INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

DEFINITIONS AND TERMINOLOGY

Course Title	**MICROPROCESSORS AND MICROCONTROLLERS**				
Course Code	AECB24				
Programme	B.Tech				
Semester	FIVE				
Course Type	CORE				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	2	1	3		
Chief Coordinator	Ms. B Lakshmi Prasanna, Assistant Professor				
Course Faculty	Ms. B Lakshmi Prasanna, Assistant Professor				

OBJECTIVES:

The students will try to learn:	
I	The architecture and operation of microprocessors and microcontrollers.
II	The programming and interfacing of Intel microprocessors, microcontrollers to design processor and controller based circuits.
III	The applications of microprocessors and microcontrollers in the field of Communications, Electronic measurement, control systems, Consumer electronics industry and other real-time systems.

COURSE OUTCOMES:

Upon the successful completion of the course, Students will be able to:		
CO No	**Course Outcomes**	**Knowledge Level (Bloom's Taxonomy)**
CO 1	**Outline** the internal architecture of 8085, 8086 and 8051 microcomputers to study their functionality.	Understand
CO 2	**Illustrate** the organization of registers and memory in 8086 for programming and memory allocation within processor.	Understand

CO 3	**Explain** various addressing modes and instruction set of target microprocessor and microcontroller useful for writing assembly language programs.	Understand
CO 4	**Distinguish** between minimum mode and maximum mode operation of 8086 microprocessor with timing diagrams.	Analyze
CO 5	**Interpret** the functionality of various types of interrupts and their structure for controlling the processor or controller and program execution flow.	Understand
CO 6	**Demonstrate** the internal architecture and various modes of operation of the devices used for interfacing memory and I/O devices with microprocessor.	Understand
CO 7	**Choose** an appropriate data transfer scheme and hardware to perform serial data transfer among the devices.	Apply
CO 8	**Make use of** 8051 microcontroller to perform Time/Counter operations in various applications.	Apply
CO 9	**Select** the suitable registers of 8051 microcontroller and program it to perform data conversion, interfacing with memory and I/O devices.	Apply
CO 10	**Build** necessary hardware and software interface using microcomputer based systems to provide solution for real world problems.	Apply

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S.No	Question	Answer	Blooms Taxonomy Level	Course Outcome
		MODULE-I 8086 MICROPROCESSORS		
1	Define microprocessor?	A processor on a single integrated circuit. In the world of personal computers, the terms microprocessor and CPU are used interchangeably	Remember	CO 1
2	What is pipelining?	A technique used in advanced microprocessors where the microprocessor begins executing a second instruction before the first has been completed	Remember	CO 1
3	What is a clock speed?	The clock speed determines how many instructions per second the processor can execute	Remember	CO 1
4	Define is a RISC processor?	RISC stands for Reduced Instruction Set Computer. It is designed to reduce the execution time by simplifying the instruction set of the computer.	Remember	CO 1
5	What is an Input device?	A device that allows input of information to a computer.	Remember	CO 1
6	What is an Interface?	Interfacing a microprocessor is to connect it with various peripherals to perform various data operations and controlling of the devices.	Remember	CO 1
7	Define CISC processor?	CISC stands for Complex Instruction Set Computer. It is designed to minimize the number of instructions per program, ignoring the number of cycles per instruction.	Remember	CO 1
8	What is a coprocessor?	A coprocessor is a specially designed microprocessor, which can handle its particular function many times faster than the ordinary microprocessor.	Remember	CO 1
9	Define addressing modes?	The term addressing modes refers to the way in which the operand of an instruction is specified.	Remember	CO 3
10	Define ALU?	An arithmetic logic unit (ALU) is a digital circuit used to perform arithmetic and logic operations.	Remember	CO 1
12	What is an Instruction format?	The assembler processes an Instruction it converts the instruction from its mnemonics form to standard machine language format called the "Instruction format".	Remember	CO 3

13	What is speed of a microprocessor?	Time required for executing a basic instruction	Remember	CO 1
14	What is an ISR?	ISR (Interrupt Service Routine)is a short program to instruct the microprocessor on how to handle the interrupt.	Remember	CO 1
15	Define assembler?	Assembler converts instructions written in low-level symbolic code into machine code.	Remember	CO 1
16	What is Program?	Program is a set of instruction used to perform a task.	Remember	CO 1
17	Define Instruction?	Instruction is a command to the microprocessor to perform a task.	Remember	CO 3
18	Define Mnemonics?	Mnemonics is an abbreviation for each binary instruction word	Remember	CO 3
19	What is architecture?	Architecture is the study of internal logic circuitry.	Remember	CO 1
20	What is a control unit?	Provides necessary timing and control signals to all the operation of the microprocessor and microprocessor system	Remember	CO 1
21	What is a system bus?	System bus is used for communication path between Microprocessor and peripherals. System bus is a group of wires used to carry the information bits.	Remember	CO 1
22	What is versatility?	The microprocessors are versatile as the same chip can be used in A number of applications by configuring the software program.	Remember	CO 1
23	What is a register?	The Registers are a mini-storage area for data used by the Arithmetic Logic Unit (ALU) to complete the tasks the Control Unit has requested.	Remember	CO 2
24	What is a pre-fetch unit?	The pre-fetch Unit decides when to order data and instructions from the Instruction Cache or the computer's main memory based on commands or the task at hand.	Remember	CO 1
25	What is a decode unit?	The Decode Unit decodes or translates complex machine language instructions into a simple format understood by the Arithmetic Logic Unit (ALU) and the Registers. This makes processing more efficient.	Remember	CO 1
26	What is a flag register?	Flag Register shows the status of the microprocessor before/after an operation.	Remember	CO 2
27	What is a carry flag?	Carry Flag Is set if there is a carry or borrow from arithmetic operation	Remember	CO 2
28	What is a program counter?	Program Counter (PC)is a register that is used to control the sequencing of the execution of instructions. This register always holds the address of the next instruction	Remember	CO 1
29	What is a stack?	Stack is an area of memory identified by the programmer for temporary storage of information.	Remember	CO 2
30	What is an address bus?	Address bus carries the address, which is a unique binary pattern used to identify a memory location or an I/O port.	Remember	CO 1
31	What are the modes in which 8086 can operate?	The 8086 can operate in two modes and they are minimum (or uniprocessor) mode and maximum (or multiprocessor) mode.	Remember	CO 4
32	What are the hardware interrupts of 8086?	The interrupts of 8086 are INTR and NMI. The INTR is general maskable interrupt and NMI is non-maskable interrupt.	Remember	CO 5
33	What is a segment register?	The segment registers stores segment base address of the memory segment.	Remember	CO 2

