

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: EMBEDDED SYSTEMS	Course Code : 15EE63C
Semester : VI	Course Group : Core
Teaching Scheme (L:T:P) : 4:0:0 (in Hours)	Credits : 4 Credits
Type of course : Lecture +Assignments	Total Contact Hours : 52
CIE : 25 Marks	SEE : 100 Marks
Programme: Diploma in Electrical and Electronics Engg.	

Pre-requisites : Knowledge on Mathematics, Electrical Engg, Analog and Digital electronics and C language, Electrical machines, Power electronics, E and E Measurements.

Course Objectives : To understand the architecture of 8051, instruction set, programming and interfacing

COURSE TOPICS:

Unit No	Unit Name	Hours
1	Introduction to 8051 Microcontroller	06
2	8051 Architecture	09
3	8051 Instruction Set	09
4	8051 Assembly and C Programming	07
5	8051 Timers, Serial port and Interrupt Programming	11
6	8051 Interfacing and Peripherals	10
	Total	52

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Acquire knowledge on Microcontrollers and 8051 pin descriptions.
2. Explain 8051 architecture
3. Understand various instructions of 8051.
4. Develop simple programs for 8051 in assembly and C language.
5. Write programs on Counter and Timer of 8051, programs for serial communication and interrupts of 8051.
6. Design simple circuits for interfacing various peripherals with 8051.

Composition of Educational Components

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's Taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)	Total Marks (Out of 145)
1	Remembering	10	20
2	Understanding	50	75
3	Application/ Analysis	40	50
Total		100	145

Course Outcome linkage to Cognitive Level

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Acquire knowledge on Microcontrollers and 8051 pin descriptions.	<i>R/U</i>	2, 8,10	06
CO2	Explain 8051 architecture	<i>R/U</i>	2,8, 10	09
CO3	Understand various instructions of 8051	<i>R/U</i>	2,8, 10	09
CO4	Develop simple programs for 8051 in assembly and C language	<i>A</i>	2,3,4,5,7,8, 9,10	07
CO5	Write Counter / Timer programs, programs for serial communication and interrupts of 8051.	<i>U/A</i>	2,3,4,5,7,8, 9,10	11
CO6	Design the simple circuits for interfacing various peripherals with 8051	<i>R/U/A</i>	2,3,4,5,7,8, 9,10	10
		Total sessions		52

Course Content and Blue Print of Marks for SEE:

Unit	Unit Name	R/U/A	Hour	Max. Marks per Unit	5 Marks Qns.	10 Marks Qns.	Questions to be set for (5marks) PART - A			Questions to be set for (10marks) PART - B			Marks Weightage (%)
					Part A	Part B	R	U	A	R	U	A	
1	Introduction to 8051 Microcontroller	R/U	6	15	1	1	1				1		10
2	8051 Architecture	R/U	9	25	1	2	1				2		17
3	8051 Instruction Set	R/U	9	25	2	1.5	1	1		0.5	1		17
4	8051 Assembly and C Programming	A	7	20	1	1.5			1			1.5	14
5	8051 Timers, Serial port and Interrupt Programming	U/A	11	30	2	2		1	1		1	1	21
6	8051 Interfacing and Peripherals	R/U/A	10	30	2	2		1	1		1	1	21
TOTAL			52	145	9	10	9 (45 Marks)			10 (100 Marks)			

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
EMBEDDED SYSTEMS	1	3	3	3	3		3	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Content:

Unit –I

Introduction to 8051 Microcontroller (6 Hrs)

Introduction to microcontrollers, applications, comparison between microprocessor and micro controller, block diagram of 8051, features of 8051, Pin diagram of 8051, Pin description of 8051, I/O ports Pins and their functions, structure of Assembly language program.

Unit –II

8051 Architecture (9 Hrs)

Registers, On chip 8051 chip ROM memory address range, 8051 data type and directives, register banks, On-chip ROM memory and RAM Memory organization, stack and stack pointer, SFR registers, I/O ports structure and operation bit address. Registers - A, B, SP, DPTR, PC and SFRs. General Format and functions of each bit of PSW SFRs, machine cycle, Time delay calculations.

Unit –III

8051 Instruction Set (9 Hrs)

Arithmetic instructions, Addressing modes, Data transfer instructions, Logical and compare instructions, Jump and Loop, Rotate and swap instructions, Branch instructions, Bit manipulation instructions, Stack and Subroutine instructions.

