L-2, JT (ME)

Question Booklet

Recruitment for the post of Junior Technician

Department: Mechanical Engineering

Level-2 Test

Application No.	:	
Name of the Candidate	:	
Date of Test	:	**07th December 2025**

Instructions to Candidates:

- The test booklet comprises 100 objective multiple-choice questions (MCQs).
- Candidates must record all responses exclusively on the OMR answer sheet supplied.
- **Each correct answer is awarded one mark, while 0.25 marks will be deducted for every incorrect response.**
- Answers must be marked using only **BLUE or BLACK ballpoint pens**.
- Ensure that the chosen option is clearly shaded in the **OMR sheet** as per the instructions provided on it. Incomplete or ambiguous markings may lead to rejection of the response.
- No additional sheets will be issued for rough work. Candidates may utilize the space provided within the question booklet for any rough calculations or notes.
- At the end of the examination, candidates must return both the OMR answer sheet and the question booklet to the invigilator. Failure to do so may result in disqualification.
- The total duration of the examination is **150** minutes.

Signature of the candidate

For rough work

Indian Institute of Information Technology, Design and Manufacturing, Kanchipuram

Written Exam for Junior Technician (Mechanical Engineering)

Name: _____

Instructions:

- **Duration: 150 minutes**
- **Marking Scheme: Each question carries 1 mark.**
- **Negative Marking: For every incorrect answer, 0.25 marks will be deducted**

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1. In a torsion test, a circular shaft of radius r experiences a torque T. The maximum shear stress occurs at
   A) Center of the shaft
   B) Outer surface of the shaft
   C) Mid-length of the shaft
   D) At the torque application point

2. ISO 14001 is a standard related to:
   A) Machine design
   B) Electrical safety
   C) Welding procedures
   D) Environmental management systems

3. A tangent is drawn to a circle from a point outside it. If the distance between the external point and the center is d and the radius of the circle is r, what is the length of the tangent?
   A) $\sqrt{(d^2 + r^2)}$
   B) $\sqrt{(d^2 - r^2)}$
   C) $d - r$
   D) $d + r$

4. A time series has 500 data points sampled at 50 Hz. What is the total time duration of the recorded data?
   A) 10 seconds
   B) 5 seconds
   C) 25 seconds
   D) 50 seconds

5. For an isotropic material, if the Poisson's ratio ν approaches 0.5, what happens to the bulk modulus K?
   A) K approaches zero
   B) K approaches infinity
   C) K becomes equal to shear modulus G
   D) K becomes equal to Young's modulus E

6. Which of the following is NOT a principle of dimensioning?
   A) Dimensions should be clear and concise
   B) Avoid dimensioning to hidden lines
   C) Provide redundant dimensions
   D) Use standard units and symbols

7. What is the 5S system used in workplace housekeeping?
   A) A safety alarm system
   B) A material handling technique
   C) A method to eliminate chemical waste
   D) A method to organize and maintain clean workplaces

8. In first angle projection, the top view is placed:
   A) Above the front view
   B) Below the front view
   C) To the left of the front view
   D) To the right of the front view

9. Machining a ductile material like mild steel at a high cutting speed and large positive rake angle typically produces what type of chip?
   A) Discontinuous chips
   B) Segmental chips
   C) Continuous chips

D) Built-up edge chips

10. The "safety data sheet" (SDS) is used for:
A) Listing employee names
B) Describing chemical properties and hazards
C) Tracking equipment usage
D) Monitoring workshop temperature

11. A wire of length L and diameter d is stretched by a force F. If the diameter of the wire is doubled while keeping the length and force constant, the elongation will:
A) Increase by 2 times
B) Decrease by 2 times
C) Decrease by 4 times
D) Increase by 4 times

12. In data processing, which operation involves transforming data from one coordinate system to another?
A) Transformation
B) Interpolation
C) Regression
D) Normalization

