

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Instrumentation

INS 6B 15B—INSTRUMENTATION IN PETRO-CHEMICAL INDUSTRIES

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer atleast eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Discuss theories behind the origin of crude oil.
2. List chemical properties of crude oil.
3. Classify petrochemicals.
4. Write chemical formula for chloromethane.
5. What is the purpose of drying ?
6. Explain the three process involved in hydro cracking.
7. Describe the process of polymerization.
8. Define the process of sweetening.
9. List any four acetylene derivatives.
10. What is the operating principle of RTD ?
11. Draw an orifice meter and explain working.
12. Mention any *two* types of pressure sensors.

(8 × 3 = 24)

Section B*Answer atleast five questions.**Each question carries 5 marks.**All questions can be attended.**Overall Ceiling 25.*

13. Describe PVC production process with process diagram.
14. Explain the process of alkylation with process diagram.

Turn over

15. Describe the working of ultrasonic flow meter.
16. Explain the process of reforming.
17. Describe the process of distillation of crude oil.
18. Explain the working of vortex flow meter.
19. Define Intrinsic safety equipment. Explain its working.

(5 × 5 = 25)

Section C

Answer any one question.

Each question carries 11 marks.

20. Write short notes on : (i) Migration of crude oil and (ii) Basin mapping methods.
21. With necessary process diagrams explain LQ structure in distillation column.

(1 × 11 = 11)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Instrumentation

INS 6B 14—PLC AND SCADA

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer atleast eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. What are the types of inputs in PLC ?
2. List out the languages used in PLC programing.
3. What are the types of PLCs.
4. Write a PLC program to implement AND logic.
5. What is meant by NO and NC conditions in PLC ?
6. What are the advantages of ladder language ?
7. Give the limitations of PLC automation system.
8. Differentiate between sourcing mode and sinking mode connections.
9. Write a PLC program to turn on a Lamp 5 seconds after the input swich is turned on.
10. Give applications of SCADA system.
11. What is meant by data acquisition systems ?
12. List out the protocols used for communication in SCADA systems.

(8 × 3 = 24 marks)

Section B*Answer atleast five questions.**Each question carries 5 marks.**All questions can be attended.**Overall Ceiling 25.*

13. With necessary diagrams explain how AC output units are connected to PLC.
14. Explain the steps for executing a program in PLC.

Turn over

15. Write a PLC program to implement the SOP expression $Y = \bar{A}B + B(\bar{C} + D)$.
16. Compare relays and PLCs.
17. Discuss different types of counters used in PLC. Distinguish between counters and timers.
18. How AC and DC inputs are interfaced in PLC, explain with neat diagrams ?
19. Explain the architecture of SCADA systems.

(5 × 5 = 25 marks)

Section C

Answer any one question.

The question carries 11 marks.

20. Two motors are to be controlled in a sequence. The second motor starts 30 seconds after the starting of first motor by a push switch. Develop a PLC ladder diagram for the following cases and describe the circuit.
Case (A) : Only one motor operates at a time.
Case (B) : Both the motor gets off together after 50 seconds
21. With a neat diagram explain the automation in water purification system using SCADA.

(1 × 11 = 11 marks)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Instrumentation

INS 6B 13—INSTRUMENTATION SYSTEM DESIGN

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer atleast **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. List out any *two* components of instrumentation system.
2. Which materials are used to construct pipes ?
3. What are the methods of engineering analysis ?
4. Define valve co-efficient CV.
5. List out any *two* hazards in using electric circuits.
6. State the operating principle of venture meter.
7. What are intrinsic safety barrier ?
8. Differentiate piping and tubing.
9. How earthing is done ?
10. What are the responsibilities of a process engineer ?
11. How to prepare a bid document ?
12. What is a graphical LCD ?

(8 × 3 = 24 marks)

Turn over

Section B

*Answer atleast **five** questions.*

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Classify control valves.
14. A K type thermocouple produces a voltage which is measured by the potentiometer as 25mV. Determine the temperature T when the Reference Junction isothermal block is indicated by a thermistor as 0° C. Use the seeback co-efficient for 20° C.
15. Derive differential equation of flow nozzle.
16. List out the *five* factors to be considered while selecting a control valve.
17. How flow is measured by using orifice plate ?
18. List major data that must include in instrument loop diagram.
19. Discuss steps involved in design of control panel.

