Name:

Enrolment No:

UPES

End Semester Examination, December 2024

Programme Name: B. Tech (Electronics & Communication Engineering) / Electronics & Computer Engineering)

Course Name : Embedded Systems **Time : 03 Hrs**

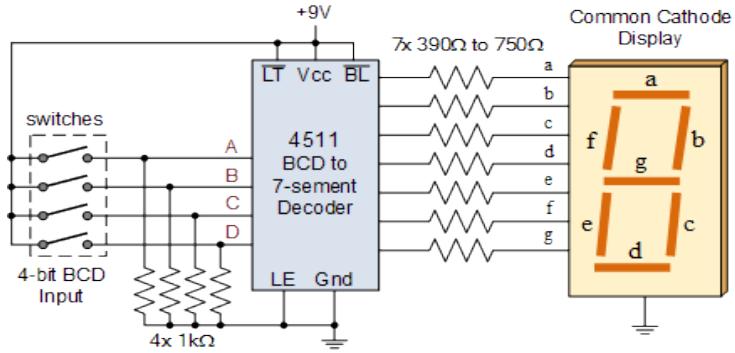
Course Code : ECEG-3078 **Max. Marks : 100**

Nos. of page(s) : 02 **Semester : V**

Instructions: Assume any data in programming, if required.

SECTION A (4 x 5 = 20 Marks)

Attempt *all* the questions

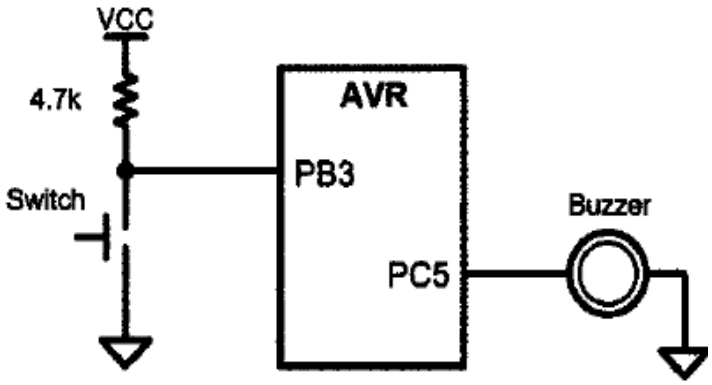
S. No.		Marks	CO
Q.1	List the features of microcontroller-based system and given the example to support your answer.	**5**	**CO1**
Q.2	Discuss the concept of semaphore. How many types of semaphore are used in RTOS.	**5**	**CO4**
Q.3	Write a program (WAP) for generating the duty cycle of 75 % and display it on the port PC7 for AVR.	**5**	**CO2**
Q.4	Draw the logic diagram and functional table to support common cathode display of the 7-segment display (0 to 9) and develop the code in Embedded 'C' programing language to support the same functionality.  Fig.1 Common Cathode -7 Segment Display	**5**	**CO3**

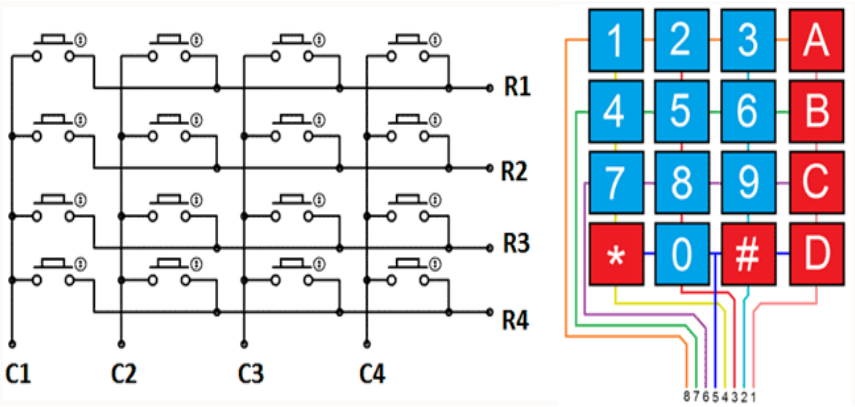
SECTION B (4 x 10 = 40 Marks)

Attempt *all* the questions

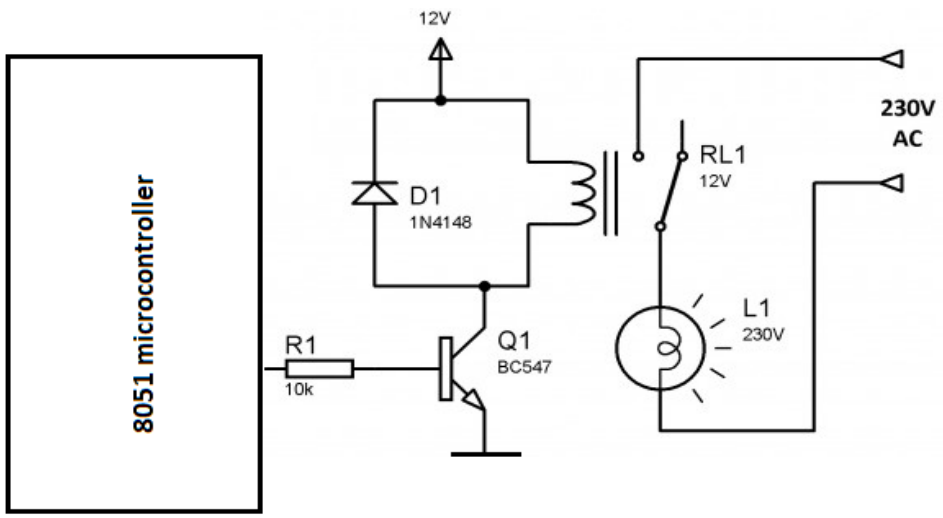
Q.5	Discuss the simplified pin layout of AVR-ATMEGA-32 microcontroller with a complete description of each pin ***OR*** How to control the direction of stepper motor using 4-step and 8-step sequence. Discuss the technique. Draw the interface diagram of the microcontroller to stepper motor using opt isolator based on a switch in clockwise and counter clockwise direction.	**10**	**CO1**