13. The color yellow on safety signs usually indicates:
A) Fire hazard
B) Electrical hazard
C) Caution or warning
D) Emergency exit

14. An interlock device on a machine is intended to:
A) Increase production speed
B) Track usage time
C) Reduce vibrations
D) Prevent unsafe operation unless conditions are met

15. Which of the following non-ferrous alloys has the highest thermal conductivity?

A) Brass
B) Bronze
C) Copper
D) Aluminum

16. The term "carbon footprint" of a mechanical process refers to:

A) Number of carbon atoms in raw materials
B) Total greenhouse gases emitted, measured as CO_2 equivalent
C) Total electricity usage
D) Total soot particles generated

17. Which is the least preferred method in the waste management hierarchy?

A) Source reduction
B) Reuse
C) Landfilling
D) Recycling

18. The maximum draft achievable in a single rolling pass without cracking is governed by:

A) The roll diameter only
B) The friction coefficient between rolls and material
C) The material's yield strength and ductility
D) The rolling speed only

19. The hydrostatic pressure at the bottom of a tank 5 m deep containing water ($\rho = 1000$ kg/m^3, $g = 9810$ mm/s^2) is approximately:

A) 4.9×10^4 Pa
B) 4.9×10^7 Pa
C) 9.8×10^4 Pa
D) 9.8×10^7 Pa

20. A shaft is dimensioned as 25 mm ±0.02 mm, and the hole is dimensioned as 25.05 mm ±0.01 mm. What is the minimum clearance between the hole and shaft?

A) 0.00 mm
B) 0.02 mm
C) 0.04 mm
D) 0.03 mm

21. What is the purpose of sampling frequency in digital data acquisition?
A) To increase data resolution
B) To store more data
C) To define how often data points are collected per second
D) To convert digital data back to analog

22. In numerical data processing, which term refers to the measure of how spread out the data is
A) Variance
B) Mode
C) Mean
D) Median

23. In a sectional view, the cutting plane line is represented by:
A) Thin continuous line
B) Thick dashed line.
C) Thin dotted line
D) Thick chain line with arrows

24. What does the symbol "⌴" represent?
A) Countersink
B) Counterbore
C) Spotface
D) Chamfer

25. To inscribe an equilateral triangle inside a circle, the angle subtended by each side at the center is:
A) 120°
B) 90°
C) 60°
D) 180°

26. Hydrostatic pressure increases by 1 atm for every:
A) 10 m water depth
B) 9.81 m water depth
C) 1 m water depth
D) 100 m water depth

27. An auxiliary view is used to show:
A) Top view of complex objects
B) True shape of inclined surfaces
C) Hidden parts
D) Internal components

28. The term 'eutectic point' refers to:
A) Temperature, where alloy melts completely
B) Temperature, where two phases solidify simultaneously
C) Point of maximum hardness
D) Points of maximum ductility

29. In closed-die forging, which factor primarily controls the required forging load?
A) Lubricant viscosity only
B) Die temperature only
C) Rate of deformation only
D) Material flow stress and friction between die and workpiece

30. In a rolling process, a steel slab of 20 mm thickness is reduced to 12 mm in one pass. If the width remains constant at 500 mm and the length before rolling is 1 m, what is the length of the slab after rolling?
A) 1.2 m
B) 1.5 m
C) 1.67 m
D) 2.0 m

31. In arc welding, the main reason for slag formation is to:
A) Increase arc length
B) Shield the weld pool from oxidation
C) Add hardness to the weld

D) Cool down the weld faster

32. Which of the following is NOT a cutting tool?
A) Hacksaw
B) Chisel
C) File
D) Spanner

33. A cutting plane passing parallel to the slant edge of a cone produces a section that is:
A) A circle
B) An ellipse
C) A parabola
D) A hyperbola

