

**The Open University of Sri Lanka**  
**Faculty of Natural Sciences**  
**B.Sc/ B. Ed Degree Programme**



<b>Department</b>	: Physics
<b>Level</b>	: 05
<b>Name of the Examination</b>	: Final Examination
<b>Course Title and - Code</b>	: Practical Physics – PHU5301/PYU3161
<b>Academic Year</b>	: 2019/2020
<b>Date</b>	: 26.01.2021
<b>Time</b>	: 1.30 p.m. – 3.30 p.m.
<b>Duration</b>	: 02 hours

**General Instructions**

1. Read all instructions carefully before answering the questions.
  2. This question paper consists of (06) questions in (05) pages.
  3. Answer any Four (04) questions only. All questions carry equal marks.
  4. Answer for each question should commence from a new page.
  5. Draw fully labelled diagrams where necessary
  6. Involvement in any activity that is considered as an exam offense will lead to punishment
  7. Use blue or black ink to answer the questions.
  8. Clearly state your index number in your answer script
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*The Open University of Sri Lanka*  
*B.Sc. Degree Programme- Level 05*  
*Final Examination 2019/2020*  
*PHU5301/PYU3161- Practical Physics*



**Duration: Two (02) hours**

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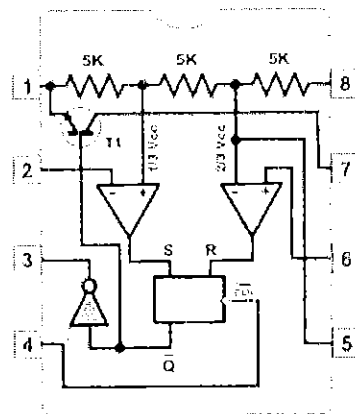
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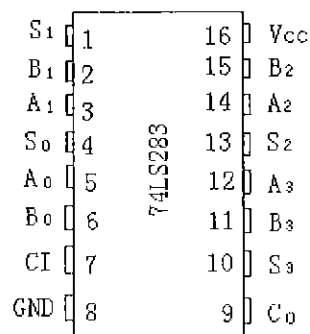
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**ANSWER ANY FOUR QUESTIONS.**

1. (a) What is the difference between combinational logic and sequential logic circuits?  
Differentiate the circuits in Registers, counters, Adders and Subtractors into those two groups.
  - (b) Distinguish the difference between J-K flip flops and D-type flip flops by using their truth tables and draw the block diagrams of these two flip flops including Clearing, Pre-setting and Clock facilities.
  - (c) What are the frequently used ICs as J-K flip flops and D-type flip flops in practice?
  - (d) Draw the block diagram of a four bit binary counter constructed using J-K flip flops and sketch the waveform at the output of each flip flop.
  - (e) Modify the circuit drawn in (d) for a BCD counter including any extra gates that are necessary.
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2. (a) Why do you need an external oscillator to drive a microcontroller? Name the two types of oscillators use in microcontroller circuits and discuss their limitations.
  - (b) A 555 timer IC can be used to build an oscillator to generate clock signals. What is the mode of operation of this oscillator and the type that you listed under part (a)?
  - (c) The internal circuit of 555 timer IC is given in the figure below. Name the electrical and electronic circuit elements present inside and label the pins of this IC.



- (d) If you are provided with 555 timer IC, 12 V battery, 100 k $\Omega$  and 1M $\Omega$  resistors, 0.1  $\mu$ F and 0.001  $\mu$ F capacitors, how do you construct the oscillator described in part (b)?
- (e) Write down the mathematical expression used to calculate the pulse width of the clock signal of the above oscillator and find the pulse width for the given components.
3. (a) Draw the pin configuration of a Seven Segment Display (SSD) labelling all the pins and the corresponding LED segments.
- (b) How do you identify common cathode SSD and common anode SSD, if you are provided with a multimeter?
- (c) What are the driver ICs used with those two types of SSDs that mentioned in part (b)?
- (d) 74283 in the following figure is a four bit binary Adder IC. Construct a four bit binary subtractor using this IC and any other necessary gates.

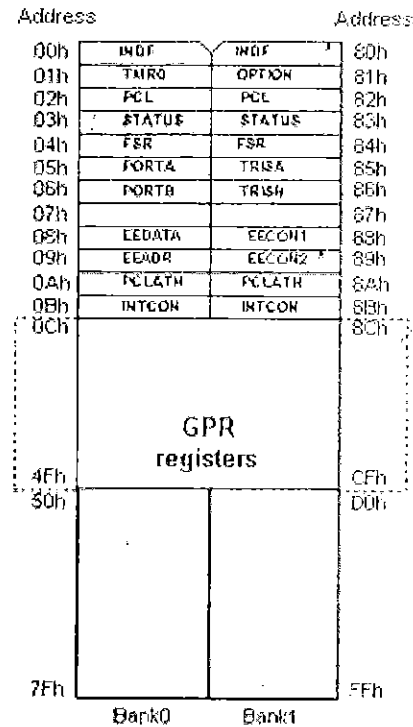


- (e) Briefly explain how two binary numbers are subtracted in the above circuit using an example.