Unit –IV

8051 Assembly and C Programming (7 Hrs)

Programs on Loop and Jump instructions, call instructions, arithmetic and logic instructions, Compare instruction, Rotate and Swap instructions, BCD and ASCII conversion vice-versa programs, Bit manipulation programs.

8051 programming using C – Advantage of using C. Data types. Simple programs based on arithmetic, logical, branching, bit manipulation, rotate and swap instructions.

Unit –V

8051 Timers, Serial port and Interrupt Programming (11 Hrs)

Timers of 8051 and their associated Registers, General format and function of each bit of TMOD, TCON, Modes of operation of timers, programs on timers and counters in assembly language.

Basics of serial communication, SBUF SFR, pin description of 9 pin RS232 connector, Pin description of Max233, 8051 connection to RS232 using Max233, Baud rate and its calculation, General format and function of each bit of SCON, PCON SFR's, Programs on serial communication in assembly language.

Interrupts versus polling, Interrupt service routine (ISR) Interrupts with vector table, General format and function of each bit of IE, IP SFR, Programs on interrupts in assembly language.

Unit –VI

8051 Interfacing and Peripherals (10 Hrs)

Interfacing an LCD and LED to 8051, 8051 interfacing with Hex keyboard, ADC, DAC and sensor interfacing, Interfacing DC motor, Stepper motor, Relay, Opto isolator and RTC.(Only circuit diagrams and explanation)

Text Book:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D McKinlay “ THE 8051 MICROCONTROLLER AND EMBEDDED SYSTEMS Using Assembly and C”. Pearson Second edition.

Reference Books:

1. The 8051 Microcontrollers-II edition-Kenneth j Ayala. Perram Publications.
2. Embedded system Design-Frank Vahid /Tony Givargis WSE. Wiley Publications.
3. 8051 Microcontroller-Hardware, Software and applications-V Udayashankara/M S mallikarjunaswamy-Tata McGraw Hill
4. Programming and Customizing the 8051 Microcontroller-MykePredko-Tata McGraw Hill
5. Intel 8 bit Embedded controller Handbook-Intel
6. Programming Embedded systems in C and C++ - Michael Barr –O'Reilly
7. 8051 Microcontroller – Uma S.Rao

e-Resources:

- 1) [YouTube videos on interfacing various peripherals and devices](#)
- 2) www.microdigital.com

Course Delivery:

The Course will be delivered through lectures, classroom interaction, animations, group discussion, exercises and student activities, assignments.

Course Assessment and Evaluation:

	What		To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	CIE (Continuous Internal Evaluation)	I A Tests	Students	Three IA tests for Theory: (Average marks of Three Tests to be computed).	20	Blue Books	1 to 6
		Student Activity		Student Activity	05	Report of 3 pages	1 to 6
		TOTAL		25			
	SEE (Semester End Examination)	End Exam	Students	End Of the Course	100	Answer Scripts at BTE	1 to 6
Indirect Assessment	Student Feedback on course		Students	Middle Of The Course	Feed Back Forms		1 to 6
	End Of Course Survey			End Of The Course	Questionnaires		1 to 6

*CIE – Continuous Internal Evaluation

*SEE – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Course Contents with Lecture Schedule:

Lesson No./ Session No.	Contents	Duration
Unit I	Introduction to 8051 Microcontroller	6 Hours
1.	Introduction to microcontrollers and their applications	01 Hour
2.	comparison between microprocessor and micro controller and block diagram of 8051	01 Hour
3.	features of 8051 and Pin diagram of 8051	01 Hour
4.	Pin description of 8051	01 Hour
5.	I/O ports Pins and their functions.	01 Hour
6.	structure of Assembly language program	01 hour
Unit II	8051 Architecture	9 Hours
7.	Explain A, B, SP, DPTR,	01 Hour
8.	Explain PCSFRs, Register banks	01 Hour
9.	General format and functions of each bit of PSW SFRs.	01 Hour
10.	On chip RAM Memory organization	01 Hour
11.	stack and stack pointer	01 Hour
12.	8051 data type and directives	01 Hour
13.	I/O ports structure and operation	01 Hour
14.	On chip 8051 chip ROM memory address range	01 Hour
15.	machine cycle, Time delay calculations	01 Hour
Unit III	8051 INSTRUCTION SET	9Hr
16.	Explain the various addressing modes of 8051 with examples	01 Hour
17.	Explain ADD, ADDC, SUBB- instructions with examples	01 Hour
18.	Explain MUL,DIV,DA INC,DEC instructions with examples	01 Hour
19.	Explain the data transfer instructions MOV, MOVX	01 Hour
20.	Logical instructions – AND,OR, XOR ,CPL	01 Hour

