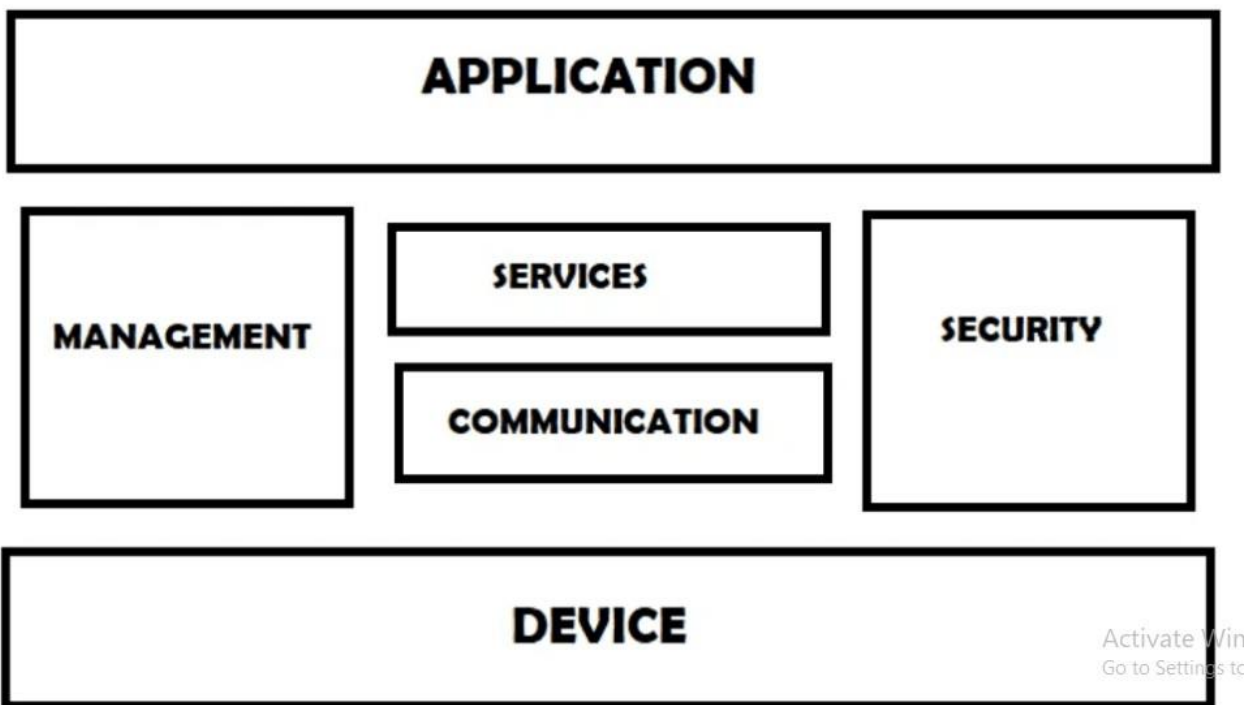
10. Describe the Programming Embedded Systems in C ?

UNIT III IOT AND ARDUINO PROGRAMMING

Introduction to the Concept of IoT – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino– Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

PART A

1. Draw the logic design of IOT and describe its components?



A logical design for an IoT system is the actual design of how its components (computers, sensors, and actuators) should be arranged to complete a particular function. It doesn't go into the depth of describing how each component will be built with low-level programming specifics.

2.What is Raspberry PI ?

Ans.: Raspberry Pi is a low-cost, credit card-sized computer that connects to a computer monitor or TV using HDMI, and uses a standard keyboard and mouse. It can run a host of operating systems, such as Raspbian, Android, Windows 10, IoT Core, etc.

3. What are the different raspberry pi model types ?

Ans.: The Raspberry Pi models are of two types
Model A (introduced later as a hardware-reduced model)
Model B (introduced first and is the full hardware model)

4.What is Python ? Ans.: Python is an object-oriented, high-level programming language with integrated dynamic semantics primarily for web and app development.

5.What is Python ? Ans.: Python is an object-oriented, high-level programming language with integrated dynamic semantics primarily for web and app development.