34	What is a ready signal	This is the acknowledgment from the slow devices (or) memory that they have completed the data transfer.	Remember	CO 1
35	What is ALE?	ALE -Address Latch Enable: This signal indicates the availability of the valid address on the address / data lines.	Remember	CO 1
36	What is DEN signal?	DEN signal indicates the availability of valid data over the address / data lines.	Remember	CO1
37	What is a numeric processor?	The numeric processor 8087 is a coprocessor which has been designed to work under the control of the processor 8086 and offer it additional numeric processing capabilities.	Remember	CO 1
38	Define bit.	Bit is the smallest unit of memory storage.	Remember	CO 1
39	What is Von Neumann Architecture?	Data and instructions stored in a single memory unit	Remember	CO 1
40	What is Harvard Architecture	Data and instructions stored in a separate memory units	Remember	CO 1
41	What is machine instruction?	Machine instruction is binary code for processing by hardware.	Remember	CO 3
MODULE-II PROGRAMMING WITH 8086 MICROPROCESSOR				
1	What is assembler directives?	Assembler directives direct the assembler to do something. As the name says, it directs the assembler to do a task.	Remember	CO 3
2	What is define byte (DB) directive?	Define Byte [DB] directive defines the byte type variable.	Remember	CO 3
3	What is define word (DW) directive?	Define Word [DW] directive defines items that are one word (two bytes) in length.	Remember	CO 3
4	What is define quad word (DQ) directive?	Define Quad word [DQ] directive is used to tell the assembler to declare variable 4 words in length or to reserve 4 words of storage in memory.	Remember	CO 3
5	What is define ten bytes (DT) directive?	Define Ten bytes [DT] is used to define the data items that are 10 bytes long.	Remember	CO3
6	What is assume directive?	The ASSUME directive is used to tell the assembler that the name of the logical segment should be used for a specified segment.	Remember	CO 3
7	What is equ directive??	This EQU directive is used to give a name to some value or to a symbol. Each time the assembler finds the name in the program, it will replace the name with the value or symbol you given to that name.	Remember	CO 3
8	What is even directive??	EVEN directive instructs the assembler to increment the location of the counter to the next even address if it is not already in the even address.	Remember	CO 3
9	What is group directive?	The GROUP directive is used to group the logical segments named after the directive into one logical group segment.	Remember	CO 3
10	What is PROC directive?	The PROC directive is used to identify the start of a procedure. The term near or far is used to specify the type of the procedure.	Remember	CO 3
11	Which Interrupt Has The Highest Priority?	TRAP has the highest priority.	Remember	CO 5
12	List out few Assembly Controls?	JMP Jump; Intel 80×86; unconditional jump (near [relative displacement from PC] or far; direct or	Remember	CO 3

		indirect [based on contents of general purpose register, memory location, or indexed]) Jump Conditionally; Intel 80×86; conditional jump (near [relative displacement from PC] or far; direct or indirect [based on contents of general purpose register, memory location, or indexed]) based on a tested condition: JA/JNBE, JAE/JNB, JB/JNAE, JBE/JNA, JC, JE/JZ, JNC, JNE/JNZ, JNP/JPO, JP/JPE, JG/JNLE, JGE/JNL, JL/JNGE, JLE/JNG, JNO, JNS, JO, JS		
13	What are Assembly Condition Codes?	Condition codes are the list of possible conditions that can be tested during conditional instructions. Typical conditional instructions include: conditional branches, conditional jumps, and conditional subroutine calls. Some processors have a few additional data related conditional instructions, and some processors make every instruction conditional. Not all condition codes available for a processor will be implemented for every conditional instruction.	Remember	CO 3
14	What Is Data Movement?	Data movement instructions move data from one location to another. The source and destination locations are determined by the addressing modes, and can be registers or memory. Some processors have different instructions for loading registers and storing to memory, while other processors have a single instruction with flexible addressing modes.	Remember	CO 3
15	What is Assembly Numbers?	Numerical data is generally represented in binary system. Arithmetic instructions operate on binary data. When numbers are displayed on screen or entered from keyboard, they are in ASCII form.	Remember	CO 3
16	What is Assembly Arithmetic Instructions?	The processor instruction set provides the instructions ADD, SUB, MUL, DIV, INC, and DEC to perform arithmetic operations which tests according to the need of the program.	Remember	CO 3
17	What is Assembly Logical Instructions?	The processor instruction set provides the instructions AND, OR, XOR, TEST, and NOT Boolean logic, which tests, sets, and clears the bits according to the need of the program.	Remember	CO 3
18	What is Assembly Conditions?	Conditional execution in assembly language is accomplished by several looping and branching instructions. These instructions can change the flow of control in a program. Conditional execution is observed in two scenarios – • Unconditional jump • Conditional jump	Remember	CO 3
19	What is Assembly Strings?	We have already used variable length strings in our previous examples. The variable length strings can have as many characters as required.	Remember	CO 3
20	What is Assembly Procedures?	Procedures or subroutines are very important in assembly language, as the assembly language programs tend to be big in size. Procedures are recognized by a name.	Remember	CO 3
21	What is Assembly Recursion?	A recursive procedure is one that calls itself. There are kind of recursion: direct and indirect.	Remember	CO 3

