Fundamentals of Manufacturing
Practice Certification Exam

Instructions: Read each question carefully and then select the correct answer. Your answer should be recorded on the scoring sheet provided. Mark only one answer for each question. Erase any changes completely. Use only a number 2 pencil on the answer sheet. Before beginning the test, fill in the spaces for your name and also fill in the spaces for computer recognition of your name. This is an open book examination. Calculators are permissible. Time Limit: 60 minutes.

SELECT THE BEST ANSWER

1. What is the cutting speed for turning a 3 inch diameter shaft rotating at 200 rpm?
   a. 78.5 sfpm
   b. 157.0 sfpm
   c. 314.0 sfpm
   d. 1884.0 sfpm

2. A laser beam is aimed at a vertical glass surface forming a 30 degree angle with respect to the horizontal. The beam is partially reflected by the glass, with the reflected beam forming an angle with respect to the glass plate that is closest to:
   a. 60 degrees
   b. 50 degrees
   c. 30 degrees
   d. 47 degrees

3. A vehicle moving at 30 m/s suddenly applies the brakes, decelerating at 5 m/s². How far will it travel before it stops?
   a. 45 meters
   b. 90 meters
   c. 36 meters
   d. 180 meters

4. A motor exerts a constant torque on a flywheel (initially at rest). If the motor torque is 25 N-m, and the flywheel mass moment of inertia is 40 kg-m², the flywheel speed after 5 seconds will be closest to:
   a. 25 rpm
   b. 47 rpm
   c. 30 rpm
   d. 3 rpm
5. Two resistors—one 6 ohm and one 12 ohm—are connected in a parallel circuit, which is in turn connected in series to a 5 ohm resistor. The resistance of the combined circuit is closest to:
   a. 17 ohms
   b. 23 ohms
   c. 11 ohms
   d. 9 ohms

6. A 24 volt power supply is connected to a motor that draws 10 amps of current. The power flowing through the motor is approximately:
   a. 416.7 watts
   b. 2.4 watts
   c. 0.417 watts
   d. 240 watts

7. The solution to the system of equations \(4x - 6y = 20\) and \(2x + 2y = 5\) is closest to:
   a. \(x = 1.5, y = -2\)
   b. \(x = 3.5, y = -1\)
   c. \(x = 2.5, y = -0.5\)
   d. \(x = 5.0, y = 0.0\)

8. A rectangular block is 30 mm by 40 mm, and is to be inserted into a circular hole. The minimum hole radius is closest to:
   a. 28 mm
   b. 15 mm
   c. 25 mm
   d. 40 mm

9. Five sample hardness measurements yielded BHN measurements of 28, 33, 31, 27 and 36 with a mean of 31. The sample standard deviation is closest to:
   a. 2.5
   b. 2.8
   c. 3.5
   d. 4.0

10. Which of the following is the most adjustable type of chuck?
    a. Collet
    b. Scroll
    c. Power
    d. Diaphragm

11. Which of the following is typically the best method of joining or fastening for ease of automated assembly?
    a. Rivets
    b. Screws
    c. Snap fits
    d. Welds
12. Most NC machines have a positioning resolution of:
   a. 0.0001"
   b. 0.001"
   c. 0.01"
   d. 0.1"

13. Which of the following would NOT be listed as an advantage of electrical discharge machining (EDM)?
   a. Used on difficult-to-machine metals
   b. Rapid cutting rate
   c. Will machine hardened steel
   d. Machines difficult hole designs

14. Metal spinning is a ________ operation.
   a. Machining
   b. Forming
   c. Casting
   d. Forging

15. A non-traditional machining process that can be used to machine thin materials is:
   a. Chemical machining
   b. Laser beam machining
   c. Abrasive jet machining
   d. All of the above

16. Which of the following cutting tool materials will allow the highest cutting speed?
   a. High carbon steel
   b. Stellite
   c. Tungsten carbide
   d. High speed steel

17. The set of standards used for comparing dimensions or for checking the accuracy of measuring instruments is called:
   a. Gage blocks
   b. Optical flats
   c. Surface plates
   d. Sine bars

18. What is the taper (in inches per foot) of a mandrel with a large diameter of 1.6", a small diameter of 1.2", and a length of 5 inches?
   a. 0.79"
   b. 0.68"
   c. 0.86"
   d. 0.96

19. What is the pitch diameter of an 8 diametral pitch gear with 18 teeth and a 2.5" outside diameter?
   a. 2.25 PD
   b. 2.34 PD
   c. 2.44 PD
   d. 2.52 PD
20. The diameter of an aluminum piston is measured to be 2.0002" as it comes out of a lathe. If the piston temperature is 80°C when measured, what will be its diameter at room temperature (20°C)?
   a. 1.9972"
   b. 1.9992"
   c. 2.0000"
   d. 2.0032"

21. Which of the following is NOT considered a thermoplastic engineering resin?
   a. Nylon
   b. Elastomer
   c. Acetal
   d. Polycarbonate

22. The percentage of carbon in SAE 2317 steel is:
   a. 17%
   b. 1.7%
   c. 0.17%
   d. 0.7%

23. If the axial strain of a specimen is 0.010, and the lateral strain of a specimen is 0.003, what is the Poisson’s Ratio?
   a. 0.1
   b. 0.2
   c. 0.3
   d. 0.4