21	Compare instructions – CJNE, DJNZ	01 hour
22	Rotate and swap instructions – RR, RL, RRC, RLC, SWAP	01 Hour
23	Jump – LJMP, SJMP, Bit manipulation instructions	01 Hour
24	Stack and Subroutine instructions – PUSH, POP, LCALL, ACALL, RET	01 Hour
UNIT IV	8051 Assembly and C Programming	07 Hour
25	Programs on Loop and Jump instructions, call instructions	01 Hour
26	Programs on Arithmetic instructions Unsigned Addition, Subtraction, Multiplication, Division	01 Hour
27	Signed number arithmetic and arithmetic operations	01 Hour
28	Programs on Logical and compare instructions	01 Hour
29	Rotate Swap, BCD to ASCII conversion and single bit instructions.	01 Hour
30	8051 programming using C – Advantage of using C. Data types	01 Hour
31	Simple programs based on arithmetic, logical, branching, bit manipulation, rotate and swap instructions	01 Hour
Unit V	8051 Timers, Serial port and Interrupt Programming	11 Hr
32	Timers of 8051 and their associated Registers TMOD, TCON format	01 Hour
33	Modes of operation of timers and programs on timers in assembly language	01 Hour
34	Programming counters in assembly language	01 Hour
35	Basics of serial communication, SBUF SFR	01 Hour
36	Pin description of 9 pin RS232 connector, Pin description of Max233, 8051 connection to RS232 using Max233	01 Hour
37	Baud rate and its calculation, General format and function of each bit of SCON, PCON SFR's	01 Hour
38	Programs on serial communication in assembly language.	01 Hour
39	Interrupts versus polling, ISR, Interrupts with vector table	01 Hour

40	General format and function of each bit of IE,IP SFR	01 Hour
41	Programming Timer and External hardware interrupts	01 Hour
42	Programming Serial communication interrupt and Interrupt priority in 8051	01 Hour
Unit VI	8051 Interfacing and Peripherals	10Hr
43	Interfacing an LCD to 8051 and explain	01 Hour
44	Interfacing a LED to 8051 and explain	01 Hour
45	8051 interfacing to the keyboard with explanation	01 Hour
46	ADC interfacing to 8051 and explain	01 Hour
47	Sensor(temperature) LM35 interfacing to 8051 and explain	01 Hour
48	8051 to DAC interfacing and explain	01 Hour
49	Explain RTC DS12887 and interface it to 8051	01 Hour
50	Relay and Opto isolator interfacing to 8051 and explain	01 Hour
51	Interface stepper motor to 8051 and explain	01 Hour
52	Interface DC motor to 8051 and explain	01 Hour

Student Activity (any one to be submitted with 3 pages self HAND WRITTEN report):

1. Draw an Elevator interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
2. Draw an LCD interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
3. Draw an LED interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
4. Draw an Hexkey board interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
5. Draw an ADC interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
6. Draw an DAC interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
7. Draw an DC MOTOR interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
8. Draw an STEPPER MOTOR interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
9. Draw and SENSOR interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
10. Draw an OPTO ISOLATOR interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
11. Draw an RTC interface circuit with 8051 with assemble language/ C program and execute on 8051 kit
12. Draw an RELAY interface circuit with 8051 with assemble language/ C program and execute on 8051 kit

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimension	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks One activity on any one CO (course outcome) may be given to a group of FIVE students Grand Average/Total						14/4 =3.5 ≈4				

**Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given- Industrial visit and report writing**

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Conventions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
Total marks						14/4=3.5 ≈4				

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks		
1 st IATest/ 6 th week, 9 Aug 16, 9-10 AM	V SEM, E & E Engg	Embedded Systems	20		
	Year: 2015-16	Course code:15EE63C			
Name of Course coordinator :					
Units Covered :1 and 2					
Course Outcomes : 1 and 2					
Instruction :(1). Answer all questions (2). Each question carries five marks					
Question No.	Question		CL	CO	PO
1	List the applications of microcontrollers		R	1	2, 10
2	List any five features of 8051. OR Compare microprocessor and microcontrollers		R U	1	2, 10
3	Explain PSW SFR. Or Explain the structure of Port 0.		U U	2	2, 10
4	Explain the internal RAM organization of 8051		A	2	2, 10

CL: Cognitive Level, R-Remember, U-Understand, A-Application, PO: Program Outcomes

Model QUESTION Paper BANK:

Course Title: **EMBEDDED SYSTEMS**

Course Code: 15EE63C

CO1- Acquire knowledge on Microcontrollers and 8051 pin descriptions.

