



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATIONS FOR BACHELOR OF SCIENCE
IN ELECTRICAL AND ELECTRONICS ENGINEERING

SUPPLEMENTARY EXAMINATION

EEE 306: DIGITAL ELECTRONICS II

DATE: 29/8/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

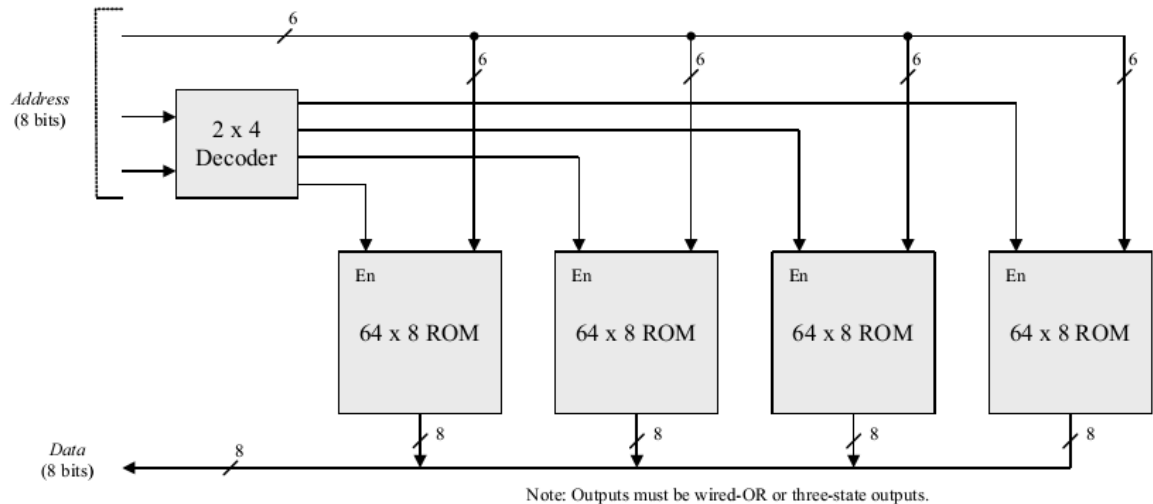
Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Show how an 8 line-to-1-line multiplexer can be constructed using 4 line-to-1 line multiplexers. (5 marks)
- (b) Design a 4-bit magnitude comparator using 2-bit magnitude comparator units. (5 marks)
- (c) Difference between static and dynamic RAMs. Draw the circuits of one static RAM MOS cell and one dynamic RAM MOS cell. (10 marks)
- (d) What is a shift register? Differentiate between SISO and a PIPO shift register using four D flip flops. (5 marks)
- (e) What is a digital multiplexer? Draw the scheme of a 4-input multiplexer using basic gates (AND/OR/NOT) and explain its operation. (5 marks)

QUESTION TWO (20 MARKS)