34. A steel rod of length 1.2 m and diameter 10 mm is subjected to a tensile load that produces a stress of 100 MPa. Calculate the elongation if E=210 GPa.
A) 0.57 mm
B) 0.67 mm
C) 0.79 mm
D) 0.87 mm

35. In sheet metal bending, the neutral axis shifts towards the:
A) Outer surface (tension side)
B) Inner surface (compression side)
C) Mid-thickness of the sheet
D) Side opposite to bending force

36. In the principal stress formula, if τ_{xy}=0 and $\sigma_x = \sigma_y$, the principal stresses are:
A) Equal to σ_x
B) Zero
C) σ_x and $-\sigma_x$
D) Undefined

37. Which of the following is a non-ferrous metal?
A) Cast iron

B) Copper
C) Steel
D) Stainless steel

38. For a rectangular beam subjected to bending, the bending stress is maximum at:
A) Neutral axis
B) Supports
C) Mid-span
D) Outer fibers

39. Which of the following types of strain is NOT recoverable?
A) Elastic strain
B) Volumetric strain within elastic limit
C) Thermal strain
D) Plastic strain

40. Which of the following correctly represents the relationship between longitudinal strain ε_l and lateral strain ε_t using Poisson's ratio ν?
A) $\varepsilon_t = -\nu\varepsilon_l$
B) $\varepsilon_t = \nu\varepsilon_l$
C) $\varepsilon_l = -\nu\varepsilon_t$
D) $\varepsilon_l = \nu\varepsilon_t$

41. The main purpose of annealing is to:
A) Increase tensile strength
B) Relieve internal stresses and soften the metal
C) Harden the surface
D) Form martensite

42. Bronze is an alloy of copper and:
A) Zinc
B) Lead
C) Aluminum
D) Tin

43. Which non-ferrous alloy is commonly used for high-temperature applications due to its excellent creep resistance?

A) Brass
B) Bronze
C) Nickel-based superalloys
D) Aluminum

44. In a compressible fluid flow, the Mach number is defined as the ratio of:

A) Fluid velocity to sound velocity
B) Pressure to velocity
C) Velocity to density
D) Density to sound velocity

45. The maximum shear stress in a circular shaft subjected to torque T is given by:

A) $\frac{16T}{\pi d^3}$

B) $\frac{32T}{\pi d^3}$

C) $\frac{2T}{\pi d^3}$

D) $\frac{4T}{\pi d^3}$

46. For a material following perfectly plastic behavior, what happens to the stress after yielding?

A) It increases linearly
B) It remains constant
C) It decreases gradually
D) It increases exponentially

47. Which mechanical property is NOT directly obtained from a simple tensile test?

A) Young's modulus
B) Yield strength
C) Toughness

D) Fatigue strength

48. The phenomenon where fluid velocity near a solid boundary decreases to zero is known as:
A) Boundary layer separation
B) No-slip condition
C) Turbulent flow
D) Laminar sublayer

49. The core in casting is used to:
A) Form the external shape of casting
B) Support the pattern
C) Form internal cavities or hollow sections
D) Facilitate cooling

50. The circulation around a closed contour in an inviscid, incompressible, irrotational flow is:
A) Zero
B) Constant and non-zero
C) Depends on Reynolds number
D) Infinite

51. Least count of a micrometer with pitch 0.5 mm and 50 divisions on the sleeve is:
A) 0.01 mm
B) 0.005 mm
C) 0.02 mm
D) 0.025 mm

52. The allowance provided to a pattern for easy withdrawal from a sand mold is
A) Finishing allowance
B) Shake allowance
C) Shrinkage allowance
D) Distortion allowance

53. The rate of cooling affects:
A) Grain size of the casting

B) Color of the casting
C) Only the shape of casting
D) None of the above

54. The number of views required to fully describe an object in orthographic projection is typically:
A) 1
B) 2
C) 3
D) 4

55. The solidification process where liquid and solid phases coexist is called:
A) Nucleation
B) Growth
C) Mushy zone
D) Eutectic reaction

