MAC Workshop Assessment Quiz

Integrating Human Intelligence, Artificial Intelligence, and Human-Centered Skills for the Future Engineer

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Workshop Assessment: 20 Multiple-Choice Questions
Pass Mark: 70% (14 out of 20)

Question 1

What is Artificial Intelligence?

A. Naturally occurring intelligence
B. Biological intelligence
C. Human-made or engineered intelligence
D. Animal intelligence
E. Emotional intelligence

Question 2

Artificial Intelligence is best defined as:

A. A computer program that only performs calculations
B. Systems designed to perform tasks requiring human intelligence
C. Mechanical equipment used in plants
D. Computer hardware only
E. A process simulator

Question 3

Which of the following inspired the development of Artificial Neural Networks?

A. Distillation columns
B. Heat exchangers
C. Human brain neurons
D. Process control valves
E. Fluid mechanics

Question 4

Machine Learning is:

A. A replacement for engineers
B. A subset of Artificial Intelligence
C. A type of process simulator
D. A refinery operation method
E. A safety audit technique

Question 5

Which component of a biological neuron receives incoming signals?

A. Axon
B. Synapse
C. Dendrite
D. Nucleus
E. Membrane

Question 6

In Artificial Neural Networks, synapses are represented by:

A. Sensors
B. Weights

C. Pumps
D. Reactors
E. Compressors

Question 7

Which cognitive function is most associated with drawing logical conclusions?

A. Memory
B. Perception
C. Reasoning
D. Creativity
E. Communication

Question 8

Which of the following is NOT a human cognitive function?

A. Learning
B. Memory
C. Reasoning
D. Distillation
E. Decision-making

Question 9

Which AI technology powers systems such as ChatGPT?

A. Heat Integration
B. Transformers
C. Distillation Models
D. Valve Algorithms
E. Piping Networks

Question 10

Generative AI is primarily used to:

A. Operate pumps directly
B. Generate new content and solutions
C. Replace process engineers
D. Design piping automatically without review
E. Eliminate human judgment

Question 11

Which of the following is a common application of AI in chemical and process engineering?

A. Predictive maintenance
B. Manual drafting
C. Hand calculations only
D. Filing paperwork
E. Mechanical fabrication

Question 12

AI-based predictive maintenance helps organizations:

A. Increase equipment failures
B. Reduce reliability
C. Predict failures before breakdown occurs
D. Eliminate inspections completely
E. Remove operators

Question 13

Which engineering application can benefit from AI-based fouling prediction?

A. Heat exchangers
B. Office furniture

C. Lighting systems only
D. Building decoration
E. Parking management

Question 14

One major benefit of AI-assisted process safety monitoring is:

A. Increased risk-taking
B. Reduced situational awareness
C. Early detection of hazardous conditions
D. Elimination of safety procedures
E. Removal of alarms

Question 15

Which historical refinery incident discussed in the workshop involved an FCC slide valve failure?

A. Piper Alpha
B. Deepwater Horizon
C. ExxonMobil Torrance Refinery Incident
D. Bhopal Incident
E. Flixborough Incident

Question 16

Which human-centered skill remains essential despite advances in AI?

A. Ethical judgment
B. Data storage
C. Pattern matching
D. Automated calculation
E. Data transmission

Question 17

Why can AI not fully replace engineers?

A. AI cannot perform calculations
B. AI cannot process data
C. Engineering requires judgment, ethics, leadership, and accountability
D. AI cannot learn from data
E. AI cannot use computers

Question 18

Industry 4.0 is most closely associated with:

A. Manual operation only
B. Steam engines
C. Digitalization, automation, and intelligent systems
D. Mechanical drafting boards
E. Typewriters

Question 19

The most effective future engineer will combine:

A. Technical skills only
B. AI tools only
C. Human-centered skills only
D. Technical expertise, AI capability, and human-centered skills
E. Software programming only

Question 20

What is the central message of this workshop?