Unit 1 –Introduction to 8051 Microcontroller

Cognitive Level: REMEMBER

- 1) State the concept of microcontroller.
- 2) List the applications of Microcontrollers.
- 3) List the features of 8051 microcontroller.
- 4) Draw the block diagram of 8051.
- 5) Draw the pin diagram of 8051.

Cognitive Level: UNDERSTAND

- 6) Compare between microprocessor and micro controller with block diagram.
- 7) Describe the function of each pin of 8051.
- 8) Draw the block diagram of 8051 and explain.
- 9) Explain the structure and function of Port 0.
- 10) Explain the structure and function of Port 1.
- 11) Explain the structure and function of Port 2.
- 12) Explain the structure and function of Port 3.
- 13) Explain the structure and function of Port 0 and port 1.
- 14) Explain the structure and function of Port 1 and port 2.
- 15) Explain the structure and function of Port 2 and port 3.
- 16) Explain the structure of assembly language program.

CO2- Describe 8051 architecture

Unit 2 –8051 ARCHITECTURE

Cognitive Level: REMEMBER

- 17) Explain Program counter and data pointer.
- 18) Explain the 8051 data types and directives.
- 19) Briefly explain A and B registers.
- 20) Explain briefly the organization of internal ROM.
- 21) Explain briefly stack and stack pointer.

Cognitive Level: UNDERSTAND

- 22) Draw the PSW SFR and explain the function of each bit.
- 23) Draw and explain the internal RAM organisation.
- 24) Explain the special function registers with their internal RAM address.
- 25) Explain alternate functions of Port 0 pins
- 26) Explain alternate functions of Port 2 pins
- 27) Explain alternate functions of Port 3 pins
- 28) Explain stack operation in 8051.
- 29) Explain 8051 timing and delay calculations.
- 30) Explain machine cycle for the 8051.
- 31) Calculate the period of the machine cycle for 8051 with a crystal frequency of (i) 11.0592 MHz, (ii) 16 MHz (iii) 20 MHz

CO3- Identify various instructions of 8051.

Unit 3 -8051 INSTRUCTION SET

Cognitive Level: REMEMBER

- 32) List the addressing modes.
- 33) List the data transfer and exchange instructions.
- 34) List the arithmetic instructions of 8051.
- 35) List the logical instructions of 8051.
- 36) Tabulate jump and call instructions.
- 37) List the types of rotate instructions.
- 38) Tabulate single bit instructions.
- 39) List the four arithmetic flags.

Cognitive Level: UNDERSTAND

- 40) Explain immediate addressing mode with examples.
- 41) Explain register addressing mode with examples.
- 42) Explain direct addressing mode with examples.
- 43) Explain indirect addressing mode with examples.
- 44) Explain indexed addressing mode with examples.
- 45) Explain PUSH and POP instructions with examples.
- 46) Explain the opcode, operation and one example of exchange instruction.
- 47) Explain the increment and decrement opcodes and their operation.
- 48) Explain the different ADD opcodes and their operations.
- 49) Explain ADDC opcode and its operation with example.
- 50) Explain SUBB opcode and its operation with an example.
- 51) Write the multiplication opcode syntax and its operation with example.

- 52) Write the division opcode syntax and its operation with example.
- 53) Explain DA instruction with example.
- 54) Explain AND logic instruction with an example.
- 55) Explain OR logic instruction with an example
- 56) Explain XOR logic instruction with an example.
- 57) Explain CPL logic instruction with an example.
- 58) Explain RR and RL instructions with examples.
- 59) Explain RRC and RLC instructions with examples
- 60) Explain SWAP instruction with an example.
- 61) Explain LJMP and SJMP instructions with examples
- 62) Explain LCALL and ACALL instructions with examples
- 63) Explain RET and RETI instructions.

CO4- Develop simple programs for 8051 in assembly and C language.