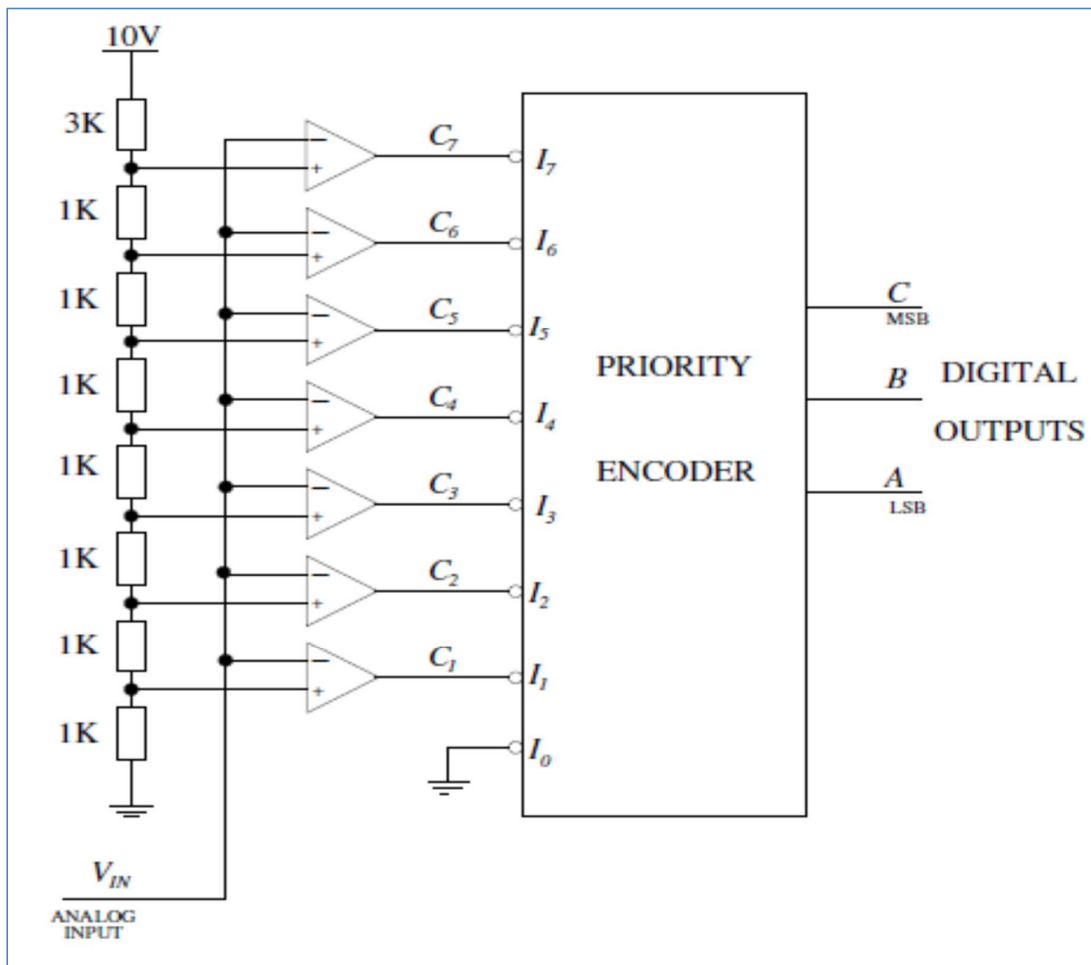
- (a) What is a shift register? Can a shift register be used as a counter? If yes, explain how? (3 marks)
- (b) What is a Decoder? Compare a decoder and a demultiplexer with suitable block diagrams. (4 marks)
- (c) Given a 64x8 ROM chip with an enable input, show the necessary external connections needed to construct a 256x8 ROM using an appropriate number of chips and a decoder. (7 marks)



- (d) Distinguish between combinational logic circuits and sequential logic circuits. How are the design requirements of both circuits specified? (6 marks)

QUESTION THREE (20 MARKS)

- (a) A DAC is used to output a *sine wave* using SysTick Interrupts and a sine-wave table. Assume the DAC has 7 bits, the DAC output is connected to a speaker, the SysTick ISR executes at 32kHz, the sine table has 256 elements, and one DAC output occurs each interrupt. The DAC output range is 0 to 3.3V. The bus clock is 80 MHz. The ADC maximum rate is 125 kHz. What frequency sound is produced, in Hz? (3 marks)
- (b) An 8-bit ADC has an input range of 0 to +10 volts and an output range of 0 to 255. What digital value will be returned when an input of +7.5 volts is sampled? Give your answer as a decimal number. (3 marks)
- (c) Flash converters are the fastest ADCs, where the conversion time equals the sum of the comparator plus encoder propagation delays. A typical flash converter has a conversion time of about 50ns, compared with a typical 20μsec for successive approximation ADCs. A 3-bit flash ADC is shown below. Describe the operation of this converter (preferably in form of a table). What is the main disadvantage of this type of ADC. (7 marks)



- (d) A 10-bit digital slope integrating A/D converter has a full-scale input of 10V. If the clock period is 15 μ S, how long will it take to convert an input of 4V? How long for an input of 10V? (4 marks)
- (e) What increase in speed can be gained by using a 12-bit successive approximation converter instead of the digital slope converter, assuming a full-scale input voltage? (3 marks)

QUESTION FOUR (20 MARKS)

- (a) Determine the analog output voltage of 6-bit DAC (R-2R ladder network) with V_{ref} as 5V when the digital input is 011100 (6 marks)
- (b) What is the function of A/D converter? (3 marks)
- (c) Explain the construction and principle of operation of a 3 bit parallel comparator ADC with the help of a diagram and give its truth table. (7 marks)
- (d) A 5-bit DAC produces an output voltage of 0.2V for a digital input of 00001. Find the value of the output voltage for an input of 11111. What is the resolution of this DAC? (4 marks)

QUESTION FIVE (20 MARKS)

- (a) Draw the circuit of a monostable multivibrator using two transistors. Use the following data in your circuit: $V_{cc}=10V$, $V_{CE(sat)}=0.2V$, $V_{BE(sat)}=0.8V$, $\beta=80$, for both the transistors. The resistor and capacitor connected to the base of Q_2 have values $20k\Omega$ and $C = 0.1\mu F$ respectively. Determine the monostable pulse width. (8 marks)
- (b) Explain how the timer IC 555 can be operated as an astable multivibrator, using timing diagrams. (12 marks)