

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Instrumentation II (EX602)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) "Microprocessors are indispensable tools in modern industrial instrumentation systems". As an engineer, provide a technical explanation including block diagrams to this statement by relying on observations from your case-study. [4]

b) What benefit are obtained from a memory-mapped I/O design? Design an interface arrangement for 8085 microprocessor to map output ports in address space 1000H to 2000H and input ports in address space 3000H to 4000H. [4]

2. a) Consider a double handshake scheme that allows data transfer from an input peripheral device to an 8085-microprocessor through an 8255-PPI. [5]

- i) List all control signals that get exchanged between the devices.
- ii) Draw a detailed timing diagram showing the exchange of control and data signals. Include the cause and effect arrows in your timing diagram.
- iii) With a neat sketch how the overall system diagram between the modules mentioned above
- iv) Generate an appropriate control word based upon your drawing and derive the address of the control register of the 8255-PPI used in your design.

b) List the control signals used by the ISA bus. Provide convincing arguments to justify the replacement of the ISA bus by the PCI bus. Calculate the bandwidth of a 64 bit PCI bus operating at 66-MHz. [3]

3. a) What are the criteria should be involved during the design of RS-232A in Simplex, Half Duplex and Full Duplex modes. [4]

b) Explain the USB signals and associated bus states. Also mention the signal levels to achieve these bus states. [4]

4. a) Why do we need to digitize a signal? What are the errors associated with A/D or D/A converters? [6]

b) What are the selection criteria for A/D or D/A converter? [2]

c) To convert an analog signal into digital form, 8-bit ADC is used. The ADC has eight input channels, and channel four is used to capture the incoming analog signal. The address of the desired channel is sent through pins PB0, PB1 and PB2. After at least 50-nanoseconds, this address must be latched. The latching signal is sent using PB4. After another 2.5-microseconds, PB3 is used to initiate the conversion process. The completion of the process is signaled via PC5. The output latch of the ADC can be enabled through PB6, and digital data can be read through port A of 8255-PPI. [8]

- i) Draw a circuit showing the interfacing of the ADC module, 8255-PPI and 8085 microprocessor on the basis of the connections described above.
 - ii) Draw the timing waveforms of all the control and data signals involved in the process.
 - iii) Provide a flowchart that depicts the ADC process
 - iv) Derive port addresses from your circuit diagram and provide the control word
5. a) In high-speed circuits, "ground" is a meaningless concept, the important question is, "what path does return current follow?" Justify the above statement with proper reasons and examples. [4]
- b) Discuss the importance of an interface unit. What factors need to be accounted for while designing input and output interface units? [4]
6. a) Define impedance matching. What is the impact of impedance discontinuities? [2]
- b) How do you reduce crosstalk when routing signal traces on a PCB? [4]
7. What are the basic principles of signal propagation and circuit layout for Routing Signal Traces which are predominant of effective circuit layout? [6]
8. Programs are to be read by humans. For programs to be useful, reliable and maintainable, you must make them readable and understandable. Good design and programming practices can make programs more readable. Explain in brief how you can make programs more readable. [8]
9. Answer the following questions with respect to your case study: [12]
- i) What is techno-commercial feasibility of a system? Provide examples from your case-study experience.
 - ii) List the major technical drawbacks present in the existing MBI system that you witnessed at the industrial site.
 - iii) Give at least three feasible technical solutions to overcome the drawbacks that you witnessed. Show how your solution will offer higher reliability and incorporate fault-tolerant design practices. Include block diagrams.
 - iv) If you had to present your design to the company's management team, what sort of question would you anticipate? Provide a list of at least five questions that would be asked from a management point of view. How would you cope with the questions, and how would you convince the team to accept your design?
 - v) Repeat part (d), but now you are trying to convince senior engineers. How will the question and answer session change compared to part (d)?
 - vi) Compare and contrast your design with the existing design in terms of the following metrics: cost/performance ratio, technical specifications (hardware and software) and design complexity (provide diagrams)

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- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. a) How do you select a microprocessor or a microcontroller for your project? [3]
- b) Explain the block diagram of a microprocessor based instrumentation system. What are the basic features of a microprocessor based instrumentation system? [5]
2. a) Write a short note on PCI Bus. [2]
- b) Interface a keyboard and a printer in mode 1. Port A is designed as input for keyboard with interrupt I/O port B is designed as output for printer with status check I/O. Draw the mapping circuit and write the control word and address map. [6]
3. a) Design a cable that has a USB connector at one end and an RS-422 connector at the other end. Assume the USB is connected to a laptop and the RS-422 connector is attached to a printer. Your design should include the following: [6]
 - i) Technical names of the pins and wires involved in the design.
 - ii) Intermediate chips to maintain voltage uniformity between the two standards.
 - iii) Neat and labeled sketch of the wiring between the two standards.
- b) What is a USB interface chip? Why are they required? Compare and contrast USB device interface chips and USB host interface chips. [4]
4. a) Calculate the values of the LSB, MSB, resolution and full-scale output for an 8-bit DAC for the 0 to 10V range. [2]
- b) How can you design a DAC with 12 bit resolution with the 8085 microprocessor having 8 bits data lines? Explain with suitable block diagram. [6]
5. a) What are the essential components of data acquisition system? Explain with the help of block diagram. [4]
- b) Explain Bluetooth network topology in brief. What are the advantages of Bluetooth applications? [4]
6. a) What are the characteristics of a safety ground? [2]
- b) Describe different types of noise coupling mechanism in brief. How do you check their predominance in the circuit? [4]

7. A data logger receives signals from a Bluetooth scatternet. The scatternet consists of three piconets and within each piconet there are four bluetooth devices. The piconets communicate within themselves and amongst each other using the master/slave protocol. [10]
- Describe an analog transmission mechanism to capture the blue tooth signals by the data logger. Draw a complete system block diagram.
 - Describe the mater/slave protocol that is present in blue tooth piconets and scatternets
 - Draw the scatternet topology depicting the scenario maintained in the question. Make sure you adhere to the rules of the masters/slave protocol.
8. a) While designing an electronic instrument you should group circuits according to their characteristics to maintain the correct operation of each circuit. What are the considerations during grouping components and circuits and what is the impact of such grouping? [4]
- b) What are the factors that derive reliability of an electronic system? [2]
9. Compare and contrast the three traditional models of software development with respect to their strengths and weaknesses. Propose a fourth software development model that outperforms the classical methods and justify your choice in terms of reliability, maintainability, flexibility, portability and reusability. [4]
10. Draw the complete block diagram of industrial process control system involved in your case study. Explain why you want to implement this control system over existing one in terms of cost, manpower and plant automation. What problems you might face after implementing this control system. [12]

