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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Microcontrollers and Embedded Systems (ELEG-368)   **Semester: VI**
Program: B.Tech Instrumentation & Control Engineering
Time: 03 hrs.   **Max. Marks: 100**
Instructions: *Assume necessary data in programming if required.*

SECTION A (4 x 5 = 20 Marks)

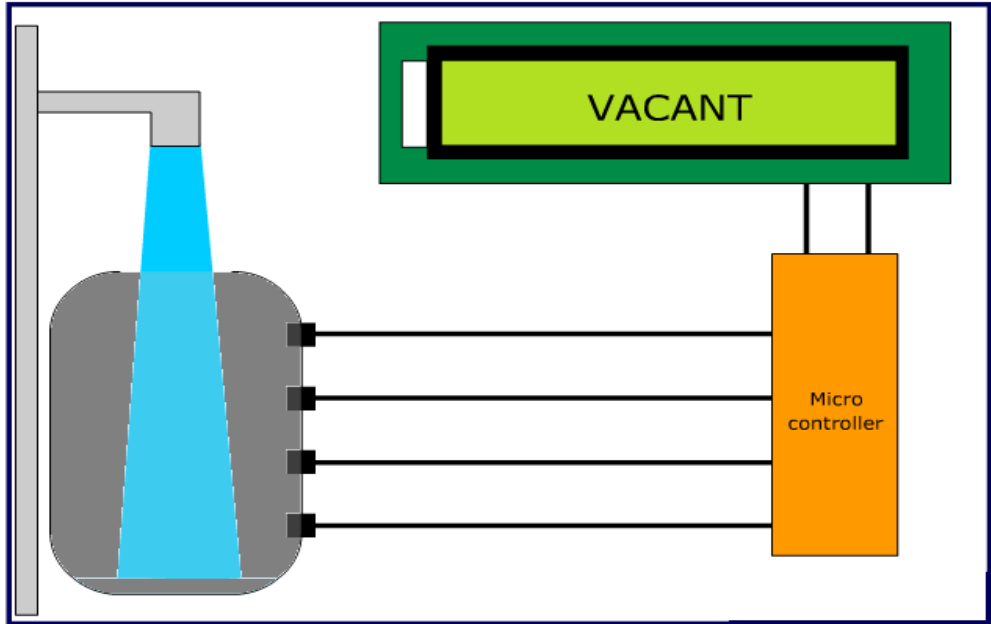| S. No.	*Attempt All the questions*	Marks	CO
Q.1	What is Embedded System? Compare microcontroller versus embedded processors.	4	CO1
Q.2	Draw the block diagram of 8051 microcontroller and pin layout with the complete description of each pin and units of block.	4	CO3

Q.3	Show the stack and stack pointer for each line of the following program.
	 ORG 0
	 MOV SP , #70 H
	 MOV R5, #66 H
	 MOV R2, #7FH
	 MOV R7, #5DH
	 PUSH 5
	 PUSH 2
	 PUSH 7
	 CLR A
	 MOV R2, A
	 MOV R7, A
	 POP 7
	 POP 2
	 POP 5
		4	CO4

Q.4	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.	4	CO2
Q.5	Detail three factors that can affect the delay size in assembly and embedded 'C' programming for 8051 microcontroller. Write a program to generate the delay of 1 ms.	4	CO5

SECTION B (8 x 5 = 40 Marks)

	Attempt All the questions		
Q.6	Explain the use of line driver IC MAX-232 and DB-9 connector used in serial communication and interface with 8051 microcontroller.	8	CO4
Q.7	What is the practical use of semaphore in real time applications? Detail the following instructions of 8051 microcontrollers. LJMP, SJMP, MOVC, DJNZ, CPL	8	CO2
Q.8	How to control DC motor using H bridge. Interface the DC motor to 8051 microcontroller pin P 2.7 (Switch) with the help of L293 and write the code to monitor the status of the pin	8	CO4

