NEW YORK UNIVERSITY TANDON SCHOOL OF ENGINEERING
Department of Mechanical and Aerospace Engineering

Mechatronics (ROB-GY 5103)
Midterm Study Guide: Sample Question Answers

Fall 2023 — **Section A** — 3.0 credits

1. **What is the difference between forward bias and reverse bias?**
   When a diode is forward biased current is allowed to flow through it once it overcomes the minimum voltage required to move through the PN junction. In reverse bias mode the diode does not allow current to flow. In a Zener diode when in reverse bias mode, current is allowed to flow but the voltage will remain constant at the device's rating. This makes it good for voltage regulation.

2. **Explain the difference between RAM and ROM.**
   RAM is Random Access Memory. It is the temporary storage the microcontroller uses for processing data. ROM is Read Only Memory. It is permanent storage and contains the factory instructions for the microprocessor to function.

3. **Explain the importance of registers.**
   Registers are how the microcontroller keeps track of the state of the i/o pins using 1s and 0s. The BS2 has a DIR, INS, and OUTS register. DIR is the configuration of the pin (input or output). INS stores the state of the input pins (high or low). And OUTS stores the state of the output pins (high or low).

4. **When might you use an inductor in a circuit?**
   Possible answers:
   - In an RLC circuit to vary impedance. Impedance determines voltage transfer, such as in a transformer.
   - To regulate current flow in a motor.
   - To tune ultra-high-frequency signals (ex. RF signals)

5. **Explain the terminals of a comparator.**
   Inverting terminal: inverts the input signal
   Noninverting terminal: does not invert the input signal
   Positive power supply (V+): supplies a positive voltage to the op amp
   Negative power supply (V-): supplies a negative voltage to the op amp
   Output terminal: outputs either the positive or negative power supply

6. **When might you use an comparator?**
   Used to compare two voltage signals and output V+ or V- accordingly. Typically used for logic operations.

7. **Explain debouncing.**
   The process of interpreting the signal during the bounce of a button press so that the microcontroller has an accurate understanding of the button's state.

8. **What is the purpose of a pull-up/down resistor?**
   To prevent a floating input in an electronic circuit.

9. **Describe at least one method for circuit isolation.**

   Possible answers:

   - Optoelectronic isolation: a phototransistor and an led are used to interface two circuits whose power supplies are completely separate.
   - Transistors: used to switch current in a circuit from one power supply or device to another (electrical solution). In this case, power supplies share common ground.
   - Relay: used to switch current in a circuit from one power supply or device to another (electromechanical solution).