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1. Draw and explain the block diagram of microprocessor based instrumentation system. Also list out advantages of implementing an MBI system. Explain briefly the concept of DMA. [4+2+2]
2. Assume that your group has decided to make a PC based instrumentation control system for automatic concrete purifying factory using an 8255 PPI card at base address 4000H in memory mapped I/O mode for controlling purpose. [1+1+2+2+4]
 - a) List out the collected documents and components.
 - b) List out the different signals you need to derive and or can be connected directly to your interfacing circuit.
 - c) Draw minimum mapping circuits for the above system.
 - d) What are the addresses captured by your card? Generate the control word for the system.
 - e) Write a program module to read ten set of raw data from port A and port B; add the data and store the result starting from address 4040H.
3. a) Describe the problem that occurs when you attempt to connect together two Rs.232 devices that are both configured as DTE. Draw a diagram which shows how this problem can be resolved. [5]
 - b) Explain USB protocols which should be followed during the USB design. [5]
4. What are characteristics of A/D or D/A converters? With necessary diagram explain the interfacing of 10 bit DAC with 8085 along with timing diagram. [2+4]
5. a) What is data logger? Explain the characteristics for a data logger. [5]
 - b) Write the advantages and disadvantages of optical fiber communication. [3]
6. Elucidate the principle of grounding? Mention how many configurations are available to provide the basic principle of grounding. [1+5]
7. a) What are the reasons for using low power design? [2]
 - b) Write about ground bounce, cross talk, impedance matching and timing skew. [4]
8. Fault tolerance reduces possibility of dysfunction or damage from abnormal stresses and failure. It has three distinct areas: careful design, testable functions and redundant architecture. Explain how we can avoid many failures using these three approaches. [6]
9. IOE is planning to apply new software for its database management system. Suggest the best selection and purchase procedure? Explain in detail about good programming practice. [3+5]
10. What have you learned from case study? Draw the complete block diagram of the industrial process control involved in your case study. What are the critical factors affecting the production you have noticed in the visited industry and what measures can you suggest for the same? What problems you might face after implementing your suggested process control system. [12]

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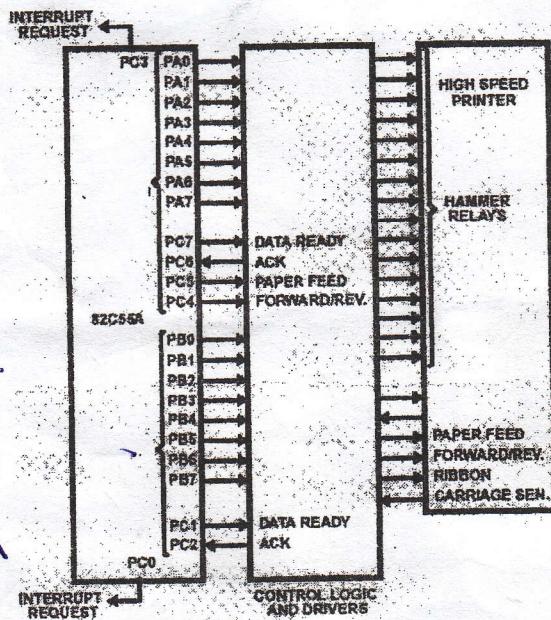
Subject: - Instrumentation II (EX602)

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1. Describe the various PC interfacing techniques involved while interfacing an I/O device with a PC. Differentiate closed loop microprocessor based system over open loop microprocessor based system. [3+4]
2. Explain briefly about PCI bus. [3+6]

The base address for the interfacing circuit given below is 5500 H:

- a) Identify the Port address
- b) Write the necessary control words to initialize the 8255
- c) Draw the timing diagram for the configuration as shown in figure below.



3. a) Explain how communication takes between two data terminal equipment in NULL modem connection. [4]
- b) Compare between RS 232C, RS422A and RS423A. [4]
- c) Compare the standards: USB1.1 and USB 2.0 [2]
4. Explain the error associated with A/D and D/A converters. [8]

5. What are the components used in Data Acquisition system, explain with necessary block diagram. Why optical fiber is dominating the other guided medium used in data transmission schemes. [5+3]
6. a) Describe the working principle of decoupling capacitor in short. [2]
- b) Explain different types of noise coupling mechanism. [4]
7. Starting from the converting the requirement into design, Explain the procedure of designing electronics circuit. [6]
8. Write about the factors we should consider while doing component placement. What rule does a designer have follow while routing signal tracks in PCBs in order to avoid the effect of impedance mismatch and cross talk. [3+3]
9. Once you have tested, verified and release software, you have to maintain it. As with testing, you cannot separate software maintenance from system concerns. Discuss at length how you get common bugs in software and develop a good corrective action to fix software bugs in your distributed software. [8]
10. Explain existing system involved in your case study with necessary block diagram. What was your recommendation over the existing system in term of cost, manpower and plant automation. [12]

Best of Luck ***

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Level	BE	Full Marks	80
Programme	BEL, BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Instrumentation II (EG771EX)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. How can you prevent or suppress noise energy from coupling between circuits? Explain all preventive methods for various energy coupling mechanism. [8]
2. Explain mode definition control word of 8255. Write the required mode definition control word for each of the following cases: [6+4]
 - a) Port A: Mode 0 input
Port B: Mode 0 output
Port C_{upper}: input
Port C_{lower}: Output
 - b) Port A: Mode 1 input
Port B: Mode 0 output
Port C_{upper}: PC₇₋₆ output
Port C_{lower}: PC₂₋₀ input
 - c) Port A: Mode 2
Port B: Mode 1 output
 - d) Port A mode 2
Port B: Mode 0 output
Port C_{lower}: PC₂₋₀ input
3. Design an I/O interface to interface an 8 bit ADC with 8085 microprocessor. Write an assembly language program for 8085 to initialize and read data from ADC. Assume any data required. [4+4]
4. Explain interrupt driven data transfer scheme with interrupt service routine. [8]
5. What do you mean by data archiving? Explain the characteristics of data logger. [2+6]
6. What are the advantages of microprocessor based system in an industry? Draw and explain the complete block diagram of industrial process control system involved in your case study. [10]
7. What do you mean by sampling theorem? Explain its application on digital instrumentation design. [2+4]
8. Explain the block diagram of FM/FM telemetry. [6]
9. Write short notes on: [4×4]
 - a) Reset and failure detection
 - b) Routing single traces
 - c) Good programming practice
 - d) Null modem connection for RS 232 port