6 . .List the benefits of Python. Ans.: Python can be used to develop prototypes.

- ✓ Python allows for a more productive coding environment than massive languages like C# and Java.
 - ✓ Python powers Django, a complete and open source web application framework
 - ✓ Most automation, data mining, and big data platforms rely on Python.
- Python supports modules and packages, which encourages program modulation and code reuse.

7...What is GND in GPIO ?Ans.: GND means ground pins. Ground GPIO pins are physical numbers 6, 9, 14, 20,

25, 30, 34 and 39.

Define Raspberry Pi hardware. Ans.: Raspberry Pi hardware includes ARM processor, GPU, RAM and USB port

8.. What is Raspbian OS? Ans.: Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. • An operating system is the set of basic programs and utilities that make your Raspberry Pi run • As Raspbian is a Linux operating system it has good security features, has excellent networking capabilities. Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs.

9.What are the 4 protocols of IoT?(April/May 2019

Most common protocols

1. MQP. Short for Advanced Message Queuing Protocol, AMQP is an open standard protocol used for more message-oriented middleware. ...
2. Bluetooth and BLE. Bluetooth is a short-range wireless technology that uses short-wavelength, ultrahigh-frequency radio waves. ...
3. Cellular. ...
4. CoAP. ...
5. DDS. ...
6. LoRa and LoRaWAN. ...
7. LWM2M. ...
8. MQTT.

10 .Why Linux OS used in Raspberry pi ? (April/May 2019)

Linux is an open-source operating system intended with retro gaming in mind. While it may operate on standard computer systems, it is specifically designed for various minicomputers such as the androids and Raspberry Pi . This property makes it versatile and dynamically applicable to any PC or laptop hardware.

11.. In what way Raspberry pi is better than arduino ? (April/May 2019)

In summary, Arduino has a simpler software environment that is well-suited for basic control of inputs and outputs, while Raspberry Pi has a more powerful and versatile operating system that provides greater functionality for complex projects.

12. .Define IoT.

The Internet of Things as simply an interaction between the physical and digital worlds. The digital world interacts with the physical world using a plethora of sensors and actuators

13 .Point out the challenges faced by Internet of Things.

1. Security. In our opinion, security is the most crucial issue that needs to be addressed for IoT.
2. Costs.
3. Reliability and Hardware.
4. Ease of Integration.
5. Connectivity.
6. Development Skill set.
7. Quality Control.Design

14.... Summarize the characteristics of IoT.

Authenticity of data collected via IoT device (the data that you can rely on)

Automation of the contracts based on the rules decided while creating contracts & tamperproof data collected via IoT. ...

Security of the data collected via IoT devices.

15. Explain the benefits of IoT,

Automation of the contracts based on the rules decided while creating contracts & tamperproof data collected via IoT. ...

Security of the data collected via IoT devices.

16 What is .LCD shield?

The keypad of LCD (Liquid Crystal Display) shield includes five buttons called as up, down, left, right, and select

17. What are the Types of Shields?

The popular Arduino shields are listed below:

- **Ethernet shield**
- **Xbee Shield**
- **Proto shield**
- **Relay shield**
- **Motor shield**
- **LCD shield**
- **Bluetooth shield**
- **Capacitive Touchpad Shield**

18 What is. Arduino Uno Pinout - ICSP Header?

ICSP stands for In-Circuit Serial Programming

19. Define I2C

- SCL/SDA pins are the dedicated pins for I2C communication. On the Arduino Uno they are found on Analog pins A4 and A5.

20 . **Define Arduino Interrupt** - INT0 and INT1. Arduino Uno has two external interrupt pins.

PART –B

1. Briefly explain the Technical Building blocks of IoT,
2. Describe the Communication Technologies of IOT
3. Draw the Physical design of IOT and explain .
4. Explain the Sensors and sensor Node and interfacing using any Embedded target boards Raspberry Pi.
5. Explain about Arduino shields.
6. Explain the types of Arduino in detail.

UNIT IV

IOT COMMUNICATION AND OPEN PLATFORMS

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth WiFi – ZigBee– GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming –Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins –Connecting to the Cloud.