A. AI will completely replace engineers
B. Engineering fundamentals are no longer important
C. Human intelligence and AI should work together to improve engineering

practice
D. Process safety is no longer needed
E. Human-centered skills are obsolete

This assessment directly aligns with the workshop topics of Human Intelligence, Cognitive Functions, Artificial Intelligence, Machine Learning, Neural Networks, Generative AI, Process Safety, Industry 4.0, and Human-Centered Skills in Modern Engineering Practice.

Advanced Assessment Quiz

Integrating Human Intelligence, Artificial Intelligence, and Human-Centered Skills for the Future Engineer

Advanced Level Questions (Engineering Applications, AI/ML, Process Safety, and Calculations)

Question 21

A machine learning model predicts heat exchanger fouling resistance as:

$R_f = 0.0002 + 0.00005t$

where:

R_f = fouling resistance ($m^2 \cdot K/W$)

t = operating time (months)

What is the predicted fouling resistance after 12 months?

A. 0.00050

B. 0.00060

C. 0.00070

D. 0.00080

E. 0.00090

Question 22

A neural network predicts distillation overhead purity using:

Purity = 85 + 0.8 (Reflux Ratio)

If the reflux ratio increases from 5 to 8, what purity is predicted?

A. 89.0%

B. 90.4%

C. 91.4%

D. 92.6%

E. 93.8%

Question 23

An AI model predicts compressor failure with 95% accuracy.

Out of 200 compressors monitored, how many failures would be correctly predicted?

A. 180

B. 185

C. 190

D. 195

E. 198

Question 24

An ANN model reduces heat exchanger cleaning costs from $250,000/year to $175,000/year.

What is the annual savings?

A. $50,000

B. $65,000

C. $75,000

D. $85,000

E. $100,000

Question 25

A reactor operates at:

- Current conversion = 82%
- AI optimized conversion = 91%

What is the increase in conversion?

A. 7%

B. 8%

C. 9%

D. 10%

E. 11%

Question 26

An AI-based predictive maintenance system reduces unplanned downtime from 120 hours/year to 45 hours/year.

What percentage reduction is achieved?

A. 52.5%

B. 57.5%

C. 62.5%

D. 67.5%

E. 72.5%

Question 27

A Process Safety Risk Score is calculated as:

Risk = Severity x Likelihood

If Severity = 8 and Likelihood = 6:

What is the Risk Score?

A. 36

B. 42

C. 48

D. 54

E. 60

Question 28

A machine learning model for equipment failure prediction has:

- True Positives = 90
- False Positives = 10

Precision is:

$$\text{Precision} = \frac{TP}{TP + FP}$$

What is the precision?

A. 80%

B. 85%

C. 88%

D. 90%

E. 95%

Question 29

A refinery furnace consumes 120 MW.

AI optimization reduces fuel consumption by 8%.

What is the new furnace duty?

A. 105.6 MW

B. 108.0 MW

C. 110.4 MW

D. 112.8 MW

E. 115.0 MW

Question 30

An engineer receives the following recommendation from a Generative AI system:

"Increase reactor temperature by 50°C to improve conversion."

What should be the engineer's FIRST action?

A. Implement immediately

B. Ignore the recommendation

C. Verify against design limits, safety requirements, and engineering principles

D. Send to management without review

E. Assume AI is correct

Bonus Discussion Question (Not Graded)

Question 31

A refinery deploys an AI system capable of optimizing operations, predicting failures, and recommending maintenance actions. The system consistently performs better than historical plant averages.

Should final operational and safety decisions be delegated entirely to the AI system?

A. Yes, because AI is more accurate

B. Yes, if management approves

C. No, because engineers remain responsible for validation, safety, ethics, and accountability

D. Yes, provided the plant is automated

E. Only during emergencies

This question reinforces the central theme of the workshop:

Artificial Intelligence enhances engineering capability, but human intelligence, ethical responsibility, leadership, and professional judgment remain indispensable.