Unit 4 - 8051 Assembly and C Programming

Cognitive Level: APPLICATION

- 64) Write a program to multiply 25 by 10 using repeated addition.
- 65) Write a program to add the first 20 natural numbers.
- 66) Write a program to load the accumulator with the value AAH and compliment the ACC 700 times.
- 67) Write a program to toggle the bits of port 1 with a delay which depends on the value in R0.
- 68) Write a program to create a square wave of 50% duty cycle on bit 0 of port1.
- 69) Write a program to create a square wave of 66% duty cycle on bit 0 of port1
- 70) Write a program to a)keep monitoring pin p0.1 until it becomes high b)when P0.1 becomes high, read in the data from port1 c)send a low-to-high pulse P0.2 to indicate that the data has been read.
- 71) A switch is connected to pin P1.0 and an LED to pin P2.7. Write a program to get the status of the switch and send it to LED.
- 72) Write a program to copy the value 55H into RAM memory locations 40H to 44H using direct addressing mode.
- 73) Write a program to copy the value 55H into RAM memory locations 40H to 44H using register indirect addressing mode without loop
- 74) Write a program to copy the value 55H into RAM memory locations 40H to 44H using register indirect addressing mode with a loop.
- 75) Write a program to clear 16RAM locations starting at RAM address 60H.
- 76) Write a program to take 10 bytes of data from RAM locations 45H to 54H, add 02 to each of them and save the result in the RAM locations 79H down to 70H.
- 77) Write a program to see if the RAM location 37H contains an even value. If so, send it to P2. If not, make it even and then send it to P2.

- 78) Write a program to add numbers stored in RAM locations 40 -40H and store the result in register A(lower byte) and R7(higher byte).
- 79) Write a program to add two 16 bit numbers FC45H and 02ECH.
- 80) Assume that 5 BCD numbers are stored in RAM location starting from 40H. Write a program to add the numbers and store the result in BCD.
- 81) In a semester, a student has to take six courses. The marks of the student(out of 25) are stored in RAM locations 47H onwards. Find the average marks, and output it on port 1.
- 82) Ten hex numbers are stored in RAM locations 50H onwards. Write a program to find biggest number in the set. The biggest number should finally be saved in 60H.
- 83) Write a program to transfer value 41H serially via pin P2.1. Put two high's at the start and end of the data. Send the byte LSB first.
- 84) Assume the register A has a packed BCD. Write a program to convert packed BCD to two ASCII numbers and place them in R2 and R6.
- 85) Write an 8051 C program to get a byte of data from P1, wait half sec and then send it to P2.
- 86) Write an 8051 C program to toggle all the bits of P0 and P2 continuously with 250ms delay. Use the inverting operator.
- 87) Write 8051 C program to convert ASCII digits of '4' and '7' to packed BCD and display them on P1.

CO5-Write programs using Counter and Timer of 8051, programs for serial communication and interrupts of 8051.

Unit 5 –8051 Timers, Serial port and Interrupt Programming

Cognitive Level: UNDERSTAND

- 88) Draw the general format and function of each bit of TMOD SFR.
- 89) Draw the general format and function of each bit of TCON SFR.
- 90) List the different operating modes of timers in 8051.
- 91) Draw a diagram showing 8051 connection to RS232 using Max233
- 92) Explain SBUF register
- 93) Draw the general format and function of each bit of SCON SFR.
- 94) Draw the general format and function of each bit of PCON SFR
- 95) List the different modes of serial transmission.
- 96) List the interrupts and their destination according to hierarchy upon reset.
- 97) Differentiate interrupts and polling
- 98) Draw the IE SFR and explain the function of each bit
- 99) Draw the IP SFR and explain the function of each bit
- 100) Define ISR

Cognitive Level: APPLICATION

- 101) Explain briefly different modes of timer with diagram.
- 102) Explain the operation of timer in Mode 1.
- 103) Explain the operation of timer in Mode 2.
- 104) List the steps to program timer in mode 1.
- 105) List the steps to program timer in mode 2
- 106) Write a program to create a square wave of 50% duty cycle on P1.5 use timer0 in mode1 to generate the delay.
- 107) Write a program to a toggle the pin P2.5 continuously every 250 msec a use timer 0 in mode 2
- 108) Assume the 1HZ external clock is being fed to pin T1 write a program for counter 1 in mode 2 to count up and display the state of TL1 count on P1.
- 109) Sketch the RS232DB9 connector and tabulate function of each pin.
- 110) Sketch the MAX233 connector and tabulate function of each pin
- 111) List the steps to program 8051 to transfer data serially
- 112) List the steps to program 8051 to receive data serially
- 113) Write a program to transfer letter 'Y' serially at 9600 baud rate continuously.
- 114) Write a program to receive data serially and send it out to port 0 in parallel also save the data at 60H RAM location.
- 115) Explain six interrupts in 8051.
- 116) Write a program to get single bit of data from P1.7 and send it to P1.0 while simultaneously creating a square wave of 200µsec on pin 2.5 using interrupts.

