23 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	Back		
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 indispensible 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 8085microprocessor 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 active 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? [5]

   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 MIH 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 etc. 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 & software) and design complexity (provide diagrams).

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

Exam.	[redacted]		
Level	BE	Full Marks	80
Programme	BEI., 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. 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 capaired by your card? Generate the control word for the system.
   e) Write a program module to read ten bet of hex 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 Rs232 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. What are 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 such 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+6]
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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23 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	Regular		
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) 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]

   a) Describe an analog transmission mechanism to capture the blue tooth signals by the data logger. Draw a complete system block diagram.
   b) Describe the mater/slave protocol that is present in blue tooth piconets and scatternets
   c) 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 implementating this control system. [12]

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2069 Chaitra

Exam.	Regular		
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. Explain briefly the concept of DMA. Draw circuit Diagram of an interfacing circuit containing 4 KB ROM and 8 KB RAM. Assuming Base address in 4000H. You also need to draw write and read cycle timing diagram. [2+6]
2. In a microprocessor based system, an 8255A PPI card is used to interface a keyboard and a printer to the processor. The 8255A PPI is interfaced with the 8085 microprocessor in the system such that the base address of 8255 A PPI is 4044 H.
   a) What are the addresses captured by the card? [1]
   b) Draw the complete interfacing circuit of 8255A PPI with 8085 microprocessor for the given system. [3]
   c) If the printer is interfaced to port A and the keyboard is interfaced to port B of the PPI generate the control word to initialize the 8255A PPI with proper explanations. Both printer and keyboard use 8-bit parallel data transfer with handshaking. [2]
   d) Derive the control word to enable interrupt request to the microprocessor by port A of 8255A PPI in above system, with proper explanations. [2]
3. a) Compare the USB standards: USB 1.1 and USB 2.0 [3]
   b) Describe simplex, half duplex and full duplex operation using RS-232 port. [7]
4. What are types of errors present in a A/D or D/A converters? With necessary diagram explain the interfacing a ADC using interrupt. [3+5]
5. a) Explain different network topologies of Bluetooth device with appropriate diagrams. [4]
   b) What is a data logger? Explain the desirable characteristics for a data logger. [1+3]
6. Explain different types of Noise coupling Mechanism with concept of Pseudo impedance. [6]
7. What are the reasons for using low power? Mention the guidelines to be considered for low power design. [2+4]
8. A careful circuit layout not only makes the production of circuit boards easier but also makes them less error prone. What rules does a designer have to follow while routing signal tracks in PCBs in order to avoid the effects of impedance mismatch and crosstalk? [3+3]
9. What is fault tolerance in software? What do you mean by roll-back recovery and roll-forward recovery? Explain different types of bugs in software. [2+2+4]
10. a) What are the types of Microprocessor based system used in instrumentation system? How it makes more benefits in industry? [3]
    b) Explain detail about different processing plant which you have studied in case study. Also draw the block diagram for further improvement of these all plant and overall system. [9]

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2069 Chaitra

Exam.	Regular		
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.*

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10. a) What are the types of Microprocessor based system used in instrumentation system? How it makes more benefits in industry? [3]
    b) Explain detail about different processing plant which you have studied in case study. Also draw the block diagram for further improvement of these all plant and overall system. [9]

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4IR TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

Exam.	Regular / 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. 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]
   b) An 8255A PPI connected to 8085 has a system base address of 80H. [5]
      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 generators 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. [6×2]
   a) Static and Dynamic errors in Digital to Analog Converters
   b) Software selection and purchase

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24 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Chaitra

Exam.	Regular		
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.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) One thing embedded real time systems have in common is that they include some type of processor. They range any where 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 part 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 developments 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 the 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

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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