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Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Instrumentation II (EX 602)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. a) One thing embedded real time systems have in common is that they include some type of processor. They range anywhere from a serial-program input device to a full-fledged PC on a chip or board. At some point, an engineer decided on the type of processor to use. How did he pick it? Are there any rational reasons for picking one over another? Or are all processor selections based on personal bias? And what are the situational factors imposing selection of a microprocessor or microcontroller for a design. Discuss at length. [7]

b) Give a short introduction of ISA bus. [3]

2. You have to interface ADC with 8085 using 8255A ports. Interface a fan and a heater using opto couplers to derive the I/O devices. If the temperature is less than 10°C, turn on the heater and if the temperature is higher than 35°C, turn on the fan. Use port A of 8255 for transferring digital data output of ADC to the CPU and port C for control signals. Assume that an analog input is present at second input of the multiplexer and a clock input of suitable frequency is available for ADC. Also write an appropriate flow chart and algorithm to facilitate your design. Draw the diagram of your design. [8]

3. a) What is disaster recovery in software? How could it be implemented at your organization? [3]

b) In the software development process, proper planning is essential in delivering the finished product to the client. Equally it is important that bugs have to be removed from the product. Discuss in details about the nature of bugs in software development process. What are the preventive steps you would take to minimize introduction of the bugs? [6]

4. How stub discontinuity cause impedance mismatch. Also point out the causes of crosstalk. Explain in your own words with relevant figure. [4+2]

5. "Establishing requirement is the most difficult part of circuit design". While designing the electronic circuit, specify and explain the procedure of converting the requirements into design. [6]

6. a) Differentiate between USB 1.1 and USB 2.0. State briefly how USB 2.0 identifies itself with the interfacing unit and establishes communication protocol. Draw the necessary diagrams. [6]

b) Explain the functions of DSR, DTR, RTS, CTS, TXD and RXD signals. [2]

7. Signals from three different transducers (A, B and C) located 100 meters away from a control room in a factory are very important to control stepper motors to give final tune to the products. The strength of these signals ranges from 10mV to 20mV and separated at 4KHz. Transducer A, B and C generate 6KHz, 10KHz and 14KHz signals

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	52
Year / Part	III / I	Time	3 hrs.

Subject: - Microprocessor Based Instrumentation

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Interface two 8K RAM chips and two 4K EPROM chips with 8086 so as to form a completely working system configuration. We know that, after reset, 8086 starts from address FFFF0H. Select the starting address of EPROM such that this address (FFFF0H) lies in it. The RAM address must start at 00000H. [10]
2. a) If the speeds of I/O devices do not match the speed of the microprocessor, what types of data transfer techniques are used? Describe them briefly with necessary block diagrams and control signals. [8]
 - i) What are the addresses assigned for Port A, Port B, Port C and control register?
 - ii) Write down the control word to initialize this card as follows: Port A mode 0 output, Port B handshake input, Port C_{upper} output and reaming pin of Port C_{lower} input.
 - iii) For above case, write down bit set/reset control word to initialize Port B interrupt request.
3. Differentiate between synchronous and asynchronous data transmission. What is the time required for transmission of a character with one start bit, 7 data bits, one parity bit and one stop bit with 1200 baud? [4+4]
4. What are the criteria for selection of Analog to Digital converter for your design? [4]
5. a) An arc welder on the end of the robotic arm generates noise interference in the local embedded controller. The welder produces 120A at 12V. What could be the coupling mechanism for noise interference? How this can be minimized? [4]
 - b) How would you protect against electrostatic discharge? [4]
6. a) Define crosstalk. How can reduce crosstalk when routing signal traces on a PCB. [6]
 - b) List out the factors which you need to consider for high speed design. [3]
7. Discuss the prototyping model of software development with its merits and demerits. [8]
8. a) Discuss the advantages of digital signal transmission over analog signal transmission. [4]
 - b) Draw the clear block diagram of data logger showing all necessary components. [4]
9. Write short notes on:
 - a) Static and Dynamic errors in Digital to Analog Converters
 - b) Software selection and purchase

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- a) How do you want to route these signals to the control room? [2]
 - b) If your A/D converter do not have S/H hold circuits, what specification of S/H chip you select for your design? Discuss also the errors associate with the converter. [6]
 - 8. a) Why protecting against ESD should be considered in design? [2]
 - b) Describe different types of noise coupling mechanism in brief and how do you check their predominance in the circuit? [4]
 - 9. a) What is Bluetooth device? How does it transmit data using pico and scatter net? [3]
 - b) Draw the block diagram of a data logger and explain its operation in details. [4]
 - 10. Recommend the changes that you deem necessary in the visited industry during your case study? Explain the reasons why management should implement these changes? Assume that you have a senior reporting Computer/Electronics engineering closely looking at work from the system development level, apart from convincing the management team at the visited industry to implement new system, you also need to convince the senior engineer technically so that your recommendation will be implemented. How do you want to achieve this technically? Debate on your technical design to replace the current system and also relate probable problems you might face after system implementation. [12]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEL, BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Instrumentation II

- ✓ Candidates are required to give their answers in their own words as far as practicable.
 - ✓ Attempt All questions.
 - ✓ The figures in the margin indicate Full Marks.
 - ✓ Necessary figure is attached herewith.
 - ✓ Assume suitable data if necessary.
1. a) A motorcycle drove by your house while you were watching television. A picture was interrupted by groups of lines marching across the screen. The interferences faded as the motorcycle passed. The distance between the television and motorcycle was 50 ft. The rise time on an arc discharge in a spark plug is in order of 1 ns, indicating a maximum frequency of order 250 MHz. Explain what the coupling mechanism was and how it can be minimised. [4]
- b) Differentiate safety grounding, signal referencing and return path for signal. [6]
2. a) Why transmission line techniques should be considered when the clock frequency exceeds 1 MHz in a circuit or system? What are two rules of thumb that may be used to estimate when transmission line effects begin? [2+3]
- b) What is cross talk? How do you avoid cross talk while making layout of the circuit? [6]
3. Discuss the spiral model of software development with its merits over other models: waterfall model and Prototyping model. [7]
4. Please share your experience visiting industrial process control system involved in your case study. Talk about the recommended control system over the existing one in terms of cost, manpower and plant automation. Do you foresee any problem after implementing this control system? [8]
5. Draw the block diagram of a data logger and explain the characteristics of each block. [10]
6. In the given diagram attached with the question, 8255 A mapped at base address of 7F00H using memory mapped I/O is used to control the operation of lathe. The microcomputer reads the instruction codes from tape reader on handshake basis and sends appropriate control words to the lathe.
 - a) What are the addresses captured by this 8255 card? [2]
 - b) How do you initialise 8255A in correct mode for this application? Write down necessary control words to initialise mode as well as enable interrupt. [2]
 - c) Describe with required timing diagrams how the instruction code from tape reader is read by microprocessor and then sends to the lathe? [5]
 - d) Draw the interfacing circuit of 8255A with 8085 at the base address given above. [3]
7. Discuss the advantages of optical data transmission over electric data transmission. [4]
8. Write short notes on
 - a) Microwave link.
 - b) Choosing microprocessor/microcomputer for design.
 - c) Null modem connections.