4. (a) How do the following terms relate to Microcontrollers?

- (i) Harvard and Von-Neumann architecture                      (ii) CISC and RISC

(b) Following figure shows the RAM organization of the PIC16F84 microcontroller.



- (i) How many memory locations are there in this memory map and what is the width of one memory location?
- (ii) What is the space allocation for special function registers and general purpose registers?
- (c) What are the other two types of memories in this microcontroller used to store data and programme?
- (d) What is the purpose of EEADR and EEDATA registers at addresses 08h and 09h respectively in this RAM?
- (d) Describe the function of PORT A, PORT B and TRIS A, TRIS B at the addresses 05h, 06h and 85h, 86h respectively.
- (e) What is the bit in STATUS register used to select Bank 0 and Bank 1? Write statements in Assembly language to change Bank 0 to Bank 1 and vice versa by setting and clearing that bit.

5. (a) Following Assembly language programme is used to on/off a LED connected to a PIC16F84 microcontroller.

```

STATUS EQU 03H
TRISB      EQU 86H
PORTB      EQU 06H
X          EQU 0CH
Y          EQU 1CH

INIT   BSF   STATUS, RPO ; -----
       BCF   TRISB,0    ; -----
       BCF   STATUS, RPO ; -----

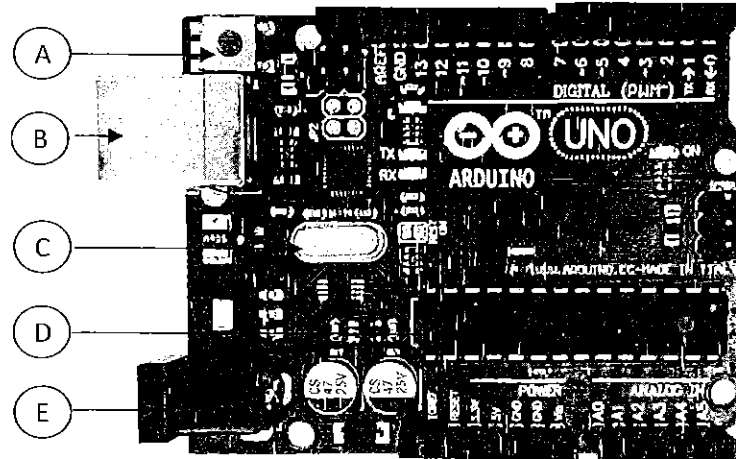
MAIN   BTFSS PORTA, 0   ; -----
       GOTO  MAIN
       CALL  DELAY      ; -----
       BSF   PORTB, 0   ; -----
       CALL  DELAY      ; -----
       GOTO  MAIN

DELAY  DECFSZ X,1
       GOTO  DELAY
       DECFSZ Y,1
       GOTO  DELAY
       RETURN
       END

```

- (i) Name three registers used by this programme.
- (ii) Identify five Assembly language instructions in this programme and describe what they mean.
- (b) What is the purpose of introducing a subroutine called “DELAY” in this programme?
- (c) Write down the action takes place when the instruction is executed in front of each line of the programme where space is provided.
- (d) If you are provided with PIC16F84A microcontroller, 330  $\Omega$  resistor, LED and a dip switch, how do you design the circuit connected with the microcontroller for the above programme? (Labelling only the pins of the microcontroller connected to the LED and dip switch will be sufficient)
- (e) Modify the above Assembly language programme to blink the LED connected to the microcontroller without the dip switch.

6. (a) Name the components labelled A to E in the following figure.



- (b) Group of students at OUSL decides to create an 'Automatic Hand Sanitizer Dispenser System'. Its function is as follows.

A sensor detects motion of hand close to the unit.

Unit automatically pump the sanitizer through a nozzle for 2 seconds and stops.

What is the suitable sensor to implement this unit?

List the other components need to build this unit.



- (c) Sensor detects a nearby object (e.g. hand) and sends a 5V signal (logic 1). Pump will be switched on when it receives 5V (logic 1) and will be switched off otherwise.

Write an Arduino program to achieve above functionality. Clearly mention the pins that are connected to the Pump and the Sensor.

- (d) If the temperature of the disinfection rises above 30°C, its effectiveness is reduced. Hence the team added a temperature probe to measure the temperature of the solution. At 0°C and 50°C, output voltages of the sensor are 1.5 V and 5V respectively. Assuming temperature is linearly proportional to the voltage, modify the above programme to light up a Red LED if the temperature is above 30°C.

- (e) Indicate the changes done in the circuit when implementing the above programme.