		In direct recursion, the procedure calls itself and in indirect recursion, the first procedure calls a second process, which in turn calls the first procedure.		
22	What Is Meant By Cross- compiler?	A program runs on one machine and executes on another is called as cross- compiler Programs which compile on One Machine and Execute on Another machine is called cross compiler.	Remember	CO 3
23	What is OFFSET directive?	Offset directive is used to determine the offset or displacement of a named data item or procedure from the start of the segment which contains it.	Remember	CO3
24	What is ORG directive?	The ORG directive allows setting a desired value at any point in the program.	Remember	CO 3
25	What is PROC directive?	PROC directive is used to identify the start of a procedure.	Remember	CO 3
26	What is SEGMENT directive?	SEGMENT directive is used to indicate the start of a logical segment	Remember	CO 3
27	What is Assembly Language Programming?	Assembly language programming is a low-level programming language for a computer or other programmable device specific to particular computer architecture in contrast to most high-level programming languages, which are generally portable across multiple systems. assembly language is converted into executable system code through a utility application called an assembler like NASM, MASM, etc.	Remember	CO 3
28	List out the advantages of Assembly Language Programming?	Advantages of using assembly language are – - It requires less memory and execution time; - It allows hardware-specific complex jobs in an easier way; - It is suitable for time-critical jobs; - It is most suitable for writing interrupt provider routines and different memory resident programs.	Remember	CO 3
29	What are the features of processor?	The main internal hardware of processor consists, external memory, registers, control unit, and ALU. Registers are processor components that hold information and address. To execute a program, the system copies it from the external device into the internal memory. The processor executes the program instructions.	Remember	CO 1
30	What is the fundamental unit in computer or processor storage?	The fundamental unit of computer storage is a bit; it could be ON (1) or OFF (0). A group of 9 related bits makes a byte, out of which eight bits are used for information and the final one is used for parity. According to the rule of parity, the number of bits that are ON (1) in each byte should always be odd. The parity bit is used to make the number of bits in a byte odd. If the parity is even, the system assumes that there had been a parity error (though rare), which might have been caused due to hardware fault or electrical disturbance.	Remember	CO 1
31	Find the (FAD8)H hexadecimal conversion to binary?	Hexadecimal number considered is (FAD8)H its equal binary form is - (1111 1010 1101 1000)B	Remember	CO 1
32	What are the rules followed in Binary Arithmetic?	The following table illustrates four simple rules for binary addition – Rules (iii) and (iv) show a carry of a 1-bit into the next left position.	Remember	CO 1

33	What Is Non-maskable Interrupts?	An interrupt which can be never be turned off (ie.disabled) is known as Non-Maskable interrupt.	Remember	CO 5
34	What is PTR directive?	PTR operator is used to assign a specific type of a variable or to a label.	Remember	CO 3
35	What is PUBLIC directive?	The PUBLIC directive is used to instruct the assembler that a specified name or label will be accessed from other modules.	Remember	CO 3
36	What is INT21H?	INT 21H is used to call DOS Function.	Remember	CO 5
37	Define assembler?	Assembler converts instructions written in low-level symbolic code into machine code.	Remember	CO 3
38	What is base register?	BX is known as the base register, as it may be used in indexed addressing.	Remember	CO 2
39	What is count register?	CX is known as the count register. CX registers store the loop count in iterative operations.	Remember	CO 2
40	What is an instruction pointer?	Instruction Pointer (IP)stores the offset address of the next instruction to be done.	Remember	CO 2
41	What is END directive?	The END directive marks the end of an assembly language program	Remember	CO 3
42	What is ENDP directive?	ENDP (End Procedure) used to indicate the end of a procedure.	Remember	CO 3
43	What is ENDS directive?	ENDS-End of Segment directive marks the end of a logical segment.	Remember	CO 3
44	What Happens When Hlt Instruction Is Executed In Processor?	The Micro Processor enters into Halt-State and the buses are tri-stated.	Remember	CO 3
	MODULE-III INTERFACING WITH 8086/88			
1	List out the features of 8255A?	The prominent features of 8255A are as follows − - It consists of 3 8-bit IO ports i.e. PA, PB, and PC to enhance the flexibility of 8225. Address/data bus must be externally demux. - It is TTL compatible. - It has improved DC driving capability.	Remember	CO 6
2	What is the necessity of 8259A?	In a system, microprocessor may need to perform the following tasks in an efficient way using interrupt: - Read ASCII characters from a keyboard on an interrupt basis. - Count interrupts from a timer to produce a real time clock of seconds, minutes and hours. - Communicate with an A/D converter. - Communicate with a display or printer. - Detect several emergency signals like power failure etc on aninterrupt basis.	Remember	CO 5
3	What is the function of 8259A?	The Programmable Interrupt Controller (PIC) functions as an overall manager in an interrupt-driven system environment. It accepts requests from the peripheral equipment, determines which of the incoming requests is of the highest importance (priority), ascertains whether the incoming request has a higher priority value than the level currently being serviced and issues an interrupt to the CPU based on this determination.	Remember	CO 5, CO 6
4	What is the use of 8251 chip?	Intel's 8251A is a universal synchronous asynchronous receiver and transmitter compatible with Intel's Processors.	Remember	CO 6, CO 7
5	List out different methods used for data	The data transmission between two points involves unidirectional or bi- directional transmission of	Remember	CO 7