56. Wire EDM uses which of the following as the wire electrode?
A) Copper
B) Brass
C) Tungsten
D) All of the above

57. The primary advantage of hot working is:
A) Improved surface finish
B) Reduced tool wear
C) Increased strength
D) Increased hardness

58. A sheet metal strip 2 mm thick is bent over a punch of diameter 40 mm. Calculate the bending strain at the outer fiber of the sheet.
A) 0.025
B) 0.2
C) 0.1
D) 0.05

59. Which welding process uses a non-consumable tungsten electrode?
A) MIG welding

B) TIG welding
C) Arc welding with coated electrode
D) Gas welding

60. Which type of weld joint is most commonly used in brazing?
A) Lap joint
B) Butt joint
C) Corner joint
D) Edge joint

61. Lead-based solders are avoided in modern applications because:
A) They have poor conductivity
B) They are too expensive
C) They are brittle at room temperature
D) They are environmentally hazardous

62. The term "duty cycle" in arc welding refers to:
A) Total operating hours per week
B) Ratio of welding time to total cycle time
C) Welding current variability
D) Type of electrode used

63. A welding operation uses a current of 200 A and a voltage of 25 V. If the welding efficiency is 85%, what is the actual heat input per second (in joules)?
A) 4250 J
B) 5000 J
C) 3750 J
D) 2000 J

64. Which heat treatment process increases the hardness and strength of steel by rapid cooling?
A) Annealing
B) Normalizing
C) Quenching
D) Tempering

65. A feeler gauge is used to measure:

A) Angular displacement
B) Clearance between mating parts
C) Inside diameter
D) External thread pitch

66. Quick return mechanism reduces:
A) Return stroke time
B) Cutting stroke length
C) Power consumption
D) Feed rate

67. In Ultrasonic Machining (USM), material removal takes place by:
A) Chemical reaction
B) Spark erosion
C) Abrasive impact
D) Melting

68. A negative rake angle is preferred when:
A) Cutting soft materials
B) Using carbide tools at high speed
C) Using HSS tools at low speeds
D) Machining plastics

69. In orthogonal cutting, t_1= 0.20 mm, t_2=0.50 mm, α=10.
Find shear angle ϕ
A) 19.2°
B) 23.0°
C) 27.5°
D) 30.0°

70. A lathe with 8 mm feed per revolution and 500 rpm cuts a 500 mm long job. Find time required for one pass.
A) 10 s
B) 62.5 s
C) 7.5 s
D) 125 s

71. In gear hobbing, the angular velocity ratio between the hob and the workpiece depends on:
A) Number of starts on hob and number of teeth on gear
B) Diameter of hob
C) Feed rate
D) Type of gear material

72. In Electrochemical Machining (ECM), material removal is governed by:
A) Faraday's laws of electrolysis
B) Joule's law of heating
C) Archard's wear law
D) Ohm's law

73. The clamping system in jigs and fixtures must be designed to:
A) Compensate for vibration only
B) Allow for excess play
C) Increase tool wear
D) Withstand cutting forces without deformation

74. The rake angle may be:
A) Positive
B) Negative
C) Zero
D) All of the above

75. In ECM, the material removal rate $M \alpha I \alpha t/(nF)$. If current doubles and time halves, MRR:
A) Doubles
B) Remains same
C) Halves
D) Becomes 4×

76. In Laser Beam Machining (LBM), the primary mode of material removal is:
A) Chemical etching
B) Electrolysis
C) Melting and vaporization
D) Mechanical impact

77. In jig design, indexing is required when:

A) Multiple identical holes at specific angular positions are to be drilled
B) Workpiece is irregular
C) Tool wear is high
D) Quick clamping is not possible

78. Which of the following is a mechanical property of a material?
A) Density
B) Thermal conductivity
C) Hardness
D) Color