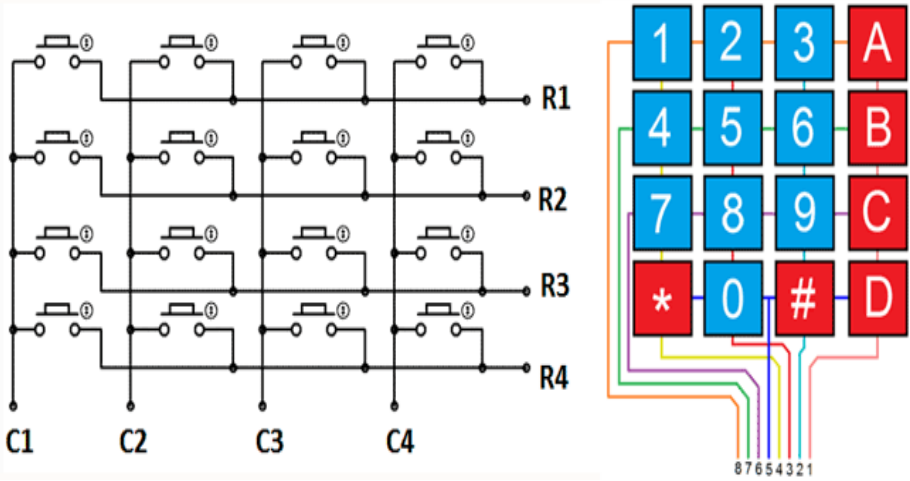|			
	(a) If Switch = 0, the DC motor rotates in clockwise direction		
	(b) If Switch = 1, the DC motor rotates in anticlockwise direction		
Q.9	Develop the data path architecture for the GCD controller for the two numbers X = 40 and Y = 50. Discuss the state table and FSMD. Also compare the custom GCD with the GCD running on a 300 MHz processor with two operand inductions and one clock cycle per instruction.	8	CO1
Q.10	How to control the direction of stepper motor using 4-step and 8-step sequence. Discuss the technique. Draw the interface diagram of 8051 microcontroller to stepper motor using optoisolator. A switch is connected to pin 1.7 of 8051 microcontroller. Write a program to monitor the status of switch and perform the followings **(a)** If SW = 0, the stepper motor moves clockwise. **(b)** If SW= 1, the stepper motor moves counterclockwise.	8	CO5

<center>**SECTION-C (20 x 2 = 40 Marks)**</center>

Attempt any two of the followings (Case Studies)

Q.11	Water level indicator is used in tanks to indicate the level of liquids and alert us when the tank is full. So by the circuit we can monitor the various levels of the tank and can avoid spillage of water and also we can configure our supplies according to the various levels of tank as shown in figure 3. Such module or circuit can be installed in big buildings where manual monitor of tanks is difficult and its indicator can be placed at some centralized place. <center>**Fig.1**</center> Write assembly programs to display the conditions of tank on LCD using either 8051 microprocessor or ATMEGA 16 on LCD display. It is optional to use the interface of 8255 PPI with microprocessor/ microcontroller. Assume any missed data. 　(a) Vacant 　(b) Quarter	20	CO3

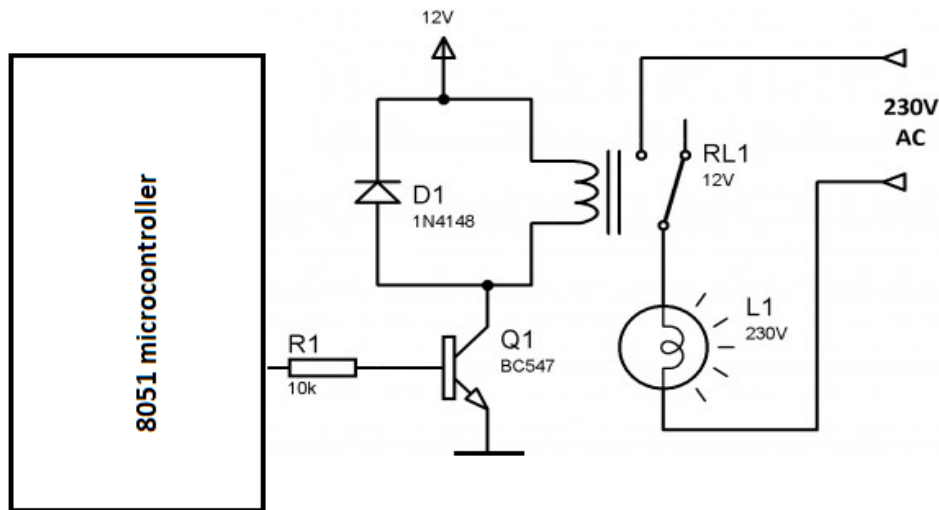|			
	(c) Half (d) Full Close tap (e) 3/ 4 of Full Draw the complete interface diagram of LCD to microcontroller and the details of all pins in 16 x 2 LCD.		
Q.12	Keypads are widely used input devices being used in various electronics and embedded projects. They are used to take inputs in the form of numbers and albhabets, and feed the same into system for further processing. In the discussion, we are going to interface a 4x4 matrix keypad with 8051 microcontroller. Before we interface the keypad with microcontroller, first we need to understand how it works. Matrix keypad consists of set of Push buttons, which are interconnected. Like 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 are connected together and another terminal of 4 push buttons are representing 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 8051. 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.2** **(a)** Develop the algorithm and flow chart to display all the characters sequentially. **(b)** Interface the keypad to 8051 microcontroller and write embedded 'C' or assembly code to support the suggested algorithm.	20	CO4
Q.13	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.	20	CO5

A relay should not be directly connected to a microcontroller; it needs a driving circuit due to the following reasons. A microcontroller will not able to supply current required for the proper working of a relay. The maximum current that A89C51 microcontroller can sink is 15mA while a relay needs about 50 – 100mA current. A relay is activated by energizing its coil. Microcontroller may stop working by the negative voltages produced in the relay due to its back emf. Fig. Shows an application to turn on/off the bulb.