	transmission?	meaningful digital data through a medium. There are basically there modes of data transmission (a) Simplex (b) Duplex (c) Half Duplex		
6	What are the various programmed data transfer methods?	(i) Synchronous data transfer (ii) Asynchronous data transfer (iii) Interrupt driven data transfer	Remember	CO 7
7	Define synchronous data transfer?	It is a data method which is used when the I/O device and the microprocessor match in speed. To transfer a data to or from the device, the user program issues a suitable instruction addressing the device. The data transfer is completed at the end of the execution of this instruction.	Remember	CO 7
8	Define asynchronous data transfer?	It is a data transfer method which is used when the speed of an I/O device does not match with the speed of the microprocessor. Asynchronous data transfer is also called as Handshaking.	Remember	CO 7
9	What are the functional types used in control words of 8251a?	The control words of 8251A are divided into two functional types. 1. Mode Instruction control word 2. Command Instruction control word	Remember	CO 6,CO7
10	What are the different types of command words used in 8259A?	The command words of 8259A are classified in two groups, 1. Initialization command words (ICWs) 2. Operation command words (OCWs)	Remember	CO 5,CO6
12	List the types of operating modes of 8259A?	(a) Fully Nested Mode (b) End of Interrupt (EOI) (c) Automatic Rotation (d) Automatic EOI Mode (e) Specific Rotation (f) Special Mask Mode (g) Edge and level Triggered Mode (h)Reading 8259 Status (i) Poll command (j) Special Fully Nested Mode (k) Buffered mode (l) Cascade mode	Remember	CO 5,CO6
13	What is the use of modem control unit in 8251?	The modem control unit handles the modem handshake signals to coordinate the communication between the modem and the USART.	Remember	CO 6
14	What are the internal devices of a typical DAC?	The internal devices of a DAC are R/2R resistive network, an internal latch and current to voltage converting amplifier.	Remember	CO 6
15	What is settling or conversion time in DAC?	The time taken by the DAC to convert a given digital data to corresponding analog signal is called conversion time.	Remember	CO 6
16	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.	Remember	CO 6
17	What is programmable peripheral device?	If the functions performed by a peripheral device can be altered or changed by a program instruction then the peripheral device is called programmable device. Usually the programmable devices will have control registers. The device can be programmed by sending	Remember	CO 6

		control word in the prescribed format to the control register.		
18	What is the need of a Port?	The I/O devices are generally slow devices and their timing characteristics do not match with processor timings. Hence the I/O devices are connected to system bus through the ports.	Remember	CO 6
19	What is handshake port?	In handshake port, signals are exchanged between I/O device and port or between port and processor for checking or informing various condition of the device.	Remember	CO 6
20	What are the internal devices of 8255?	The internal devices of 8255 are port-A, port-B, port-C and Control register. The ports can be programmed for either input or output function in different operating modes.	Remember	CO 6
21	List out the operating modes of port -A 8255?	The port-A of 8255 can be programmed to work in anyone of the following operating modes as input or output port. Mode-0: Simple 1/0 port. Mode-l : Handshake 1/0 port Mode-2 : Bidirectional 1/0 port	Remember	CO 6
22	What are the functions performed by port-C of 8255?	1. The port-C pins are used for handshake signals. 2. Port-C can be used as an 8-bit parallel 1/0 port in mode-0. 3. It can be used as two numbers of 4-bit parallel port in mode-0. 4. The individual pins of port-C can be set or reset for variouscontrol applications.	Remember	CO 6
23	Define baud rate?	The baud rate is the rate at which the serial data is transmitted (expressed as bits per second). Baud rate is also defined as l/(Tb - time period for a symbol). In some systems, one data bit maybe represented through one symbol. Then, on such occasions, the baud rate and bits/sec are same.	Remember	CO 7
24	Define USART? What are the functions performed by INTEL 8251A?	The device which can be programmed to perform Synchronous or Asynchronous serial communication is called USART (Universal Synchronous Asynchronous Receiver Transmitter). The INTEL 8251A is an example of USART. The INTEL 825lA is used for serial data transmission or reception either asynchronously or synchronously. The 8251A can be used to interface MODEM for serial communication through telephone lines.	Remember	CO 6
25	What are the control words of 8251A and what are its functions?	The control words of 8251A are Mode word and Command word. The mode word informs 8251about the baud rate, character length, parity and stop bits. The command word can be send to enable the data transmission and reception.	Remember	CO 6
26	What are the functions performed by INTEL 8251A?	The INTEL 825lA is used for converting parallel data to serial or vice versa. The data transmission or reception can be either asynchronously or synchronously. The 8251A can be used to interface MODEM and establish serial communication through MODEM over telephone lines.	Remember	CO 6
27	What is the information that can be obtained from the status word of 8251?	The status word can be read by the CPU to check the readiness of the transmitter or receiver and to check the character synchronization in synchronous reception. It also provides information regarding various errors in the data received. The various error	Remember	CO 6

		conditions that can be checked from the status word are parity error, overrun error and framing error.		
28	List out different types of errors that can occur in asynchronous serial communication?	1. Framing Error 2. Over run Error 3. Parity Error	Remember	CO 7
29	What is the significance of C/D signal in 8251?	This pin is used to select either Control register for configuring or Data bus buffer for read /write operations.	Remember	CO 6
30	What are the different scan modes of 8279?	The different scan modes of 8279 are Decoded scan and Encoded scan. In decoded scan mode, the output of scan lines will be similar to a 2-to-4 decoder. In encoded scan mode, the output of scan lines will be binary count, and so an external decoder should be used to convert the binary count to decoded output.	Remember	CO 6
31	What is de bouncing?	When a key is pressed, it bounces after a short time. If a key code is generated immediately after sensing a key actuation, then the processor will generate the same key code a number of times.(A key typically bounces for 10 to 20 msec). Hence the processor has to wait for the key bounces to settle before reading the key code. This process is called keyboard de bouncing.	Remember	CO 6
32	What is the difference in programming the 8279 for encoded scan and decoded scan?	If the 8279 is programmed for decoded scan then the output of scan lines will be decoded output and if it is programmed for, encoded scan then the output of scan lines will be binary count. In encoded mode, an external decoder should be used to decode the scan lines.	Remember	CO 6
33	What is scanning in keyboard and what is scan time?	The process of sending a zero to each row of a keyboard matrix and reading the columns for key actuation is called scanning. The scan time is the time taken by the processor to scan all the rows one by one starting from first row and coming back to the first row again.	Remember	CO 6
34	What are the tasks involved in keyboard interface?	The tasks involved in keyboard interfacing are sensing a key actuation, de bouncing the key and generating key codes (Decoding the key). These tasks are performed by software if the keyboard is interfaced through ports and they are performed by hardware if the keyboard is interfaced through 8279.	Remember	CO 6
35	What is meant by 2-key lockout and N-key rollover?	2-Key Lockout: When two keys are pressed simultaneously, one key pressed first will be recognized and code will be generated. N-Key Rollover: When a key is pressed continuously, the same key will be recognized several times, after each de bounce.	Remember	CO 6
36	What is RS-232C Standard?	The RS232C is a serial bus consisting of a maximum of 25 signals, which are standardized by EIA (Electronic Industry Association). The first 9 signals are sufficient for most of the serial data transmission.	Remember	CO 7
37	What is Memory interfacing in 8086 microprocessor?	If any instruction is executed then we require microprocessor to access the memory in order to read the instruction codes and the stored data in the memory. So, to read from the memory and write in registers this memory and microprocessor need some signals. There are some key factors that are required in	Remember	CO 6