Q.6	**(a)** What is the difference between low level and high-level programming? Draw the structure for assembly language program flow and discuss the steps to burn the program in microcontroller.
	
	(b) For an instruction cycle of 1 µs Find The delay of the subroutine
	
	Instruction Cycles
	`DELAY: LDI R16,200 1`
	`AGAIN: LDI R17,250 1`
	`HERE: NOP 1`
	`NOP 1`
	`DEC R17 1`
	`BRNE HERE 2/1`
	`DEC R16 1`
	`BRNE AGAIN 2/1`
	`RET 4`
		5+5	**CO2**

Q.7	**(a)** Detail the concept of pre-emptive nad no preemtive scheduling in RTOS with example. ***OR*** **(b)** Assume that the bit PB3 is an input and presents the condition of a door alarm. If it goes low, that means door is open. Monitor the bits continuously. Whenever it goes low, send a high to low pulse to port PC5 to turn on the buzzer. Write the assembly/ embedded 'C 'program and flow chart for the same.  Fig.2 Buzzer interfacing	**10**	**CO4**
Q.8	Explain the asynchronous data format and different modes of data transfer in serial communication. Discuss the Need of MAX 232 and DB-9/25 connector in serial communication.	**10**	**CO3**
SECTION-C (2 x 20 = 40 Marks) **Attempt *any two* the followings**			
Q.9	**(a)** How the concept of pipelining and parallel computing help in estimation of optimal delay in microcontroller-based system. Detail with the help of example. **(b)** Draw the interface diagram of the AVR microcontroller to the stepper motor using an optoisolator. The switch is connected to pin 1.7 of the microcontroller. Write a program to monitor the status of the switch and perform the following. If SW = 0, the stepper motor moves clockwise.	**10+10**	**CO3**

Q.10	Keypads are widely used input devices being used in various electronics and embedded projects. They are used to take inputs in the form of numbers and alphabet, and feed the same into system for further processing. In the discussion, we are going to interface a 4x4 matrix keypad with microcontrollers. Before we interface the keypad with microcontroller, first we need to understand how it works. Matrix keypad consists of a set of Push buttons, which are interconnected. As in our case we are using 4X4 matrix keypad, in which there are 4 push buttons in each of four rows. And the terminals of the push buttons are connected according to diagram. In first row, one terminal of all the 4 push buttons is connected together and another terminal of 4 push buttons represents each of 4 columns, same goes for each row. So, we are getting 8 terminals to connect with a microcontroller. As shown below, to interface Keypad, we need to connect 8 terminals of the keypad to any port (8 pins) of the microcontroller. Like we have connected keypad terminals to Port 1 of microcontroller. Whenever any button is pressed, we need to get the location of the button, means the corresponding ROW and COLUMN no. Once we get the location of the button, we can print the character accordingly.  Fig.3 Keypad Interfacing **(a)** Develop the algorithm and flow chart to display all the characters sequentially. Interface the keypad to AVR/ARM series microcontroller and write embedded ‘C’ or assembly code to support the suggested algorithm. **(b)** Interface the (16x2) LCD with ATMEGA-32 and detail the functionality of each pin and interface diagram. Write an embedded ‘C’ doe to display “INDIA” on same LCD.	**10+10** **10+10**	**CO4**
Q.11	In some electronic applications, we need to switch or control high voltages or high currents. In these cases, we may use electromagnetic or solid state relays. For example, it can be used to control home appliances using low power electronic circuits. An electromagnetic relay is a switch, which is used to switch High Voltage or Current using Low power circuits. It magnetically isolates low power circuits from high power circuits. It is activated by energizing a electromagnet, coil wounded on a soft iron core. A relay should not be directly connected to a microcontroller; it needs a driving circuit due to the following reasons. A microcontroller will not be able to supply the current required for the proper working of a relay. The maximum current that A89C51 microcontroller/ ATMEGA 32/ARM can sink is 15mA while a relay needs about 50 – 100mA current. A relay is activated by energizing its coil. Microcontrollers may stop	**10+5+5**	**CO4**

working by the negative voltages produced in the relay due to their back emf. Fig. Shows an application to turn on/off the bulb.



(a) Draw the exact interface diagram of the relay to microcontroller and write the code to turn ON/ OFF the bulb.

(b) Is it possible to replace the relay with an optocoupler? Draw the interface diagram to the optocoupler. Write the embedded 'C' or assembly code for the same.

(c) Replace the bulb with FAN, electro-mechanical relay (EMR) with solid state relay (SSR). Draw the interface diagram and write the code to control the speed of FAN.