(a) Draw the exact interface diagram of the relay to 8051 microcontroller and write the code to turn ON/ OFF the bulb.
(b) Is it possible to replace the relay to 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.

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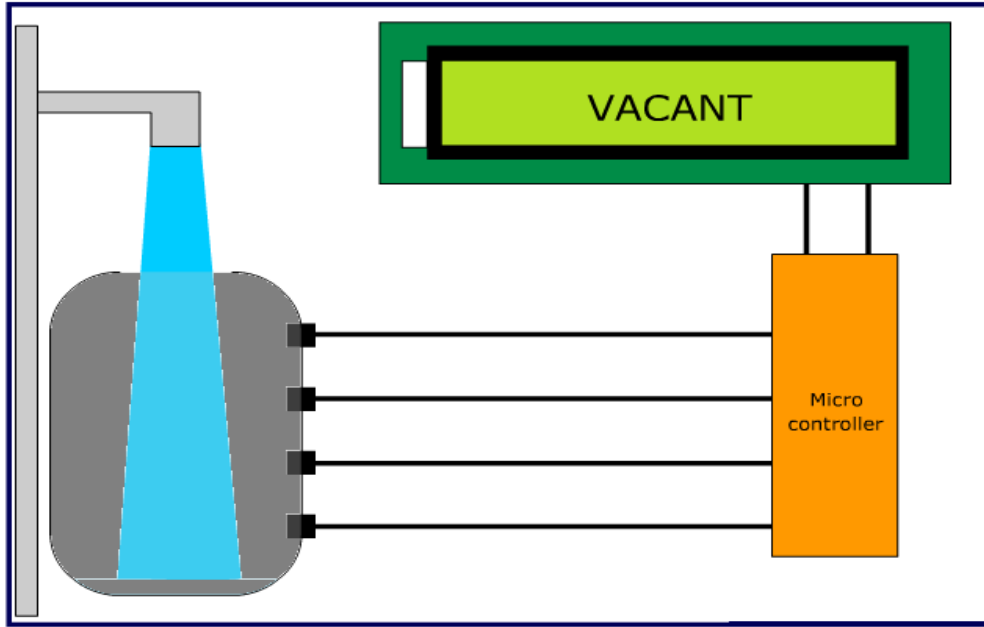|			
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Fig.2

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- (f) Vacant
- (g) Quarter
- (h) Half
- (i) Full Close tap
- **(j)** 3/ 4 of Full

Draw the complete interface diagram of LCD to microcontroller and the details of all pins in 16 x 2 LCD.

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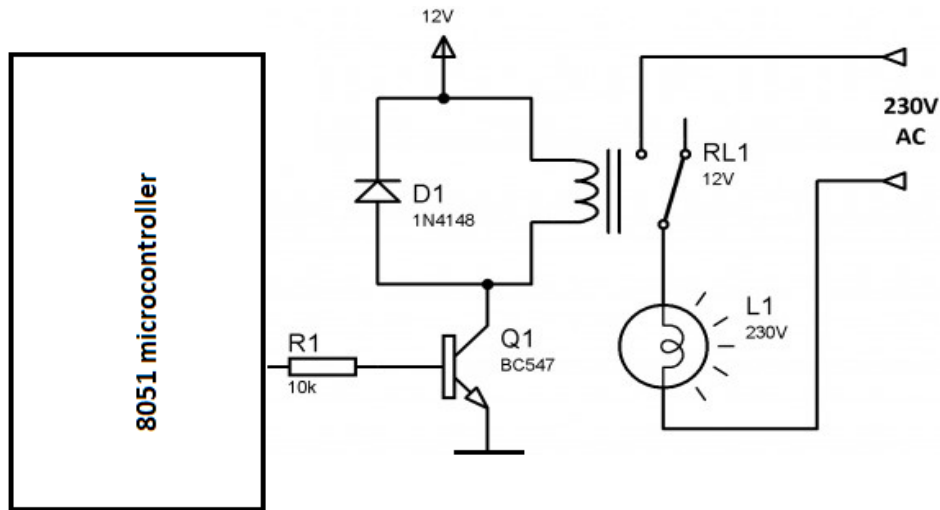
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