		interfacing process to match with the memory requirements and microprocessor signals. So, the interfacing circuit must be designed in such a way that it should match with the memory signal requirements and the signals of the microprocessor.		
38	What is I/O Interfacing in 8086 microprocessor?	IO interfacing is the communication between various devices like keyboard, mouse, printer, etc. It is a set of registers where CPU communicates and controls the I/O device with the help of reading and writing registers. These registers are connected to the CPU using buses. So, in order to interface between keyboard and other devices with the microprocessor latches and buffers are used. This type of interfacing is known as I/O interfacing.	Remember	CO 6
39	What are the Ways of Communication − Microprocessor with the Outside World?	There are two ways of communication in which the microprocessor can connect with the outside world. Serial Communication Interface Parallel Communication interface	Remember	CO 7
40	What is programmable keyboard?	It is a specially designed type of programmable keyboard/display controller launched by Intel which helps in interfacing the keyboard with the CPU. It identifies any type of key that has been pressed with the help of scanning. It then sends the response of the pressed key to the CPU and vice-a-versa.	Remember	CO 6
41	How Many Ways the Keyboard is Interfaced with the CPU?	The Keyboard can be interfaced in two modes that is either in the interrupt or the polled mode. In the Interrupt mode, whenever any key is pressed then the request is sent by the processor, otherwise the CPU will continue to follow with its main task. In the Polled mode, the CPU periodically reads an internal flag of 8279 and checks whether any key is pressed or not with any pressure exerted by the key.	Remember	CO 6
42	How Does 8279 Keyboard Work?	The keyboard which acts as an input device contains maximum of 64 keys. With the help of keyboard the user can perform various types of tasks. Certain specific key-codes are used where text is entered as an input with the keyboard.	Remember	CO 6
43	What is 8257 DMA controller?	8257 DMA stands for 4-channel Direct Memory Access. It is specially designed by Intel for data transfer at the highest speed. With the use of a DMA controller, the device sends requests to the CPU to hold its data, sequential memory address and control bus, which helps the device to transfer data directly to/from the memory. The DMA data transfer is initiated only after receiving HLDA signal from the CPU.	Remember	CO 6
44	How DMA Operations are Performed?	Primarily, when any device requires to send data between the device and the memory, the device need to send DMA request (DRQ) to DMA controller. The DMA controller sends Hold request (HRQ) to the CPU and waits for the CPU to assert the HLDA signal. Then the microprocessor tri-states all the data bus, address bus, and control bus. The CPU leaves the control over bus and acknowledges the HOLD request through HLDA signal.	Remember	CO 6

45	What are the features of 8257?	The prominent features of 8257 − It has four channels which can be exhibited over four I/O devices. Each channel has 16-bit address and 14-bit counter. Data transfer of each channel can be taken up to 64kb. Each channel can be programmed independently. Each channel can perform certain specific actions i.e., read transfer, write transfer and verify transfer operations.	Remember	CO 6
46	What is Programmable Peripheral Interface?	The 8255A is generally seen as 8-bit bidirectional data buffer, which is specially designed to transfer the data with the execution of input output instructions requested by the CPU. It has the ability to use with almost any microprocessor. It consists of three 8-bit bidirectional I/O ports (24 I/O lines) which can be configured with their different functional characteristics, each possessing unique features to upgrade the flexibility of 8255.	Remember	CO 6
47	What are the different Ports of 8255A?	8255A consists of three ports, i.e., PORT A, PORT B, and PORT C. Port A contains one 8-bit output latch/buffer and one 8-bit input buffer possessing both pull-up and pull-down devices present in Port A. Port B is similar to PORT A. Port C can be split into two parts, i.e. PORT C lower (PC0-PC3) and PORT C upper (PC7-PC4) with the help of control word. These three ports are further classified into two groups, i.e. Group A includes PORT A and upper PORT C. Group B includes PORT B and lower PORT C. These two groups can be programmed in three different modes, i.e. the first mode is named as mode 0, the second mode is named as Mode 1 and the third mode is named as Mode 2.	Remember	CO 6
48	What are the Operating Modes in 8255A?	Mode 0 − In this mode, Port A and B is used as two 8-bit ports and Port C as two 4-bit ports. Mode 1 − In this mode, Port A and B are used as 8-bit I/O ports. They can be configured as either input or output ports. Mode 2 − In this mode, Port A can be configured as the bidirectional port and Port B can be available in Mode 0 or Mode 1.	Remember	CO 6
49	What is the voltage level used in RS232C standard?	The voltage levels are Logic LOW (0) : –3V to –15V Logic HIGH (1) : +3V to +15V Commonly used voltage levels are +12V (logic HIGH) and –12V (logic LOW).	Remember	CO 7
MODULE-IV 8051 MICROCONTROLLER				
1.	What is direct addressing mode?	In Direct Addressing Mode, the address of the data is specified as the Operand in the instruction. Using Direct Addressing Mode, we can access any register or on-chip variable. This includes general purpose RAM, SFRs, I/O Ports, Control registers. Example:MOVA,47H	Remember	CO 3
2.	How time delay is generated in a microcontroller?	Counters/timers which can be used either as timer to generate a time delay or as counter to count events happening outside the microcontroller	Remember	CO 9