PART-A

1. What is IoT Communication APIs?

An API is an interface used by programs to access an application. It enables a program to send commands to another program and receive replies from the app. IoT APIs are the interface points between an IoT device and the Internet and/or other network components

2. . What is Layered system?

A layered system defines the boundaries of the components within each specific layer. For example, A client is unable to tell whether it is connected to the end server or an intermediate node.

3. What is Bluetooth?

An important short-range IoT communications Protocols / Technology. Bluetooth, which has become very important in computing and many consumer product markets. It is expected to be key for wearable products in particular, again connecting to the IoT albeit probably via a smartphone in many cases.

4. . What is Zigbee?

ZigBee is similar to Bluetooth and is majorly used in industrial settings. It has some significant advantages in complex systems offering low-power operation, high security, robustness and high and is well positioned to take advantage of wireless control and sensor networks

5. Define NFC

NFC (Near Field Communication) is an IoT technology. It enables simple and safe communications between electronic devices, and specifically for smartphones, allowing consumers to perform transactions in which one does not have to be physically present

6. What is Piconet?

The Bluetooth network is called a piconet. If it contains one master and one slave then its called a single piconet. Similarly, if it contains one master and multiple slaves are called multiple piconets.

7. Define Scatternet

Its a Combination of multiple piconets.

Here Master of one piconet can be a slave in another piconet

8. How Does GPS Function?

GPS satellites complete two accurate orbits around the planet every day. An individual

satellite's signal and orbiting parameters can be decoded and used to pinpoint the satellite's location via a GPS receiver. This data, together with triangulation, is used by GPS receivers to pinpoint the precise location of its owners

9. What is GSM/GPRS module ?

It is used to establish communication between a computer and a **GSM-GPRS system**. **Global System for Mobile communication (GSM)** is an architecture used for mobile communication in most of the countries.

10. What is Mobile Station?

A mobile phone and Subscriber Identity Module (SIM) together form a mobile station. It is the user equipment that communicates with the mobile network

11.Explain Mobile Termination .

It is interfaced with the GSM mobile network and is controlled by a baseband processor. It handles application processor that deals with handling operations related to keypad, screen, phone memory and other hardware and software services embedded into the handset

12. What is Mobile Switching Centre (MSC)

The Mobile Switching Centre or MSC is the key element in the core network region of the GSM network architecture. allow the mobile user necessities to be supported like authentication, registration, inter-MSC handovers call location & routing of the call to a cell phone subscriber

13. Define Home Location Register (HLR)

This HLR database includes the information regarding the administrative like every subscriber with their previous identified location

14. What is meant by Visitor Location Register (VLR)?

The VLR includes preferred information that is received from the HLR network to allow the preferred services for the separate subscriber

15. Define Equipment Identity Register (EIR)

The EIR (Equipment Identity Register) is the unit that makes a decision whether specified mobile gear may be permitted over the network

16. What is SMS Gateway (SMS-G)?

The SMS gateway or SMS-G is used jointly to explain two SMS-Gateways in the GSM standards. These gateways control messages which are directed in dissimilar ways.

17. What is Base Station Controller (BSC)?

The BSC (base station controller) is used to form the next phase reverse into the GSM technology. This controller is used to control a collection of base transceiver stations & it is frequently co-located through one of the transceiver stations within the group

18. What is Operation and Support Subsystem (OSS)?

The operation support subsystem (OSS) is a part of the complete GSM network architecture. This is connected to the NSS & the BSC components. This OSS is mainly used to control the GSM network & the BSS traffic load

19. Define NOOBS

New Out Of the Box Software, or simply NOOBS is an operating system installer for Raspberry Pi, delivered primarily on an SD card, which contains a variety of operating systems

20. What is a Raspberry Pi?

The Raspberry Pi is a single-board computer developed by the Raspberry Pi Foundation, a UK- based charity organization. Originally designed to provide young people with an affordable computing option to learn how to program, it has developed a massive following in the maker and DIY communities because of its compact size, full Linux environment, and general-purpose input–output (**GPIO**) pins.

