| Reg. No. | | | | | | | | | | | | | | | | |
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| Question Paper Code | 13224 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024**

Seventh Semester

**Instrumentation and Control Engineering**

**20ICEL705 - ADVANCED INSTRUMENTATION SYSTEMS**

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

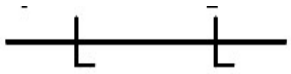
**PART - A (MCQ) (20 × 1 = 20 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 1. | The most rugged temperature sensing element listed here is a/an:<br>(a) Thermocouple (b) Orifice plate (c) RTD (d) Filled bulb | 1 | K1 | CO1 |
| 2. | Which of the following represents pressure of a liquid column with constant density?<br>(a) ϱgh (b) ϱh (c) ϱg (d) ϱv | 1 | K1 | CO1 |
| 3. | The total calibrating time in dynamic weighing method is<br>(a) 50% (b) 80% (c) 10% (d) 15% | 1 | K1 | CO1 |
| 4. | In radiation level detector, when the liquid level in the tank rises, the amount of radiation received at the detector is<br>(a) increased (b) reduced (c) unchanged (d) none of the above | 1 | K1 | CO1 |
| 5. | Which of the following gases have paramagnetic property (ability to get attracted to the magnetic field)?<br>(a) Nitric oxide (b) Hydrogen (c) Helium (d) Nitrogen | 1 | K1 | CO2 |
| 6. | Which of the following bridges are used in thermal conductivity analyzers?<br>(a) Wheatstone bridge (b) Kelvin's bridge (c) Anderson's bridge (d) Schering's bridge | 1 | K1 | CO2 |
| 7. | Non-dispersive infrared analyzer depends on the characteristic absorption of CO molecule at a wavelength of _____<br>(a) 5.4 μm (b) 4.6 μm (c) 8.9 μm (d) 10.8 μm | 1 | K1 | CO2 |
| 8. | Which of the following acts as quenching gas in Geiger Muller counter?<br>(a) Krypton (b) Argon gas (c) Alcohol (d) Hydrogen | 1 | K1 | CO2 |
| 9. | What are the two main components of risk?<br>(a) Magnitude of consequences & Safe distance from harm<br>(b) Frequency of occurrence & Safe distance from harm<br>(c) Frequency of occurrence & Magnitude of consequences<br>(d) Magnitude of consequences & Duration of harm | 1 | K1 | CO3 |
| 10. | Which standard is called an Umbrella standard?<br>(a) AIChE-CCPS (b) IEC 61508 (c) API RP 14C (d) HSE-PES | 1 | K1 | CO3 |
| 11. | SFF (Safe Failure fraction) is the ratio of<br>(a) Safe Failures / Total Failures<br>(b) Safe Failures / Dangerous Failures<br>(c) All Failures except Dangerous Undetected Failures / Total Failures<br>(d) Dangerous Detected Failures / Total Failures | 1 | K1 | CO3 |
| 12. | IEC 61511 / ISA 84 identify _____ SILs for the process industries and specify performance requirements for each level.<br>(a) Two (b) Three (c) Six (d) Seven | 1 | K1 | CO3 |
| 13. | The following class of fire occur in electrical equipment<br>(a) Class- A fires (b) Class- B fires (c ) Class- C fires (d) All of the above | 1 | K1 | CO4 |
| 14. | What is the main function of an alarm system in a process plant?<br>(a) To store materials (b) To provide warnings about unsafe conditions<br>(c) To control machinery (d) To transport products | 1 | K1 | CO4 |

15. Which of the following is a mitigation layer used to handle excess gases? *1 K1 CO4*
(a) Shutdown system (b) Scrubber (c) Alarm system (d) Control room
16. What is the purpose of evacuation procedures in safety management? *1 K1 CO4*
(a) To train employees (b) To monitor equipment
(c) To ensure safe exit during emergencies (d) To manage resources
17. A basic control loop will consist of *1 K1 CO5*
(a) signal converter, resistor, knob, and control valve
(b) transducer, valve packing, hex-head wrench, and tubing
(c) transmitter, controller, I/P transducer, and control valve
(d) resistor, capacitor, terminal block, and battery
18. Identify the following instrumentation (PFD) in a plant? *1 K1 CO5*

(a) Fuse (b) Circuit Breaker (c) Overload heater (d) Draw-out
19. Identify the following instrumentation (P&ID and loop diagram) line types in a processing plant *1 K1 CO5*



(a) Pneumatic (b) Hydraulic (c) Electrical (d) Mechanical link
20. What do you understand by the symbol shown below? *1 K1 CO5*


(a) Discrete and inaccessible to operator voltage indicator
(b) Discrete and accessible to operator voltage indicator
(c) Shared and inaccessible to operator voltage indicator
(d) Shared and accessible to operator voltage indicator

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

21. Differentiate between 3-wire RTD and 4-wire RTD. *2 K2 CO1*
22. Classify the different temperature measurement types using changes in physical properties. *2 K2 CO1*
23. Choose the basic elements needed for the chromatograph. *2 K2 CO2*
24. Infer the use of gold films in the Hydrogen Sulfide analyzer. *2 K2 CO2*
25. Summarize the application of API RP 556. *2 K2 CO3*
26. Outline the design requirements covered by NFPA 85. *2 K2 CO3*
27. What are flares used for in safety systems? *2 K1 CO4*
28. What is ALARP? Explain why it is important for managing risks in safety. *2 K2 CO4*
29. Compare PFD and P&ID. *2 K2 CO5*
30. Compose the factors to be considered in cable routing. *2 K2 CO5*

**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

31. a) Classify sensors based on the techniques used to convert mechanical pressure to proportional electronic signal. *10 K2 CO1*

**OR**

b) Illustrate the principle of Suspended solids level monitoring with neat sketch. *10 K2 CO1*

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| 32. | a) | Summarize the principle and procedures in IR Spectroscopy. | *10* | *K2* | *CO2* |
| | | **OR** | | | |
| | b) | Infer the principle in CO-CO2 Analyzer with neat sketch. | *10* | *K2* | *CO2* |
| 33. | a) | Summarize the functional aspects of Safety Instrumented system and Safety instrumented Function. | *10* | *K2* | *CO3* |
| | | **OR** | | | |
| | b) | Explain the features and concepts of safety standards API RP556 and API RP14C. | *10* | *K2* | *CO3* |
| 34. | a) | Explain in detail with diagram the concept of Process plant design and Process control system with neat sketch. | *10* | *K2* | *CO4* |
| | | **OR** | | | |
| | b) | Explain the features and concepts of safety Integrity Level. | *10* | *K2* | *CO4* |
| 35. | a) | Summarize instrument symbols found in different types of technical diagrams used to document instrument systems. | *10* | *K2* | *CO5* |
| | | **OR** | | | |
| | b) | Outline the three types of delays that are used to represent start/stop/operate circuits. | *10* | *K2* | *CO5* |
| 36. | a) i) | Discuss how the risk register can be utilized to monitor and respond to risks effectively throughout the project. | *5* | *K2* | *CO4* |
| | ii) | Draw a loop diagram for a flow measurement system and evaluate the critical information it reveals about the system's operation. | *5* | *K2* | *CO5* |
| | | **OR** | | | |
| | b) i) | Enumerate how Prevention Layers such as Process Plant Design and Alarm Systems keep industrial processes safe. | *5* | *K2* | *CO4* |
| | ii) | Draw a hook-up diagram for a pressure gauge with a specification table. | *5* | *K2* | *CO5* |