3.	What is the difference between Mode 0 and Mode 1 for Timers.	Mode 0: This is a 13-bit mode that means the timer operation completes with “8192” pulses. Mode 1: This is a16-bit mode, which means the timer operation completes with maximum clock pulses that “65535	Remember	CO 8
4.	What is indexed addressing mode?	With Indexed Addressing Mode, the effective address of the Operand is the sum of a base register and an offset register. The Base Register can be either Data Pointer (DPTR) or Program Counter (PC) while the Offset register is the Accumulator (A).	Remember	CO 3
5.	What is register indirect addressing mode?	In the Indirect Addressing Mode or Register Indirect Addressing Mode, the address of the Operand is specified as the content of a Register. This will be clearer with an example.	Remember	CO 3
6.	Define microcontroller?	A device which contains the microprocessor with integrated peripherals like memory, serial ports, parallel ports, timer/counter, interrupt controller, data acquisition interfaces like ADC, DAC is called microcontroller	Remember	CO 1
7.	List out DJNZ Instructions of Intel 8051	DJNZ Rn, rel - Decrement the content of the register Rn and jump if not zero. DJNZ direct, rel - Decrement the content of direct 8-bit address and jump if not zero.	Remember	CO 3
8.	What are the alternate functions for the port pins of port3?	RD WR T1 T0 INT1 INT0 TXDRXD are assigned to eight pins port 3.	Remember	CO 1
9.	Find the single instruction, which clears the most significant bit of B register of 8051, without affecting the remaining bits.	Single instruction, which clears the most significant bit of B register of 8051, without affecting the remaining bits is CLR B.7.	Remember	CO 3
10.	What is the function of the pins PSEN and EA of8051?	PSEN: PSEN stands for program store enable. In 8051 based system in which an external ROM holds the program code, this pin is connected to the OE pin of the ROM.	Remember	CO 1
11.	What is microprocessor and microcontroller.	Microprocessor has standalone CPU whereas microcontroller has CPU, RAM, ROM, IO and timer is all on a single chip.	Remember	CO 1
12.	What is the significance of EA line of 8051 microcontroller?	This is used to access external memory RAM and Rom in Microcontroller.	Remember	CO 1
13.	When to use MOVX and MOV instruction.	To copy the data to external memory MOVX is used.. To copy the data to internal memory MOV is used..	Remember	CO 3
14.	What is the size of the on- chip program memory and on-chip RAM in a typical microcontroller?	In 8051 microcontroller for example, internal program memory is 4KB and internal RAM is 128 bytes	Remember	CO 9
15.	List out the advantages of using a microcontroller in place of a microprocessor.	While using microcontroller the on chip resources RAM, ROM, IO and timer can be utilized. So this results in reduction of hardware.	Remember	CO 1
16.	What is the function of DPTR register?	This is used to read and write data to the data memory pointed by DPTR register.	Remember	CO 9

17.	Which addressing modes are supported by 8051 to copy the data?	Immediate addressing modes are supported by 8051 to copy the data.	Remember	CO 3
18.	What is the function of RST pin in a microcontroller.	RST(pin 9） : Reset It is an input pin and is active high normally low. This should be high for at least 2 machine cycles. It is used to reset values of some 8051 registers	Remember	CO 1
19.	Which signal is used to enable external program memory?	PSEN (pin 29） : program store enable. This is an output pin and is connected to the OE pin of the ROM	Remember	CO 1
20.	Define ALE signal in the context of multiplexing address and data information in a bus?	ALE is defined as address latch enable. It is an output pin and is active high. 8051 port 0 provides both address and data. The ALE pin is used for de- multiplexing the address and data by connecting to the G pin of the 74LS373 latch.	Remember	CO 1
21.	Which ports are used to address external memory in 8051?	Port 0 provides AD0-AD7 Port 2 provides A8-A1	Remember	CO 1
22.	What is an addressing mode?	An addressing Mode is a way to locate a target Data, which is also called as Operand. The 8051 Family of Microcontrollers allows five types of Addressing Modes for addressing the Operands.	Remember	CO 3
23.	List different addressing modes in a micro controller.	Immediate Addressing Register Addressing Direct Addressing Register – Indirect Addressing	Remember	CO 3
24.	What is Direct addressing mode.	In Direct Addressing Mode, the address of the data is specified as the Operand in the instruction. Using Direct Addressing Mode, we can access any register or on-chip variable. This includes general purpose RAM, SFRs, I/O Ports, Control registers.	Remember	CO 3
25.	What Register indirect addressing mode	In the Indirect Addressing Mode or Register Indirect Addressing Mode, the address of the Operand is specified as the content of a Register. This will be clearer with an example. Example: MOV A, @R1	Remember	CO 3
26.	How division is done in a micro controller?	The instruction DIV AB is used for division. Divide A by B A quotient B remainder	Remember	CO 3
27.	How multiplication is done in a micro controller	MUL AB Multiply A by B A low byte (A*B) B high byte (A* B)	Remember	CO 3
28.	What is the instruction two swap the two nibbles in 8051?	SWAP A. It exchanges the nibbles within accumulator.	Remember	CO 3
29.	Define Register indexed addressing mode	With Indexed Addressing Mode, the effective address of the Operand is the sum of a base register and an offset register. The Base Register can be either Data Pointer (DPTR) or Program Counter (PC) while the Offset register is the Accumulator (A).	Remember	CO 3
30.	Define Register indirect addressing mode	In the Indirect Addressing Mode or Register Indirect Addressing Mode, the address of the Operand is specified as the content of a Register.	Remember	CO 3