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1. What are the differences between microprocessor and microcontroller? Illustrate the statement "Change in simple hardware may change the memory mapping of a memory chip". [3+4]
2. What is the role of BHE in 8086 microprocessor? How will 8255A PPI accomplish the operations? Explain with example. [2+5]
3. Why null modem connection is used to establish the communication between two DTE's? Explain. [5]
4. Explain different types of bugs. How will you remove bugs effectively and efficiently? [4+4]
5. Interface DAC 0801 through 8255A PPI to 8085 microprocessor. Calculate the resolution if 5V is the full-scale voltage. Write a program to generate staircase ramp signal. [4+2+4]
6. Suppose you are working as a designer of data logger for meteorological department. You need to log temperature, humidity and rainfall from headquarter of five development regions and transmit to Kathmandu.
 - a) List out the hardware required? [3]
 - b) Select any transmission technique with region. [3]
 - c) Draw complete block diagram. [4]
7. What do you mean by grounding and shielding? Explain any four energy coupling mechanism and their remedy. [2+6]
8. What are the requirements to design circuit layout? Explain the rules for low power design. [3+4]
9. Write short notes on:
 - a) ISDN
 - b) Reliability of a system
 - c) Handshake I/O

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1. The increasing use of portable electronics appliances demand the low-power design. Low power is used for a number of reasons including portability, isolation, battery power and low heat dissipation. Discuss at length the guidelines in design so as to minimize the use of power. [6]

2. Whenever the clock frequency exceeds 1 MHz in a circuit or system, an engineer should begin considering transmission line techniques because the harmonic generated by the edge of clock and signal pulses can easily be 20 or 30 times and this will be severe at higher frequencies. Discuss different rules and criteria for high speed design that will minimize noise, ground bounce, cross talk and maintain impedance matching. [12]

3. Electrical noise problems at the system, circuit board, or integrated circuit levels can be minimized if the following simple principles are clearly understood. Explain the following statements with examples.

- Every current eventually returns to its source, NOT to ground. [2]
- Currents take the path of least impedance, NOT least resistance. [2]
- Self-inductance is a property of a complete current loop, NOT an individual wire. [3]
- The current return path is NOT the current grounding connection. [3]
- There are only 4 noise coupling mechanisms that need to be understood and controlled. [4]

4. a) When you have made a decision to purchase examination control system for an educational institution, discuss about the implementation aspect of Examination Information System from manual to computerized system and reason your choice for selecting the software from a particular vendor and discuss about the handling the bugs and security issues related to the examination control. [6]

- b) Explain the simplex connection using RS232 interface from DTE to DCE and DCE to DTE. [6]

5. How does the 8255A actually accomplish the interface activity? Describe in details using its block diagram. Also explain different modes. [12]

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1. a) Explain the methods of parallel data transfer. What are different modes of 8255 and how do you determine the control word for 8255. [8]
- b) Determine the control word for the following configuration of the ports of Intel 8255.
 - i) Port A Bi-directional, mode of port A mode 2, port B output, mode of port B mode 1. [2]
 - ii) Port A input, mode of port A mode 1. Port B output, mode of port B mode 0, Port C_{lower} (PC0 – PC2) input and remaining pins of port C_{upper} i.e., PC6 and PC7 output. [2]
2. a) Describe the problem that occurs when you attempt to connect together two RS232 devices that are both configured as DTE. Draw a diagram which shows how this problem can be solved. [6]
- b) Give some examples of the cases when impedance in a circuit are mismatched and explain the implication of the same. Discuss in your own words how to improve impedance mismatch and resulting degradation of signals along a printed circuit trace and a number of ways to terminate a signal trace. [6]
3. Draw the block diagram of a data logger and explain its operation in details. You also need to describe the characteristics of each block in detail. [12]
4. Describe different types of energy coupling mechanism and suggest procedure to minimize the couplings. Draw diagrams where necessary to support your answer. [12]
5. What are main issues involved in interfacing between analog signals and a microprocessor in a close loop system? Explain how you would select different parts, like A/D converters, MUX, S/H circuits based on your requirements. Discuss also the methods of transmitting analog interface signals in long distances. [4+6+4]
6. Write short notes on:
 - a) Static and dynamic errors in converters
 - b) Single point grounding and ground loops
 - c) False triggering may occur in a crow-bar circuit

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Programme	BEL, BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Instrumentation II

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- ✓ A motorcycle drove by your house one evening while you were watching television. The picture was interrupted by groups of lines marching across the screen. The interferences faded as the motorcycle passed. The distance between the television and motorcycle was about 15m, indicating the maximum frequency of about 250 MHz. Explain what was the coupling mechanism and how can it be minimized. [8]
- ✓ 2. How can you measure the reliability of electronics equipment? Are there any processes to improve the reliability? Discuss in detail. [7]
- ✓ 3. You are assigned to take input from the twelve light sensors to measure the light intensity of various parts of the cricket ground. Now if the sense value sensed by any sensor is less than 3BH then all the eight ground lights are to be ON otherwise do no operation. Assume necessary components to fulfill your design. Also draw the flow chart and program sequence to do the above operation. Use memory mapped I/O. [9]
- ✓ 4. Define software bugs. Explain in detail how software bugs get introduced into the software in different phases. [7]
- ✓ 5. Interface a temperature sensor using an A/D converter and port A of the 8255A PPI. Also interface a fan and a heater using optocouplers to drive the I/O devices. Write instructions to read the temperature. If the temperature is less than 10°C, turn on the heater and if the temperature is higher than 35°C, turn on the fan. Use I/O mapped I/O. Also write the appropriate program sequence to facilitate your design. [8]
- ✓ 6. Explain with the help of block diagram how two data terminal equipments (DTE's) are connected to the transmission line for communication. Also mention the process of communication established between two DTE's. [6]
- ✓ 7. An 8255A PPI is operated with port A as output, port B as input and with port C used for handshaking for port A and port B. Use memory mapped I/O.
- Write the instruction sequence to program the 8255A for this mode of operation. [2]
 - Write the format of control word obtained if port C is read. [2]
 - Draw the scheme of connection required. [3]
- ✓ 8. Suppose you are appointed as a Chief Engineer of a factory for its proper enhancement and modification of its various plants. How can you implement your ideas for further enhancement and modification? Explain on the basis of case study you have done with proposed block diagram. Use programmable peripheral interface and other necessary components to materialize your design. [8]
- ✓ 9. Write short notes on:
- Component placement in circuit design
 - Trace impedance matching
 - ISDN
 - Decoupling capacitors

