

*The Open University of Sri Lanka*  
*B.Sc. Degree Programme- Level 05*  
*Final Examination 2011/2012*  
*PYU 3161- Practical Physics*



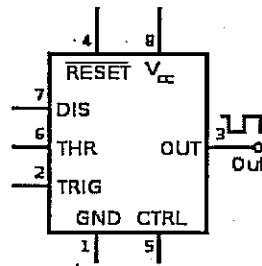
**Duration: Two (2) Hours**

**Date: 13.11.2012**

**Time: 1.30 P.m. – 3.30 P.m.**

**ANSWER FOUR QUESTIONS ONLY.**

1. (a) What do you mean by sequential logic operations? Briefly explain the use of flip flops in data banks as basic memory cells.
  - (b) Starting with the basic S-R flip flop, explain how it is developed up to a clocked J-K flip flop by drawing circuit diagrams of the flip flops using gates.
  - (c) What is the advantage of use of D-flip flops in registers? Explain your answer by drawing the circuit diagram and the truth table of a D-flip flop.
  - (d) Discuss the SET and RESET facility of D-flip flops and synchronized operation of a number of flip flops with a common clock signal.
  - (e) How do you construct a serial in parallel out 4-bit shift register with D-flip flops? Explain your answer by drawing the block diagram of the circuit of the shift register clearly labeling the input, outputs and clock inputs.
2. (a) Write down two types of oscillators that are used to clock microcontrollers.
  - (b) What are the three modes of operations of 555 timer ICs when oscillator circuits are constructed with them?
  - (c) Mention one application for each mode of operation of the 555 timer IC.
  - (d) If you are given a 555 timer IC, 12 V power supply, 100 k $\Omega$  and 1M $\Omega$  resistors, 0.1  $\mu$ F and 0.001  $\mu$ F capacitors, how do you construct a multivibrator circuit? The pin diagram of the 555 IC is given bellow. Explain your answer by drawing the circuit diagram of the multivibrator circuit.



- (e) Write down the expression for the pulse width of the clock signal generated by the 555 timer IC multivibrator circuit. Calculate the pulse width of the output signal of the circuit you constructed in (d).
3. (a) Write down two methods to convert digital signals into analogue form. Discuss the advantages in each method by comparing them.
- (b) Draw the circuit diagrams of DAC circuits you mentioned in (a) labeling the inputs and output.
- (c) Briefly explain the operation of the counter ADC by drawing a block diagram.
- (d) Suppose that the counter in the ADC circuit is connected to a seven segment display (SSD). If the output of the counter is 4 bit, how do you construct a decade counter using J-K flip flops and a NAND gate for the ADC in part (c)?
- (e) Draw the output of each J-K flip flop of the counter you constructed in (d) in a timing diagram.
4. (a) Discuss the advantages of Harvard architecture of computers over the Neumann architecture and explain what is stand for CISC and RISC.
- (b) Briefly explain the memory organization in a PIC16F84A microcontroller.
- (c) Name three special function registers in the data memory of the PIC16F84A microcontroller.
- (d) What are the special functions designated to each of the register you mentioned in part (c).
- (e) Describe the task of the programme counter (PC) and the 8-level stack functions associated with the PC.

5.
  - (a) How many clock cycles are needed to execute an instruction in a PIC16F84A microcontroller?
  - (b) Draw the timing diagram of clock signal input to the OSC1 pin and output signal observed at OSC2 pin of a PIC16F84A microcontroller.
  - (c) Suppose the frequency of the oscillator of a microcontroller is 20 MHz. Calculate the time taken to execute an instruction.
  - (d) Write a sub programme to delay the execution of the next instruction in a programme defining any variable associated with it using the instruction, DECFSZ.
  - (e) Calculate the time delay that will occur in the sub programme written in (d).
  
6.
  - (a) What are the Ports available in the PIC16F84A microcontroller to communicate with the outside world?
  - (b) How do these Ports generally configured in a Power-on Reset?
  - (c) Briefly explain how you configure a Port in a microcontroller as an input or output.
  - (d) What is the bank select bit in the Status register? Briefly explain how you address Bank 0 and Bank 1 of the data memory registers.
  - (e) Write a programme to configure Port B, bit 0 as an output using the instructions BSF and BCF.