31.	What is the purpose of 16-bit register DPTR of 8051.	DPTR stands for data pointer. DPTR consists of a high byte (DPH) and a low byte (DPL). Its function is to hold a 16-bit address. It may be manipulated as a 16-bit data register or as two independent 8-bit registers. It serves as a base register in indirect jumps, lookup table instructions and external data transfer	Remember	CO 9
32.	What is the function of 16-bit register SP of 8051.	SP stands for stack pointer. SP is a 8- bit wide register. It is incremented before data is stored during PUSH and CALL instructions. The stack array can reside anywhere in on-chip RAM. The stack pointer is initialized to 07H after a reset. This causes the stack to begin at location 08H.	Remember	CO 9
33.	List the special functions registers available in8051.	B Register Program Status Word. Stack Pointer. Data Pointer. Port0 Port1 Port2 h.Port3 i. Interrupt priority control register Interrupt enable control register	Remember	CO 9
34.	What is the code to find the 2's complement using 8051.	MOV A,R0 CPL A INC A	Remember	CO 3
35	What is the code to add 2 8-bit numbers using 8051.	MOV A, #30H ADD A, #50H	Remember	CO 3
36.	What is the code to subtract the contents of R1 of Bank0 from the contents of R0 of Bank2 using 8051.	MOV PSW,#10 MOV A, R0 MOV PSW,#00 SUBB A, R1	Remember	CO 3
37.	Define program counter? How is it useful in program execution?	The program counter keeps track of program execution. To execute a program the starting address of the program is loaded in program counter. The PC sends out an address to fetch a byte of instruction from memory and increments its content automatically.	Remember	CO 9
38.	Define stack.	Stack is a sequence of RAM memory locations defined by the programmer	Remember	CO 9
39.	What is the distribution of 128 bytes on chip RAM of 8051	Register Banks 32 bytes Bit addressable Memory 16 bytes General purpose RAM 80 bytes	Remember	CO 9
40.	List any two examples of immediate addressing mode in 8051.	MOV A, #23 ADD r2, #44	Remember	CO 3
MODULE-V SYSTEM DESIGN USING MICROCONTROLLER				
1.	What is need of auxiliary carry Flag?	The Auxiliary Carry (AC) bit is set if there is a carry-out of bit 3. In other words, if the unsigned summed value of the low nibble of the Accumulator, operand and (in the case of ADDC) the Carry flag exceeds 15 the Auxiliary Carry flag is set. Otherwise, the Auxiliary Carry flag is cleared	Remember	CO 9

2.	What are the events that generate interrupts in 8051?	The 8051 so that any of the following events will cause an interrupt: Timer 0 Overflow. Timer 1 Overflow. Reception/Transmission of Serial Character. External Event 0. External Event 1.	Remember	CO 5
3.	When the carry flag is activated?	The Carry bit (C) is set if there is a carry-out of bit 7. In other words, if the unsigned summed value of the Accumulator, operand and (in the case of ADDC) the Carry flag exceeds 255 Carry is set. Otherwise, the Carry bit is cleared.	Remember	CO 9
4.	What happens when an interrupt ends?	An interrupt ends when your program executes the RETI (Return from Interrupt) instruction. Two bytes are popped off the stack into the Program Counter to restore normal program execution. Interrupt status is restored to its pre-interrupt status.	Remember	CO 5
5.	When to use ADD and ADDC instructions	ADD and ADDC both add the value operand to the value of the Accumulator, leaving the resulting value in the Accumulator. The value operand is not affected. ADD and ADDC function identically except that ADDC adds the value of operand as well as the value of the Carry flag whereas ADD does not add the Carry flag to the result.	Remember	CO 3
6.	What happens when an interrupt occurs?	The current Program Counter is saved on the stack, low-byte first. Interrupts of the same and lower priority are blocked. In the case of Timer and External interrupts, the corresponding interrupt flag is cleared. Program execution transfers to the corresponding interrupt handler vector address. The Interrupt Handler Routine executes.	Remember	CO 5
7.	How baud rate is setup in 8051?	The Baud Rate is determined based on the oscillator's frequency when in mode 0 and 2. In modes 1 and 3, the baud rate is determined by how frequently timer 1 overflows. The more frequently timer 1 overflows, the higher the baud rate	Remember	CO 7
8.	How Timer Mode 2 operates in 8051?	Timer mode "2" is an 8-bit auto-reload mode. When a timer is in mode 2, THx holds the "reload value" and TLx is the timer itself. Thus, TLx starts counting up. When TLx reaches 255 and is subsequently incremented, instead of resetting to 0 (as in the case of modes 0 and 1), it will be reset to the value stored in THx.	Remember	CO 8
9.	What is the sequence of operations when interrupt occurs?	When the interrupt occurs, the 8051 temporarily puts "on hold" the normal execution of the program and executes a special section of code referred to as an interrupt handler. The interrupt handler performs whatever special functions are required to handle the event and then returns control to the 8051 at which point program execution continues.	Remember	CO 5
10.	What is the role of SCON (serial control register) for serial communication?	The Serial Control is used to configure the behavior of the 8051's on-board serial port. This SFR controls the baud rate of the serial port, whether the serial port is activated to receive data, and also contains flags that are set when a byte is successfully sent or received.	Remember	CO 9
11.	What is the purpose of TCON (Timer Control	The Timer Control SFR is used to configure and modify the way in which the 8051's two timers	Remember	CO 9

	register) of 8051?	operate. This SFR controls whether each of the two timers is running or stopped and contains a flag to indicate that each timer has overflowed. Additionally, some non-timer related bits are located in the TCON SFR. These bits are used to configure the way in which the external interrupts are activated and also contain the external interrupt flags which are set when an external interrupt has occurred.		
12.	How SCON (serial control register) can be used for serial communication?	The Serial Control SFR is used to configure the behavior of the 8051's on- board serial port. This SFR controls the baud rate of the serial port, whether the serial port is activated to receive data, and also contains flags that are set when a byte is successfully sent or received.	Remember	CO 9
13.	What is the role of SBUF in the context of serial communication.	The Serial Buffer SFR is used to send and receive data via the on-board serial port. Any value written to SBUF will be sent out the serial port's TXD pin. Likewise, any value which the 8051 receives via the serial port's RXD pin will be delivered to the user program via SBUF. In other words, SBUF serves as the output port when written to and as an input port when read from.	Remember	CO 9
14.	How logic 0 is represented in RS232,?	In RS232, logic 1 is represented by +3 to +25 volts. This is useful in long distance communication.	Remember	CO 7
15.	What is RS 232CStandard?	The RS232C is a serial bus consisting of a maximum of 25 signals, which are standardized by EIA (Electronic Industry Association). The first 9 signals are sufficient for most of the serial data transmission	Remember	CO 7
16.	What is the sequence of operations when interrupt occurs?	An interrupt is triggered whenever a corresponding event occurs. When the event occurs, the 8051 temporarily puts "on hold" the normal execution of the program and executes a special section of code referred to as an interrupt handler. The interrupt handler performs whatever special functions are required to handle the event and then returns control to the 8051 at which point program execution continues as if it had never been interrupted	Remember	CO 5
17.	How Timer Mode 1 operates?	Timer mode "1" is a 16-bit timer. TLx is incremented from 0 to 255. When TLx is incremented from 255, it resets to 0 and causes THx to be incremented by 1. Since this is a full 16-bit timer, the timer may contain up to 65536 distinct values	Remember	CO 8
18.	When Overflow flag is activated?	Overflow (OV) bit is set if there is a carry-out of bit 6 or out of bit 7, but not both. In other words, if the addition of the Accumulator, operand and (in the case of ADDC) the Carry flag treated as signed values results in a value that is out of the range of a signed byte (-128 through +127) the Overflow flag is set. Otherwise, the Overflow flag is cleared	Remember	CO 9
19.	What is the benefit of auto- reload mode?	When we want the timer to always have a value from 200 to 255. If you use mode 0 or 1, you'd have to check in code to see if the timer had overflowed and, if so, reset the timer to 200. This takes precious instructions of execution time to check the value and/or to reload it. When you use mode 2 the microcontroller takes care of this.	Remember	CO 8
20.	How split timer mode operates in 8051?	Timer mode "3" is a split-timer mode. When Timer 0 is placed in mode 3, it essentially becomes two	Remember	CO 8