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Microprocessor Based Instrumentation

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain why debugging in a software system is an art, and experience is often the best resource. List and explain a few steps that will help you debug effectively and efficiently.

[7]

2. What is structured programming? Differentiate between coupling and cohesion with examples.

[5]

3. Disfunction or damage from abnormal stresses and failures is reduced by implementing the fault tolerance system. The fault tolerance system has got three distinct areas: careful design, testable functions and redundant architectures. Explain in detail about the mentioned methods to avoid many failures in designing a robust system.

[8]

4. Briefly explain what is meant by saying that satellite is "stationary". Write the advantages and disadvantages of LEO and geostationary satellites.

8255 (modes)

[4]

5. Define parallel data transfer: simple output, simple strobe, single handshake I/O and Double Handshake I/O with examples of each with timing diagrams.

[4]

6. Explain the difference between input output mode and bit set rest modes in 8255 (PPI) with examples of each.

[4]

7. Draw the connection diagram to connect two RS 232 ports of two personal computers and explain how communication is established.

[5]

8. A terminal is transmitting simple asynchronous serial data at 1200 bps. How much time is required to transmit 1 bit? Assuming 7 data bits, a parity bit, and 1 stop bit, how long does it take to transmit one character?

[5]

9. Briefly explain single point and multipoint grounding with examples.

[4]

10. Assume that a 16-bit microprocessor has 20-bit address bus. Design basic interfacing circuit at your own base address for the following memory chip so that 2-byte data can be accessed in a single read or write cycle. Also write simple algorithm to transfer first 10 two bytes of data from ROM to RAM in single read and write cycle for two bytes data. You can assume any valid starting address for the data location. Also draw the timing diagrams for read operation and write operation. Assume both ROM and RAMs have active low output enable (OE) and chip select (CS) signals.

[6+3+3]

Device	Size
ROM Chip-1	8K X 8-bit
ROM Chip 2	8K X 8-bit
RAM Chip-1	4K 8K X 8-bit
RAM Chip 2	2K 8K X 8-bit

11. Write short notes on:

- Low Power Design
- Radio Telemetry of Data using FM/FM
- Debouncing Circuit

[6x3]

Final Assessment			
Exam	BE	Full Marks	40
Level	BEX,BCT,BEL	Pass Marks	16
Programme	III/I	Time	1:30mins
Year/Part			

Subject: Instrumentation-II

- ✓ Attempt any questions of 40 marks only
 - ✓ Candidates are required to give their answers in their own words as far as practicable
 - ✓ The Figures in the margin indicates Full Marks.
 - ✓ Each question carries equal marks
 - ✓
1. Draw and explain the block diagram of microprocessor based instrumentation system. Also, list out advantages of implementing an MBI system in industrial plants for control and automation.
 2. (a) Describe double handshake I/O and draw its timing diagram. Interface a stepper motor to 8085 through 8255. Show the circuit diagram and provide the flowchart that will rotate the stepper motor by 270 degrees in the clockwise direction. Assume the stepper motor has 50 rotor teeth and it is following the wave drive step sequence (i.e. single phase mode). Show the generation of the necessary control words as well.
 (b) Discuss the reasons for introducing the PCI bus.
 3. (a) Draw diagrams showing Simplex, Half Duplex, Full Duplex, and different Null Modem connections. Compare RS232, RS423, RS422A standards.
 (b) Describe single handshake I/O and draw its timing diagram.
 4. Interface a suitable ADC with an 8255 PPI and 8085-microprocessor. Show the interfacing circuit that will read four different analog values from four analog input channels and store the digitized values at memory addresses 6000H, 6001H, 6002H, and 6003H respectively. The analog values should be converted to digital form and stored if and only if the vector interrupt RST 6.5 is activated on the 8085 microprocessor. Write the pseudo-code that will show the operation of the circuit.
 5. Propose the data logging system for Aviation meteorology that takes input from at least three sensors (wind, runway visual range, rain, temperature etc). Your system must have the provision of displaying and recording the results within the range of 2500m for at least 5 data analyzing centers.
 6. (a) Explain different types of shielding mechanism employed in instrumentation system.
 7. (a) Discuss about the guidelines that need to be followed to make a circuit fault tolerant.
 (b) What is the purpose of the reset signal, and how can it be used to detect power failure detection. Explain with appropriate figures.
 8. Interface a suitable DAC with an 8255 PPI and 8085-microprocessor. Show the interfacing circuit that will convert digital values into analog baseband forms that need to be modulated and transmitted over an analog channel. Use frequency modulation as your means of modulation and send the pass band analog waveform through a transmitting antenna over a satellite link to a receiving antenna coupled with another ADC, 8255 PPI and 8085-microprocessor. Draw the complete block diagram from transmission to reception and the satellite channel in-between. Clearly mention your assumptions and provide appropriate control words as required.
 9. IOE is planning to apply new software for its database management system. Suggest the best selection and purchase procedure? Explain in detail about good programming practice (What is ESD and how does it destroy electronic circuits? Suggest procedures to protect against ESD).
 10. Recommend the changes that you deem necessary in the visited industry during your case study? Illustrate your answer with supporting figures. Explain the reasons why management should implement these changes. Debate on your technical design and provide a convincing argument about why your design should replace the current system. Also discuss the probable problems you might face after implementing your new design.