(5 × 5 = 25 marks)

Section C

*Answer any **one** question.*

Each question carries 11 marks.

20. Write short notes on : (i) Construction of electronic instruments and (ii) Construction of mechanical instruments.
21. Discuss in detail how to start and execute an instrumentation project.

(1 × 11 = 11 marks)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Instrumentation

INS 6B 12—PROCESS CONTROL INSTRUMENTATION

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer atleast eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Differentiate between manipulated variable and controlled variable.
2. Enumerate the criteria for evaluating process control loops.
3. What is meant by self regulation ?
4. Define proportional band.
5. Write the controller output equation for a P + I controller.
6. What is meant by Direct Digital Control ?
7. Mention type of valves according to the construction.
8. Define digital control.
9. What is actuators ?
10. Give the schematic of a flapper-nozzle system for two position controller.
11. Give the advantages of a derivative controller.
12. List out the advantages of digital control system.

(8 × 3 = 24)

Section B*Answer atleast five questions.**Each question carries 5 marks.**All questions can be attended.**Overall Ceiling 25.*

13. With a neat block diagram explain the basic process control loop.
14. Explain digital process control. Give example.

Turn over

15. What is an integral mode control ? Graphically show the relation between rate of change of error and K_1 (integral constant) ?
16. Differentiate between data loggers and data acquisition system.
17. Differentiate between air-to-open and air-to-close valve.
18. With a neat diagram explain the analog ON-OFF controller with neutral zone.
19. Write short notes on : (1) Analog and (2) Pneumatic controllers.

(5 × 5 = 25)

Section C

Answer any one question.

Each question carries 11 marks.

20. Illustrate the functions of op-amp implementation of P, PI, PD and PID controllers.
21. Write short notes on tuning using : (1) Process reaction curve method and (2) Ziegler Nichols Method.

(1 × 11 = 11)

SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, MARCH 2022

Instrumentation

ITN 6B 14—MICROCONTROLLERS

(2014 to 2017 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (Objective Type Questions)*Answer all questions.**Each question carries 1 mark.*

1. In the implied or implicit addressing mode, the instructions don't have any source or destination operands. (True/False)
2. PSW register is also referred to as the flag register. (True/False)
3. The 8255 IC is used as a PP1 IC. The abbreviation PPI stands for _____.
4. The instruction: INC A does not affect the Carry flag. (True/False)
5. When the 8051 is powered up, the SP register contains value _____.
6. The abbreviation ADC stands for _____.
7. LCALL instruction can be used to call subroutines available within the 64 K-byte address space of the 8051. (True/False)
8. The size of scratch pad in the RAM of 8051 is _____ bytes.
9. The 8051 microcontroller has _____ parallel 8-bit ports.
10. All interrupts in 8051 can be disabled by clearing the EA bit of the _____ same register.

(10 × 1 = 10 marks)

Section B (Short Answer Type Questions)*One or two sentences each.**Answer any ten questions.**Each question carries 2 marks.*

11. What is the function of the 'parity' flag ?
12. What is the value in the accumulator after the execution of this code snippet ?

MOV A, #0

MOV R2, #10

AGAIN : ADD A, #02

DJNZ R2, AGAIN

Turn over

13. What is the use of XRL instruction ? What is the value stored in the accumulator after execution of the following instructions ?
 MOV A, #44H
 XRL A, #40H
14. What is the function of Program Counter register in 8051 ?
15. Considering the crystal frequency XTAL = 11.0592 MHz, what will be the timer clock frequency and period?
16. Considering the 8051 crystal frequency XTAL = 11.0592 MHz, what is the frequency provided by the UART to Timer 1 to set baud rate ?
17. What is the role of SCON register in in 8051 ?
18. What happens if the 8051 is executing an ISR belonging to an interrupt and another interrupt is activated ?
19. If both INTO and INT1 in the IP are set to high, what happens if both are activated at the same time using low-level-triggered interrupts ?
20. For a given ADC with 8-bit resolution and the reference voltage $V_{ref} = 2.56$ V. calculate the 8-bit binary output if the analog input is 1.28 V.
21. What is the difference between serial and parallel ADCs ?
22. What is a DAC ?