		separate 8-bit timers. That is to say, Timer 0 is TL0 and Timer 1 is TH0. Both timers count from 0 to 255 and overflow back to 0. All the bits that are related to Timer 1 will now be tied to TH0.		
21.	What is the function of driver circuit for stepper motor?	It acts as Voltage Amplifier.	Remember	CO 9
22.	What is relation between resolution and no.of bits in ADC?	The resolution increases with no.of Bits in ADC. For ex. 8 bit ADC Provides best resolution compared to 4 bits.	Remember	CO
23.	What is the relation between clock cycle and machine cycle in a microcontroller?	The machine cycle consists of integral multiple no.of clock cycles. In 8051 each machine cycle consists of 12 clock pulses.	Remember	CO 8
24.	Define internal and external interrupts.	Internal interrupts are activated by mechanisms inside the chip. Externals interrupts are activated when signals are received at the input pins of the chip.	Remember	CO 5
25.	How timer interrupt is generated?	For ex. in mode 1, timer 1 register overflows when the register count reaches FFFF and it rolls back to 0000 and after generating timer interrupt.	Remember	CO 5
26.	What is the function of driver circuit for stepper motor?	It acts as Voltage Amplifier.	Remember	CO 8
27.	What type of communication is used in long distance?	Serial type of communication is used in long distance. This is to reduce the cost of physical mediums.	Remember	CO 7
28.	Define Baud Rate and Bit Rate.	Baud Rate means no. of symbols transmitted in one second. Bit Rate means no. of bits transmitted in one second.	Remember	CO 7
29.	How logic 1 is represented in RS232?	In RS232, logic 1 is represented by -3 to -25 volts. This is useful in long distance communication.	Remember	CO 7
30.	What is the interrupt structure of 8051?	8051 has 5 interrupt signals, i.e. INT0, TFO, INT1, TF1, RI/TI. Each interrupt can be enabled or disabled by setting bits of the IE register and the whole interrupt system can be disabled by clearing the EA bit of the same register.	Remember	CO 5
31.	What is the necessity of external memory interfacing in a microcontroller?	The designer of an 8051 Microcontroller based system is not limited to the internal RAM and ROM present in the 8051 Microcontroller. There is a provision of connecting both external RAM and ROM i.e. Data Memory and Program. The reason for interfacing external Program Memory or ROM is that complex programs written in high – level languages often tend to be larger and occupy more memory.	Remember	CO 9
32.	How much maximum external memory can be connected in a microcontroller with 16 address lines?	A maximum of 64 KB external memory can be connected in a microcontroller with 16 address lines.	Remember	CO 9
33.	What is the need of data converters in microcontrollers?	Digital processing and storage of physical quantities (sound, temperature, pressure etc) exploits the advantages of digital electronics. Better and cheaper technology compared to the analog. More reliable in terms of storage, transfer and processing Not affected by noise Processing using programs (software)	Remember	CO 7
34.	What is indexed addressing mode?	With Indexed Addressing Mode, the effective address of the Operand is the sum of a base register and an	Remember	CO 3

		offset register. The Base Register can be either Data Pointer (DPTR) or Program Counter (PC) while the Offset register is the Accumulator (A).		
35	What is register indirect addressing mode?	In the Indirect Addressing Mode or Register Indirect Addressing Mode, the address of the Operand is specified as the content of a Register. This will be clearer with an example.	Remember	CO 3
36.	What is mean by microcontroller?	A device which contains the microprocessor with integrated peripherals like memory, serial ports, parallel ports, timer/counter, interrupt controller, data acquisition interfaces like ADC, DAC is called microcontroller	Remember	CO 1
37.	What is the function of DJNZ Instructions of Intel 8051	DJNZ Rn, rel - Decrement the content of the register Rn and jump if not zero. DJNZ direct, rel - Decrement the content of direct 8-bit address and jump if not zero.	Remember	CO 3
38	What is the function of timer in a microcontroller?	A timer is a specialized type of clock which is used to measure time intervals. A timer that counts from zero upwards for measuring time elapsed is often called a stopwatch. It is a device that counts down from a specified time interval and used to generate a time delay, for example, an hourglass is a timer	Remember	CO 8
39	What is the function of counter in microcontroller?	A counter is a device that stores (and sometimes displays) the number of times a particular event or process occurred, with respect to a clock signal. It is used to count the events happening outside the microcontroller. In electronics, counters can be implemented quite easily using register-type circuits such as a flip-flop	Remember	CO 8
40	What is the function of Timer Mode Register in 8051 Microcontrollers	TMOD is an 8-bit register used for selecting timer or counter and mode of timers. Lower 4-bits are used for control operation of timer 0 or counter0, and remaining 4-bits are used for control operation of timer1 or counter1.This register is present in SFR register, the address for SFR register is 89th	Remember	CO 8

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