Exam		Final Internal Assessment	
Level	BE	Full Marks	80
Program	BEL, BEX, BCT	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Instrumentation II (EX 602)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt ALL questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- (1) (a) What is the rationale behind using a microprocessor in instrumentation systems? Give a first-hand account of the use of microprocessors or microcontrollers in modern day industries from the observations you made during your case-study. [4]
 (b) What is address decoding? Design an output port for a LED so that the device address is F5H and can be accessed through I/O mapped I/O technique. [4]
- (2) (a) Describe single handshake I/O and draw its timing diagram. Interface eight switches and a seven-segment display (common cathode) to 8085 microprocessor through an 8255-PPI at ports A and B respectively. The seven-segment display should display the switch number whenever a switch is closed. Assume a single switch is closed at a time, and that the 8255-PPI is interfaced using memory-mapped I/O technique.
 (i) Draw the circuit diagram of the setup.
 (ii) Provide the necessary control word to initialize the 8255-PPI, and derive the port addresses of the 8255-PPI from your diagram.
 (b) List the control signals used by the ISA bus. Describe the plug and play feature of the PCI bus, and show the configuration process when a device is plugged into a PCI slot. [3]
- (3) (a) Show the interfacing circuit of TTL logic with RS232 using appropriate line drivers and line receivers. What are the technological improvements incorporated in RS422 and RS423 that were omitted in RS232 standard.
 (b) Describe the enumeration process in USB 2.0 with appropriate flow diagrams. Compare and contrast USB device and host interface chips. [5]
- (4) (a) Give a detailed account of the static and dynamic errors present in data converters.
 (b) Provide a list of all control signals and mention the functions they perform during the ADC process. Draw the timing diagram involved during a typical ADC process. [4]
- (5) (a) Describe the Bluetooth network topologies and power classes.
 (b) Compare and contrast analog and digital transmission techniques with five distinguishing characteristics. [4]
- (6) (a) What are ground loops? Provide technical solutions to eliminate them.
 (b) An electronic circuit receives noise interference from a switching device. Voltage on the switching device swings from 4-volts to 6-volts within 100-microseconds, during which the current makes a transition from 10-microamperes to 25-microamperes in 10-nanoseconds. Identify the noise coupling mechanism and backup your answer with suitable calculations. [3]
- (7) (a) What is the critical length when transmission line effects need to be considered during high-speed circuit design? How does ground bounce and impedance mismatch affect high-speed designs, and how can they be corrected?
 (b) You are asked to design a heart monitoring system that is constantly observing the cardiac rhythms of a patient. The system needs to function during the presence of component and subsystem failures. Explain at least three circuit design techniques that can reduce the possibility of catastrophic dysfunction of the system. [3]
- (8) (a) Why routing signal traces is important during circuit layout? Explain the factors that need to be considered while creating a signal trace.
 (b) Give reasons for the following statements. Only technical answers will be accepted.
 (i) Clock signal are routed close to return lines on a PCB
 (ii) Ground pins are interspersed during multi-pin connector design [3]
- (9) (a) Discuss the mechanisms by which bugs get introduced into a program. Mention the metrics that quantify software development.
 (b) Compare and contrast the three classical software development models. [4]
- (10) Suppose the CEO of the company where you performed your case study is impressed with your report, and decides to hire you as a consulting engineer to oversee their existing MBI system. You are assigned the task of revamping their existing MBI system with the blueprint that you have designed. Show a well labeled, clear and detailed sketch of your design that you will be presenting to the board of directors to convince them to implement your idea. Your block diagram and supporting documents should include a minimum of the following items: the hardware solution, the software requirements, the advantages and disadvantages of your own strategy, the gain in efficiency of the plant after employing your design, and a cost breakdown of realizing your solution. [12]

82C55A interfacing Examples :