(10 × 2 = 20 marks)

Section C (Paragraph Type Questions)

Answer any six questions.

Each question carries 5 marks.

23. Describe the RAM memory allocation in 8051 microcontroller.
24. Explain the Indirect Addressing mode in 8051.
25. Explain the role of C/T bit in the TMOD register that decides the source of the clock for the timer.
26. Briefly describe the Serial Port Control Register (SCON) of 8051 and the function of each of the SCON bits.
27. Describe the working of edge-triggered external interrupts in 8051.
28. Describe in brief, the working of a typical keyboard.
29. Assume that crystal frequency for the 8051 is XTAL = 11.0592 MHz. What value do we need to load into the timer's registers if we want to have a time delay of 6ms (milliseconds) ?
30. Describe in brief, the simplex and duplex modes of data communication.
31. Briefly describe the different operating modes of 8255.

(6 × 5 = 30 marks)

Section D (Essay Type Questions)

*Answer any **two** questions.*

Each question carries 10 marks.

32. Describe a typical microcontroller with the help of a block diagram.
33. Describe the pins and the signals at each pin for the 8051 microcontroller (using the 40-pin DIP configuration) with the help of an appropriate pinout diagram.
34. Describe the PSW (Program Status Word) register and the function of each of the bits in PSW.
35. Assume that XTAL = 11.0592 MHz. What value do we need to load into the timer's registers if we want to have a time delay of 6 milliseconds? Write the code for Timer 0 to create a pulse width of 6 milliseconds on P2.3.

(2 × 10 = 20 marks)

SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, MARCH 2022

Instrumentation

ITN 6B 12—PROCESS CONTROL INSTRUMENTATION

(2014 to 2017 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (Objective Type Questions)*Answer all questions.**1 mark each.*

1. The input of a controller is :
 - a) Sensed signal.
 - b) Error signal.
 - c) Desired variable value.
 - d) Signal of fixed amplitude not dependent on desired variable value.
2. Feedback path element measure only input parameters.
 - a) True.
 - b) False.
3. A gain setting of 0.8 is equivalent to a proportional band setting of _____.
4. A condition where integral control action drives the output of a controller into saturation is called:
 - a) Self-bias.
 - b) Wind-up.
 - c) Repeat.
 - d) Noise.
 - e) Offset.
5. Derivative output compensation :
 - a) Improvement in transient response.
 - b) Reduction in steady state error.
 - c) Reduction in settling time.
 - d) Increase in damping constant.
6. Which one of the following is a disadvantage of proportional controller ?
 - a) It destabilises the system.
 - b) It produces offset.
 - c) It makes response faster.
 - d) It has very simple implementation.

Turn over

7. A first order dynamic linear system with a proportional controller exhibits an offset to a unit step input. The offset can be reduced by :
- a) Decreasing the proportional gain.
 - b) Adding derivative mode.
 - c) Adding integral mode.
 - d) Increasing the proportional gain.
8. In proportional integral control, integral action is used to _____.
- a) Increase speed of response.
 - b) Minimise overshoot.
 - c) Minimise cycling.
 - d) Minimise steady state error.
9. _____ is the algebraic difference between the measured value of a variable and the ideal value.
10. Reset control action is often expressed in units of :
- a) Percent.
 - b) Seconds per rate.
 - c) Minutes.
 - d) Repeats per minute.
 - e) Time constant ratio.

(10 × 1 = 10 marks)

Section B (Short Answer Type Questions)

*One or two sentences each.
Answer any ten questions.
2 marks each.*

11. What is the need for Process Control ?
12. What is floating control mode ?
13. Define process load.
14. Mention any two drawbacks of derivative controller.
15. What is the relation between proportional control band and proportional gain ?
16. Sketch electronic ON-OFF controller.
17. Define offset.
18. Sketch the input-output characteristic of single - speed floating controller.
19. Define controller tuning.
20. What is the principle of electric actuators ?
21. Give any two example of digital process control.
22. What is the function of actuator ?