PART B

- 1.Explain GSM services and its architecture in detail
- 2.Brief about Bluetooth architecture.
- 3.Explain IOT communication Protocols with neat diagram.
- 4.write about Rasoerypi and its function.
- 5.Explain GPS in detail.
- 6.How signals are transmitted using GPIO?

UNIT V

UNIT V APPLICATIONS DEVELOPMENT

Complete Design of Embedded Systems – Development of IoT Applications –
Home Automation –Smart Agriculture – Smart Cities – Smart Healthcare.

PART A

1.What is an Embedded System Design?

A system designed with the embedding of hardware and software together for a specific function with a larger area is embedded system design.

2. What are the Elements of Embedded Systems

- Processor
- Microprocessor
- Microcontroller

Digital signal processor

3. Write the Types of Embedded Systems

- Stand-Alone Embedded System
- Real-Time Embedded System
- Networked Appliances

Mobile devices

4.What are the Challenges in Embedded System Design

- Environment adaptability
- Power consumption
- Area occupied
- Packaging and integration
- Updating in hardware and software
- Security

There are various challenges the designers face while testing the design like Embedded hardware testing, Verification stage, Validation Maintainability

5. Write Embedded System Design Examples

- Automatic chocolate vending machine (ACVM)
- Digital camera
- Smart card
- Mobile phone
- Mobile computer..etc.

6. What are sensors?

Sensor used for sensing the change in environment condition and it generate the electric signal on the basis of change in environment condition. Therefore it is also called as transducers for providing electric input signal on the basis of change in environment

condition.

7. Define Application specific integrated circuit (ASIC) is an integrated circuit designed to perform task specific operation inside an embedded system

8. What are Embedded System processors?

Processors are the major part in embedded systems that take response from sensors in digital form and processing of this response to produce output in real-time processing environment is performed using processors.

9. Write the Types of general purpose processor

- Microprocessor
- Microcontroller
- Digital signal processor
- Analog signal processor

10. What are Three main components of Embedded systems?

1. Hardware
2. Software
3. Firmware

11. Write the Disadvantages of Embedded System

- High development cost.
- Time-consuming design process.
- As it is application-specific less market available.

12. Write the Advantages of Embedded System

- Enhanced real-time performance.

13. What Industrial Automation

It is one of the areas where the quality of products is an essential factor for a more significant investment return. Anyone can **re-engineer** products and their packaging to provide superior performance in **cost** and **customer experience** with IoT applications

14. Write the applications of IOT in Healthcare

Healthcare do real-time monitoring with the help of smart devices. It gathers and transfers health data such as blood pressure, blood sugar levels, weight, oxygen, and ECG. The patient can contact the doctor by the smart mobile application in case of any emergency

15. Write the applications of IOT in Smart Retail

IoT applications in retail give shoppers a new experience. Customers do not have to stand in long queues as the checkout system can read the tags of the products and deduct the total amount from the customer's payment app with IoT applications' help.

16. Write the applications of IOT in Smart Supply Chain

Customers automate the delivery and shipping with a smart supply chain. It also provides details of real-time conditions and supply networks.

17. Write the applications of IOT in Smart Grid

The smart grid is the IoT that attends to energy systems. Utility companies use smart grid technologies to find energy efficiencies through various means, including monitoring energy consumption, predicting energy shortages and power outages, and gathering data on how different individuals and companies use energy

18. Write the applications of IOT in Smart Farming

Farmers can minimize waste and increase productivity. The system allows the monitoring of fields with the help of sensors. Farmers can monitor the status of the area. Internet-connected devices go from 5 million to billions in just one year. Business Insider Intelligence estimates 24 billion IoT devices will install and generate more than 300 billion in revenue in the future.

19. What is MQTT Protocol?

This IoT based Home Automation Project uses MQTT protocol for exchanging data between server and client.

20. Define Signal Conditioning Unit.

This sensor is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading

PART B

1. Explain the Complete Design of Embedded Systems
2. Explain the Development of IoT Applications
3. Write a program for Home Automation and explain
4. Write a program –Smart Agriculture and explain with relevant diagrams.
5. Write a program Smart Cities and explain
6. Write a program Smart Healthcare. and explain with relevant diagrams.