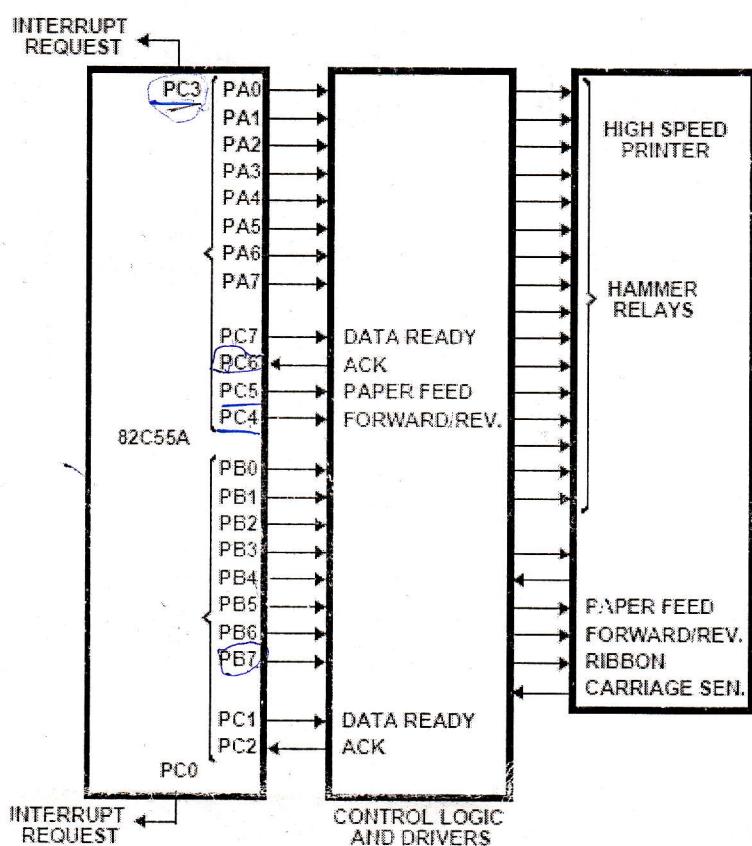


Figure 1 PRINTER INTERFACE

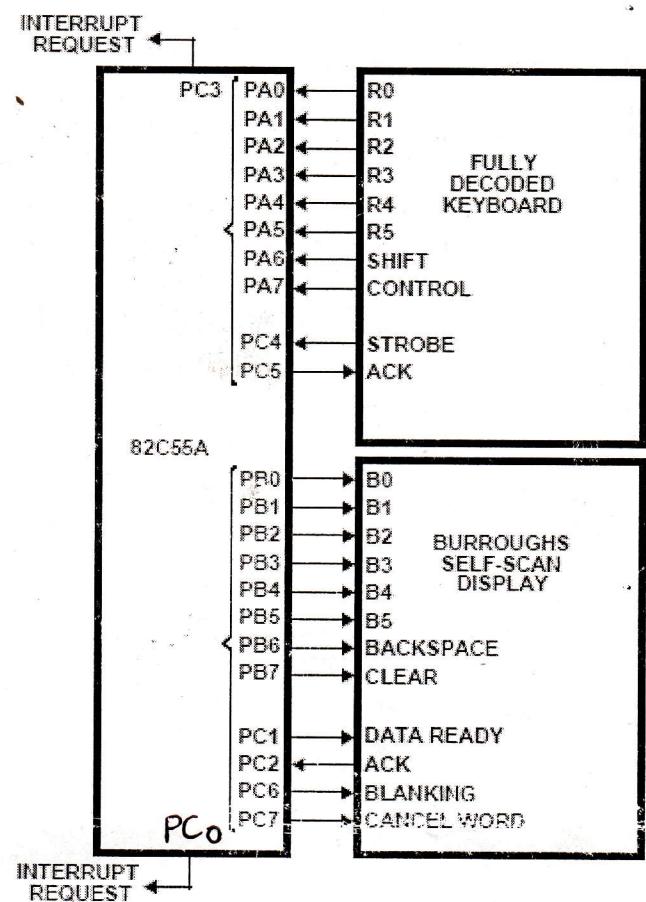
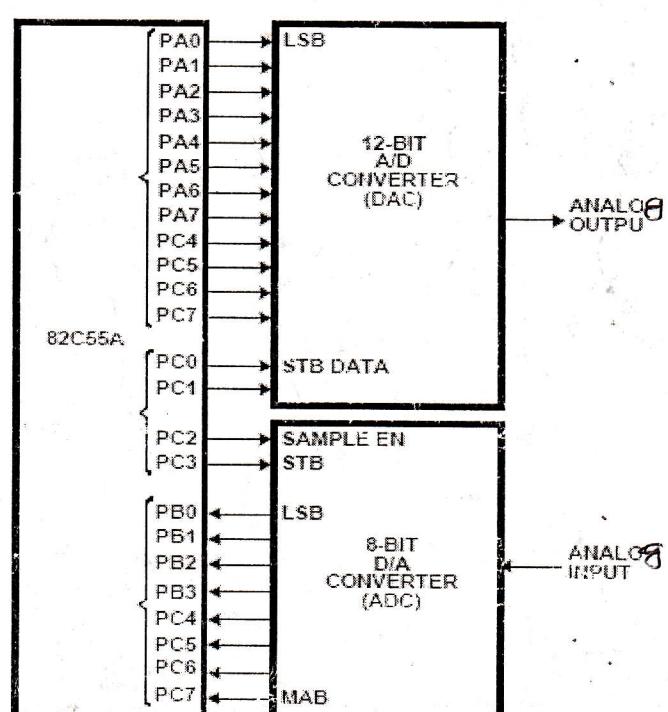
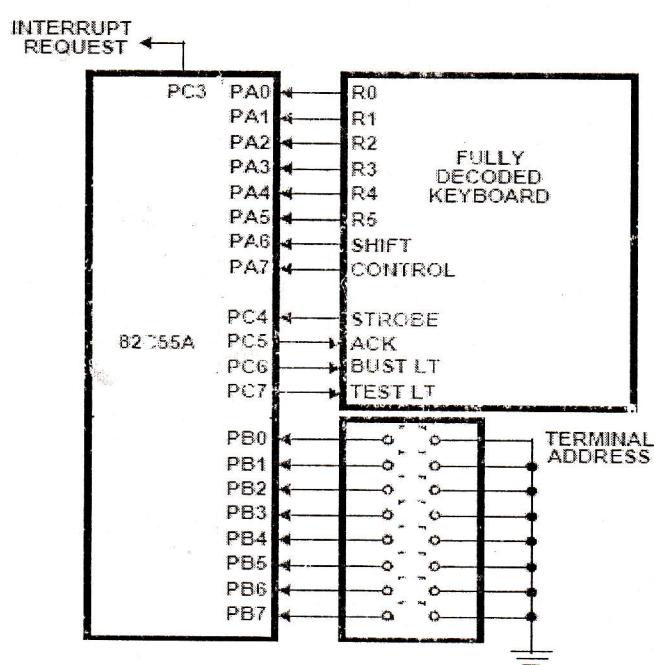


Figure 2 KEYBOARD AND DISPLAY INTERFACE



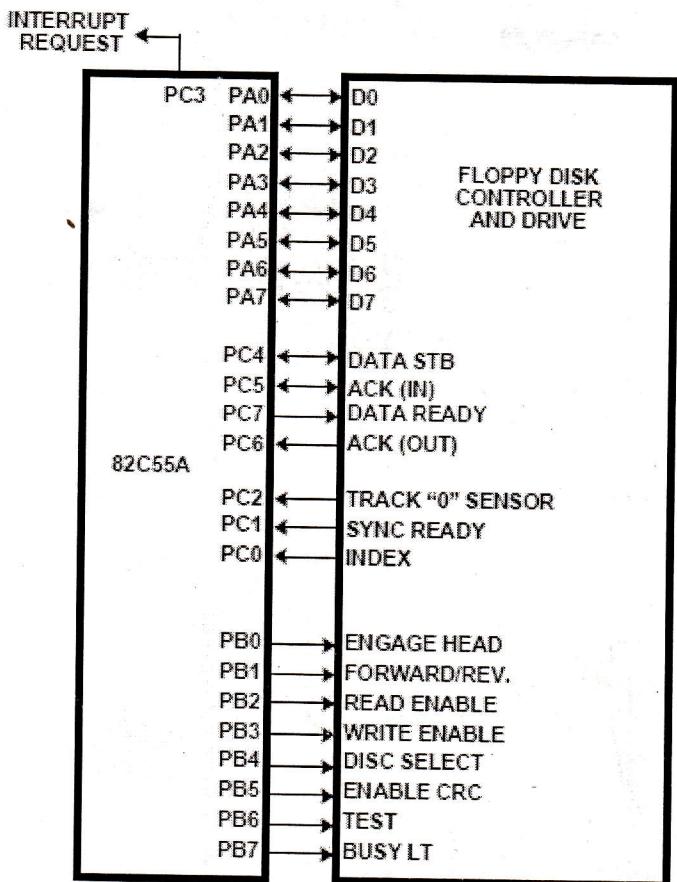
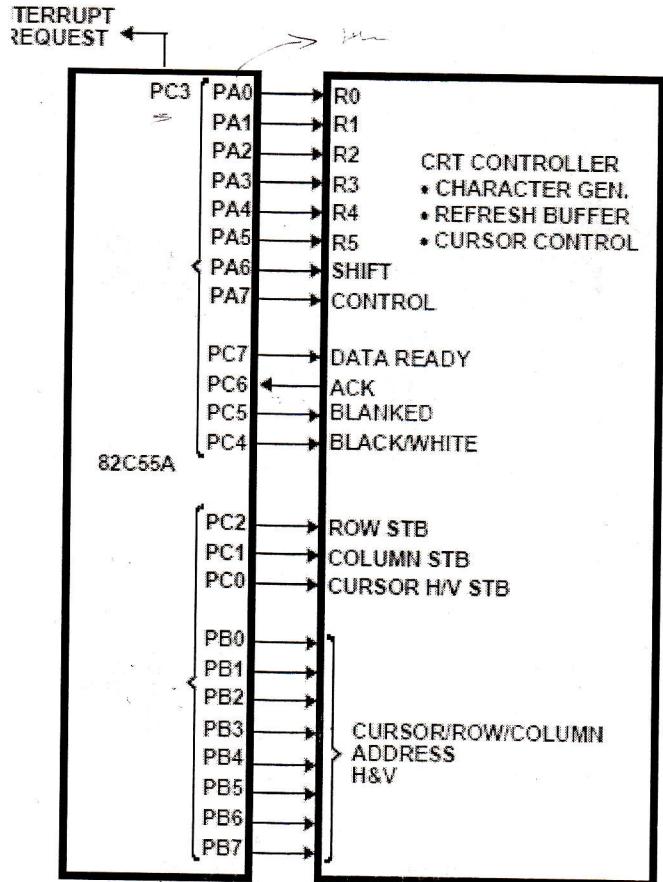