(10 × 2 = 20 marks)

Section C (Paragraph Type Questions)

*Answer any **six** questions.*

5 marks each.

23. Discuss about three-mode controller. Mention its advantages.
24. Why do we need mathematical modelling of process ?
25. Why is the electronic controller preferred to pneumatic controller ?
26. Explain the open loop method of tuning with neat diagrams.
27. Differentiate floating controller mode and continuous controller mode.
28. Explain the functioning of I/P converter with a neat sketch.
29. What are the advantages and disadvantages of PI control ?
30. Draw the block diagram of a process control system.
31. Discuss how the stability is affected for integral and derivative control.

(6 × 5 = 30 marks)

Section D (Essay Type Questions)

*Answer any **two** questions.*

10 marks each.

32. Draw the circuit for electronic PID controller and describe the working.
33. Explain in detail about direct digital control using a suitable block diagram.
34. Explain different types of electrical actuators.
35. Explain the basic elements of a process-control system.

(2 × 10 = 20 marks)

SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
MARCH 2021

Instrumentation

ITN 6B 13—BIOMEDICAL INSTRUMENTATION

Time : Three Hours

Maximum : 80 Marks

Section A (Objective Type Questions)

Answer all questions.

1 mark each.

1. The process of changing of a cell from the resting state to the action potential is called _____.
2. The horizontal segment of ECG waveform preceding the P wave is designated as the baseline or the _____ line.
3. The _____ interval represents the time during which the excitation wave is delayed in the fibers near the AV node.
4. In the standard 12-lead ECG measurement, the number of limb leads used is _____.
5. Electrodes used to measure bioelectric potentials near or within a single cell are called _____.
6. Needle electrodes are used to measure ECG, EEG, and EMG potentials from the surface of the skin. (True/False).
7. An _____ is a circuit is used to increase the amplitude of the measured biomedical signal.
8. The _____ system is an organ system that permits blood to circulate and transport nutrients and blood cells in the body.
9. Thermal convection methods for blood flow determination, although among the oldest ones used for this purpose, have now been widely replaced by other more modern methods. (True/False)
10. _____ temperature is a measure of the basic temperature of the complete organism.

(10 × 1 = 10 marks)

Turn over

Section B (Short Answer Type Questions)

*One or two sentences each. Answer any **ten** questions.
2 marks each.*

11. How are bioelectric potentials generated ?
12. What are augmented unipolar limb leads used in ECG measurement ?
13. What is EEG ?
14. What is the difference between measurement using unipolar and bipolar needle electrodes ?
15. What is the need of signal conditioning in biomedical instruments ?
16. What is cardiovascular system ?
17. What is an arrhythmia ?
18. What are Korotkoff sounds ?
19. What is Alkalosis ?
20. What is capacitance plethysmograph ?
21. How can the intensity of X-rays be controlled ?
22. What are the commonly used electronic temperature-sensing devices used in biomedical applications ?

(10 × 2 = 20 marks)

Section C (Paragraph Type Questions)

*Answer any **six** questions.
5 marks each.*

23. Explain briefly, the types of electrodes used for measurement of bioelectric potentials.
24. Briefly explain the working of a Doppler-type ultrasonic blood flowmeter.
25. Explain the placement of the three bipolar limb leads for ECG measurement.
26. Briefly explain the technique of quantification of EMG using time-integral of EMG waveform.
27. Briefly explain 'evoked potentials' and their measurement.
28. Explain in brief, the principle behind the measurement of blood pressure using Sphygmomanometer.
29. What are the major advantages and disadvantages of using laser for medical therapy and treatment ?

30. Explain diathermy and its use in therapy ?
31. What is fibrillation ? How can this medical condition be rectified ?

(6 × 5 = 30 marks)

Section D (Essay Type Questions)

Answer any two questions.

10 marks each.

32. What is the role of the cardiovascular system ? Describe the working of the human cardiovascular system with the help of a relevant diagram.
33. With the help of a diagram, describe the 10-20 electrode configuration for EEG measurement.
34. Explain the 12-lead ECG measurement with the help of relevant diagrams.
35. Explain working of Magnetic blood flow meters with the help of a neat diagram.

(2 × 10 = 20 marks)