CO6- Design simple circuits for interfacing various peripherals with 8051.

Unit 6 - 8051 Interfacing and Peripherals

Cognitive Level: REMEMBER

- 117) Explain the pin description of LCD
- 118) Explain step angle
- 119) Tabulate the resolution and step size of ADC

Cognitive Level: UNDERSTAND

- 120) Draw the ADC0804 in free running mode and explain the function of each pin
- 121) Explain the stepper motor with the diagrams of rotor alignment and stator winding configuration
- 122) Draw the pin diagram of DS12887 RTC and explain briefly the function of each pin.
- 123) Sketch the diagram of LCD interface to 8051
- 124) Draw the 8051 connection to ADC0804 with self clock
- 125) Draw the matrix key board connection to 8051
- 126) Draw the diagram to interface LM35 temperature sensor to the 8051
- 127) Draw the diagram to interface stepper motor to the 8051

- 128) Draw a circuit showing dc motor connection to 8051 through transistor, optoisolator and switch
- 129) Draw an interface of DS12887(RTC) to 8051
- 130) Draw the relay connection to an 8051.

Cognitive Level: APPLICATION

- 131) Sketch and explain the diagram of LCD interface to 8051
- 132) Draw the matrix key board connection to 8051 and explain briefly about scanning and identifying the key.
- 133) Draw and explain the 8051 connection to ADC0804 with self clock
- 134) Explain the concept of 8051 connection to DAC0808 with diagram
- 135) Explain, with diagram the interface of LM35 temperature sensor to the 8051
- 136) Explain, with diagram the interface of stepper motor to the 8051
- 137) Draw and explain a circuit showing dc motor connection to 8051 through transistor, opto isolator and switch
- 138) Explain, with circuit diagram, interfacing opto isolator to the 8051 microcontroller
- 139) Explain the relay connection to a 8051 with a diagram
- 140) Draw and explain an interface of DS12887(RTC) to 8051

Model Question Paper:

Code:15EE54C

EMBEDDED SYSTEMS

VI Semester Examination
Diploma in Electrical and Electronics Engg.

Time: 3 Hours

Max Marks: 100

- Note:** i) Answer any SIX questions from PART - A. Each question carries 5 marks.
ii) Answer any SEVEN Questions from PART - B. Each question carries 10 marks.

PART – A

- 1) List the features of 8051 microcontroller
- 2) Explain briefly stack and stack pointer.
- 3) List the addressing modes.
- 4) Explain RRC and RLC instructions with examples
- 5) Write a program to multiply 25 by 10 using repeated addition
- 6) Draw the general format and function of each bit of SCON SFR.
- 7) Draw the 8051 connection to ADC0804 with self clock
- 8) Draw the pin diagram of DS12887 RTC
- 9) List the steps to program timer in mode 1.

PART – B

- 10) (a) Describe the function of any 5 pins of 8051 (5M)
(b) Explain the structure and function of Port 0 . (5M)
- 11) (a) Draw and explain the internal RAM organisation. (10M)
- 12) (a) Draw the PSW SFR and explain the function of each bit. (7 M)
(b) Explain machine cycle for the 8051. (3 M)
- 13) (a) Explain indirect addressing mode with examples (4 M)
(b) Explain ADD and XRL instructions with examples (6 M)
- 14) (a) List the data transfer and exchange instructions . (3 M)
(b) Write a program to create a square wave of 50% duty cycle on bit 0 of port1. (6 M)
- 15) (a) Write a program to add two 16 bit numbers FC45H and 02ECH (3 M)
(b) Write a 8051 C program to toggle all the bits of P0 and P2 continuously with 250ms delay. Use the inverting operator. (7 M)
- 16) (a) Draw the IE SFR and explain the function of each bit (7 M)
(b) Explain SBUF register (3 M)
- 17) (a) Draw the ADC0804 in free running mode and explain the function of each pin (10M)

- 18) (a) List six interrupts in 8051. (3 M)
(b) Write a program to receive data serially and send it out to port 0 in parallel also save the data at 60H RAM location (7M)
- 19) (a) Explain, with diagram the interface of stepper motor to the 8051 (5 M)
(b) Explain, with diagram the interface of LM35 temperature sensor to the 8051 (5M)

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