Figure 5 BASIC CRT CONTROLLER INTERFACE

Figure 6 FLOPPY DISC INTERFACE

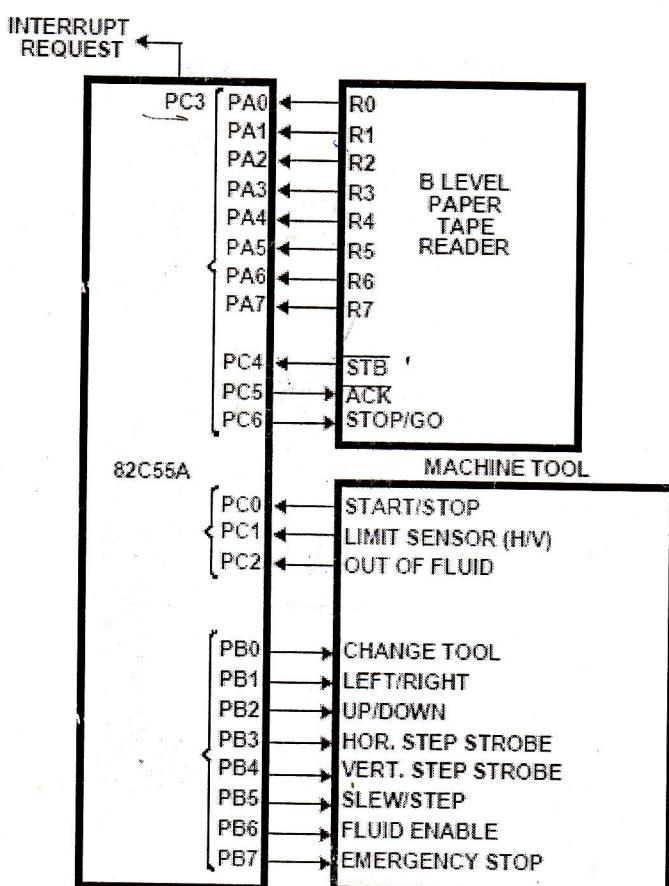


Figure 7 MACHINE TOOL CONTROLLER INTERFACE

Exam	ADT		
Level	BE	Full Marks	20
Programme	BCT/BEX/BEL	Pass Marks	08
Year/Part	III/I	Time	45Mins

Subject: Instrumentation II

Question No. 1 is Compulsory.

Attempt any three questions.

1. Draw an Interfacing circuit diagram of DAC 0808 with 8085 using 8255 PPI to generate saw tooth waveform ranging from 0V to -5V. Also write the necessary assembly program. [8]
2. Describe the Bluetooth topology. Explain the working principle of optical fiber with its advantages. [6]
3. In a large office, computer errors including system crashes were happening during thunderstorms. The grounding of the computers had been carried out according to the recommendations of the manufacturers. The grounding leads were insulated and terminated to an isolated grounding bus. This bus was connected to a grounding electrode consisting of multiple driven rods well away from the building.
 - (a) Provide the possible causes for the system failure.
 - (b) Give some technical approaches to overcome this problem. [6]
4. A remote control unit of a large communication system was placed approximately 1000 meters away from the main fixed facility. The remote unit and the fixed installation were interconnected through several RS-422 links. Each of the sites was powered from an independent power source and grounded to Earth at its near vicinity. After lightning struck the fixed facility, the interfacing line driver/receiver circuits in the remote control unit were found to have been damaged.
 - a. What might have caused the damage to the circuits at the remote unit?
 - b. What measures can be taken to prevent such damage in the future?
 - c. Suggest some methods to make your system fault tolerant. [6]
5. Provide reasons as to why the following situations occur during circuit design, and how can they be minimized:
 - a. Inductive and Capacitive crosstalk
 - b. Substrate crosstalk
 - c. Power/Ground crosstalk
 - d. Return signal crosstalk [6]

Chapter 10. Case Study

Guidelines for case study on Instrumentation II:

1. Form Small groups (4 students on each group).
2. Visit a plant/industry/process that uses MBI systems. No two groups should visit same plant.
3. Consult with the engineers/technicians to understand the current/existing process control system of the visited organization. Pay special attention to basic measurement requirements, accuracy and specific hardware/software employed, environmental conditions under which the instruments must operate, signal processing and transmissions, output devices, etc.
4. Make block diagrams of current system and describe its working mechanism.
5. Design a new system using MBI that can be interface with the existing system. Your design should help to remove some disadvantages of current system.
6. Make the block diagram of overall system and describe the hardware and software involved in your design.
7. Also, include how cost, efficiency varies and what additional benefits you get with the newly proposed system in place. Compare both existing and new/proposed system.
8. Compile a report and then prepare a PowerPoint presentation.
9. **NOTE: 10-12 marks on Final IOE Exam.**