24. What are the alloying elements in SAE 4120 steel?
   a. Chromium and Vanadium
   b. Cobalt and Nickel
   c. Nickel and Chromium
   d. Chromium and Molybdenum

25. Which of the following describes pearlite?
   a. Eutectoid composition of ferrite and cementite
   b. BCC version of iron and its solid solutions
   c. Iron carbide
   d. FCC version of martensite

26. Resistance of a material to an applied load is defined as what?
   a. Stiffness
   b. Hardness
   c. Elasticity
   d. Strength

27. What is the tensile modulus of steel?
   a. 28.5 Mpsi
   b. 40.5 Mpsi
   c. 22.5 Mpsi
   d. 38.5 Mpsi
28. Bronze is made from which 2 alloys?
   a. Copper and zinc
   b. Zinc and aluminum
   c. Zinc and tin
   d. Copper and elements other than zinc

29. A 50-mm diameter rod is 3 m long. When a tensile force of 188 kN is applied to the rod, it elongates 9.6 mm, and the diameter decreases by 0.04 mm. What is the axial strain?
   a. 0.0042
   b. 0.0039
   c. 0.0032
   d. 0.0045

30. The ratio of the maximum (or ultimate load) to the allowable load is defined as what?
   a. Maximum stress
   b. Safety factor
   c. Tensile modulus
   d. Flexural modulus

31. Accessing previously created components for assembly modeling in CAD is called:
   a. Conditioning
   b. Compositing
   c. Instancing
   d. Draw/modeling

32. Stereolithography, laminated object manufacturing, fused deposition modeling, and selective laser sintering are all examples of:
   a. Finite element modeling
   b. Laser modeling
   c. Ballistic particular manufacturing
   d. Rapid prototyping

33. Given this dimension and tolerance for the diameter of a hole, 0.482" ± 0.003", what is the dimension representing the maximum material condition (MMC)?
   a. 0.479"
   b. 0.480"
   c. 0.482"
   d. 0.485"

34. Tolerance charting of a complex machining process is of critical help in identifying:
   a. Incomplete process specifications
   b. Inadequate linear and/or geometric tolerance specifications
   c. Excessive stock removal circumstances
   d. Potential in-process tolerance stack-ups which preclude meeting design dimensions
35. The main difference between a CNC machine tool with a closed loop system or one with an open loop system is that of:
   a. Resolution
   b. Feedback
   c. Dimensioning
   d. Accuracy

36. Which CAD technique would be best to create eight evenly-spaced holes on a bolt-hole circle for manufacturing?
   a. Offset
   b. Angular displacement
   c. Circular array
   d. Copy

37. The coordinate system where the method of determining the end point of a line is based on the X and Y distance from some previously-entered point is known as:
   a. Absolute
   b. Incremental
   c. Polar
   d. Grid

38. The Z axis on a CNC machine is generally the:
   a. Spindle axis
   b. Cross slide axis
   c. Longitudinal axis
   d. Minor axis

39. In PLC programming, a ladder logic statement is referred to as a:
   a. Block
   b. Step
   c. Rung
   d. Module

40. Interlocks on an industrial robot are used:
   a. To secure the robot control program
   b. To synchronize the robot movement with external devices
   c. Only in conjunction with the manual teach pendant
   d. Primarily for shutting down the robot for safety purposes

41. Which of the following is a major tool used in Concurrent Engineering?
   a. Design for manufacture (DFM)
   b. Transaction analysis (TA)
   c. Just-in-time methods (JIT)
   d. Variation Analysis (VA)

42. Typical of the major goals of Total Quality Management (TQM) are: Doing it right the first time, High levels of employee involvement, Total maintenance, and
   a. Continuous improvement
   b. Management by objective (MBO)
   c. Decentralization
   d. Profit center establishment

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43. The use of techniques such as X-bar and R control charts to analyze a process so that appropriate actions can be taken to improve the process is known as:
   a. Quality assurance
   b. Quality function deployment
   c. Failure mode and effect analysis
   d. Statistical process control

44. If machines or products are being damaged by the improper orientation of component parts, which of the following techniques would best be employed:
   a. Kanban
   b. Tai-chi
   c. Poka-yoke
   d. Kaizen

SELECT THE BEST ANSWER

1. What is the cutting speed for turning a 3 inch diameter shaft rotating at 200 rpm?
   a. 50.3 mph
   b. 83.0 mph
   c. 126 mph
   d. 150 mph

2. A laser beam is aimed at a vertical glass surface forming a 50 degree angle with the horizontal. The beam is partially reflected by the glass with the reflected beam forming an angle with respect to the glass plate that is closest to:
   a. 40 degrees
   b. 50 degrees
   c. 60 degrees
   d. 70 degrees

3. A vehicle moving at 60 mph suddenly applies the brakes, decelerating at 5 m/s². How far will it travel before it stops?
   a. 45 meters
   b. 90 meters
   c. 180 meters
   d. 360 meters

4. A motor exerts a constant torque on a flywheel (initially at rest). If the moment of inertia is 25 lb-ft², and the flywheel mass moment of inertia is 40 kg-m², the flywheel speed after 5 seconds will be closest to:
   a. 20 rpm
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   c. 10 rpm
   d. 3 rpm