

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**FACULTY OF APPLIED SCIENCE**  
**COMPUTER SCIENCE DEPARTMENT**  
JULY EXAMINATIONS 2001

**SUBJECT:** MEASUREMENT AND DIGITAL SIGNALS PROCESSING  
**CODE:** SCS 2203

**INSTRUCTION TO CANDIDATES**

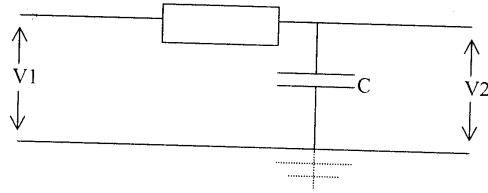
- 1 Answer Any 5 questions
- 2 Part marks will be assigned for good expression and orderly presentation
- 3 ALL necessary work should be done on the answer sheet supplied

**Time: 3 hours**

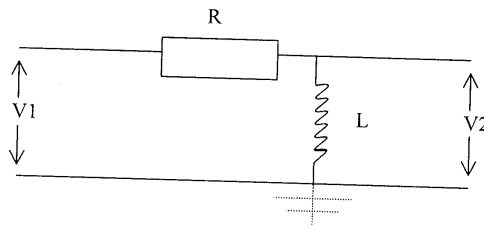
- 
1. (a) Sketch a diagram of a typical microcomputer - based measurement system.  
Explain the purpose of each block. [10]  
(b) Discuss the advantage of a manual measurement system as opposed to an automatic system. [4]  
(c) A Multiplexer is used in a system to measure temperature from 4 boilers in a power plant. Sketch a diagram of the Multiplexer using NOT, OR and AND gates only. [6]
  - 2 (a) Sketch a diagram of a typical ADC. Discuss its operation. State the advantages of Successive Approximation ADC over a Ramp type ADC [10]  
(b) State three properties of an ideal amplifier. Discuss the operation of a summing amplifier. [4]  
(c) The feedback resistance for the amplifier in (ii) is 50k whilst the inputs are  $R_1 = 10k$ ,  $R_2 = 2R_1$ ,  $R_3 = 2.5R_1$  and  $R_4 = 25k$ . Find output voltage  $V_o$  if  $V_1 = 10v$ ,  $V_2 = 15v$ ,  $V_3 = 1/2V_1$  and  $V_4 = V_1$ . [6]
  - 3 (a) Explain the purpose of a ROM-based operating system in a typical measurement system. Explain its advantages over the Disk-based system for this application. [10]  
(b) Moyo wants to use a PC to monitor the temperature in a Mains Powered Heater. Sketch a well-labeled diagram to show how he can achieve this. [5]  
(c) What is the advantage of using an opto-isolator for the above measurement system [5]

4. (a) For the circuit in Fig.1 below find the transfer function,  $H(W)$  [8]

FIGURE 1

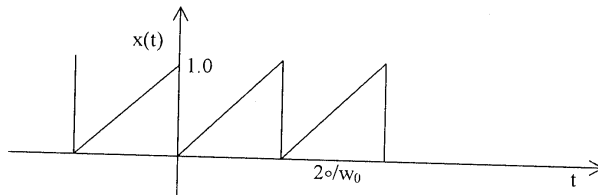


- (b) Sketch a diagram of  $H(W)$  and **Phase Margin** against  
 (c) Repeat the above for circuit Fig.2 below [8]

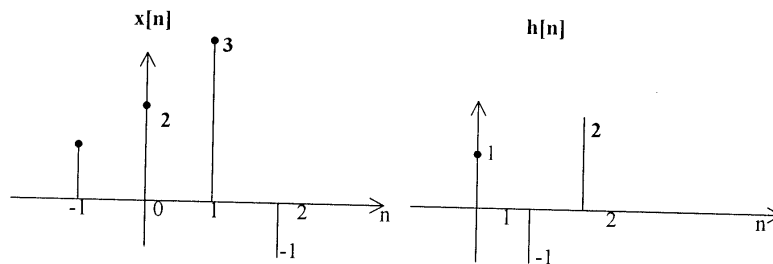


- (d) State the purpose of a sample and hold circuit in a measurement system and sketch its diagram. [4]

5. (a) Find the Fourier series representation for the following square-wave signal in Fig. 3 [8]



- (b) State the purpose of signal modulation. Describe with the aid of a diagram frequency modulation and Amplitude modulation. [8]
- (c) What is pulse code modulation (P.C.M) [4]
6. a) Find the convolution sum  $y[n]$  of the signals in Fig.4 below [8]



- b) Explain the function with the following filters [8]
- Anti-aliasing filter
  - Reconstruction filter
- (c) Sketch a diagram of a detector circuit used in signal modulation [4]
7. (a) Modern measurements system use a micro-controller. Explain the advantage of using a micro-controller over a microprocessor for a measurement system. [6]
- (b) Data acquisition in hazardous areas like mines require the use of radio for measurements. Describe the principle of operation of a Radio in mine data acquisition systems and states its advantages. [8]
- (c) What do you understand by the term Real-time system. Give an example. [6]

END OF QUESTION PAPER