79. A cylindrical rod of length 2 m elongates by 1 mm under an axial load of 20 kN. If the diameter is 10 mm, find the modulus of elasticity.
A) 1.27×10^{10} Pa
B) 5.09×10^{11} Pa
C) 2×10^{10} Pa
D) 2×10^{11} Pa

80. The main function of a rake angle is to:
A) Strengthen the cutting edge
B) Reduce cutting forces and friction
C) Support the tool
D) Improve chip flow

81. A brittle material is more likely to fail under:
A) Tension than compression
B) Compression than tension
C) Equal under both
D) None of the above

82. Which casting process uses resin-coated sand?
A) Shell Molding
B) Centrifugal Casting
C) Lost Foam Casting
D) Investment Casting

83. The modulus of toughness of a material is represented by:
A) Slope of elastic region of stress-strain curve
B) Area under the entire stress-strain curve

C) Area under the elastic portion only
D) Maximum stress before fracture

84. The kinematic viscosity of a fluid is:
A) Dynamic viscosity × Density
B) Density/ Dynamic viscosity
C) Shear stress / Strain rate
D) Dynamic viscosity/Density

85. In which casting process is molten metal poured into a ceramic mold?
A) Die casting
B) Investment casting
C) Sand casting
D) Centrifugal casting

86. If a fluid exhibits shear-thinning behavior, it is:
A) Newtonian
B) Dilatant
C) Pseudoplastic
D) Ideal

87. Over-constraining a fixture can cause:
A) Increased accuracy
B) Reduced rigidity
C) Faster machining
D) Workpiece distortion

88. In case of fire, the first thing to do is:
A) Call your friend
B) Finish your work
C) Raise the alarm and evacuate
D) Take a photo

89. A single-point tool operates at 200 m/min with life 60 min. If speed is doubled, and n=0.25. Find new tool life.
A) 12 min
B) 15 min
C) 7.5 min
D) 3.75 min

90. "Zero Liquid Discharge" (ZLD) is a concept where:
A) All wastewater is reused or evaporated, and no discharge goes outside
B) Only rainwater is discharged
C) The plant operates only on Sundays
D) Wastewater is discharged into the ground

91. Which thermal property describes the ability of a material to resist changes in temperature?
A) Thermal conductivity
B) Thermal diffusivity
C) Specific heat capacity
D) Emissivity

92. The purpose of providing a taper or draft on a pattern is to:
A) Increase strength
B) Facilitate easy removal from the mold
C) Improve surface finish
D) Reduce material cost

93. What does the second "S" in 5S (Seiton) stand for?
A) Sweep
B) Sort
C) Standardize
D) Set in order

94. What does the term 'data filtering' refer to in the context of sensor data processing?
A) Removing unwanted noise or outliers
B) Converting data to a different format
C) Increasing data size
D) Encrypting the data

95. The modulus of resilience of a material is:
A) Energy absorbed per unit volume up to the yield point
B) Energy absorbed after the yield point
C) Total energy absorbed until fracture

D) Ratio of stress to strain at fracture

96. In a material under plane strain conditions, which strain component is zero?
A) Axial strain
B) Transverse strain
C) Strain in thickness direction
D) Shear strain

97. In gear manufacturing, the process of generating gear teeth by rolling a cutting tool over the blank is called:
A) Milling
B) Hobbing
C) Shaping
D) Broaching

98. Which numerical method is widely used for solving nonlinear equations arising in mechanical systems data processing?
A) Simpson's rule
B) Trapezoidal rule
C) Euler's method
D) Newton-Raphson method

99. For incompressible flow, the continuity equation states that:
A) Velocity is constant throughout
B) Volume flow rate is conserved
C) Pressure remains constant
D) Density varies with velocity

100. The term built-up edge (BUE) refers to:
A) A layer of material that forms on the tool tip during cutting
B) A layer of lubricant on the tool surface
C) Tool wear due to corrosion
D) Cracks on the tool surface