



General Instructions

- (i) The test is of 2 hours duration.
- (ii) This test paper consists of 120 questions. The maximum marks are 120.
- (iii) Each question carries +1 marks for correct answer and there is no negative marking for wrong answer.

1. If λ_1, λ_2 and λ_3 are the eigen values of a square matrix A , then the eigen values of $A^{-1} + 2I + A$ are

- (A) $\frac{1}{\lambda_1} + 2 + \lambda_1, \frac{1}{\lambda_2} + 2 + \lambda_2$ and $\frac{1}{\lambda_3} + 2 + \lambda_3$
- (B) $\frac{1}{\lambda_1} + 2 + \lambda_1, \frac{1}{\lambda_2} - 2 - \lambda_2$ and $\frac{1}{\lambda_3} - 2 - \lambda_3$
- (C) $\frac{1}{\lambda_1} - 2 - \lambda_1, \frac{1}{\lambda_2} - 2 - \lambda_2$ and $\frac{1}{\lambda_3} - 2 - \lambda_3$
- (D) $\frac{1}{\lambda_1} + 2 + \lambda_1, \frac{1}{\lambda_2} + 2 + \lambda_2$ and $\frac{1}{\lambda_3} + 2 + \lambda_3$

2. Let the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & -1 \end{bmatrix}$.

Statement-I: $A^2 = 9I$

Statement-II: The eigen values of A are -3 and 3

The correct answer is

- (A) Both statement-I and statement-II are true
- (B) Both statement-I and statement-II are false
- (C) Statement-I is true, but statement-II is false
- (D) Statement-I is false, but statement-II is true

3. Statement-I: The function $u = x^2 + y^2, v = \tan^{-1}\left(\frac{y}{x}\right)$ are functionally independent.

Statement-II: The Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ is non-zero.

The correct answer is

- (A) Statement-I is true, but statement-II is false
 - (B) Statement-I is false, but statement-II is true
 - (C) Both statement-I and statement-II are true
 - (D) Both statement-I and statement-II are false
-

4. If f and g are the solutions of Laplace equation then $\nabla \cdot \{(f \nabla g) - (g \nabla f)\} =$

- (A) ∇g
 - (B) 0
 - (C) 1
 - (D) ∇f
-

5. If the particular integral of $y'' - 4y' = x^2 e^{2x}$ is in the form $y_p = e^{2x} y(x)$, then $y(x)$ is

- (A) $-\frac{1}{4} \left(x^2 + \frac{1}{2} \right)$
 - (B) $\frac{1}{4} \left(x^2 + \frac{1}{2} \right)$
 - (C) $x^2 + \frac{1}{2}$
 - (D) $x + \frac{1}{2}$
-

6. $\mathcal{L}\{\sin(t-3)u(t-3)\} =$

- (A) $\frac{1}{s^2+1}$
 - (B) $\frac{3}{s^2+9}$
 - (C) $\frac{e^{-3s}}{s^2+1}$
 - (D) $\frac{e^{-3s}}{s^2+9}$
-

7. The Laurent's series for the function $f(z) = 1 + \frac{3}{z+2} - \frac{8}{z+3}$ in the region $|z| < 2$ is

- (A) $\frac{3}{2} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{3}\right)^n - \frac{8}{3} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{2}\right)^n$
 - (B) $1 + \frac{3}{2} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{2}\right)^n - \frac{8}{3} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{2}\right)^n$
 - (C) $1 + \frac{3}{2} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{2}\right)^n - \frac{8}{3} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{3}\right)^n$
 - (D) $\frac{3}{2} \sum_{n=0}^{\infty} \left(\frac{z}{2}\right)^n (-1)^n - \frac{8}{3} \sum_{n=0}^{\infty} (-1)^n \left(\frac{z}{3}\right)^n$
-

8. Given $x_0 \neq 0$, if the iteration formula $x_{n+1} = \frac{1}{2} \left(-\frac{7}{x_n} + x_n \right)$, $n \geq 0$ is used to find the root of $f(x) = 0$, then $f(x) =$

- (A) $9 + x^2$
 - (B) $4 + x^2$
 - (C) $7 + x^2$
 - (D) $-7 + x^2$
-

9. If a random variable X , defined such that $E(X - 1)^2 = 10$ and $E(X - 2)^2 = 6$ then mean (μ) and variance (σ^2) are

- (A) $\frac{2}{7}, \frac{4}{15}$
 - (B) $\frac{2}{7}, \frac{15}{4}$
 - (C) $\frac{7}{2}, \frac{4}{15}$
 - (D) $\frac{7}{2}, \frac{15}{4}$
-

10. Which of the following is not the property of a distribution function $F(x)$ of a random variable X ?

- (A) $P(a \leq X \leq b) = F(b) - F(a)$
 - (B) $F(x) \leq F(y)$ if $x < y$
 - (C) $\lim_{x \rightarrow -\infty} F(x) = 0$ and $\lim_{x \rightarrow \infty} F(x) = 1$
 - (D) $F(1) = \frac{1}{2}$
-

11. Three coplanar equilibrium forces $P = 40$ N, $Q = x$ N and $R = y$ N are acting on a body and the body is said to be in equilibrium when the angle included between each other is 120° , then $x =$

- (A) 20 N
 - (B) 40 N
 - (C) 60 N
 - (D) 80 N
-

12. Two equal forces each of magnitude P acting at a point with an angle of (α) , then the resultant force is

- (A) $2 P \sin\left(\frac{\alpha}{2}\right)$
 - (B) $2 P \cot\left(\frac{\alpha}{2}\right)$
 - (C) $2 P \cos\left(\frac{\alpha}{2}\right)$
 - (D) $2 P \tan\left(\frac{\alpha}{2}\right)$
-

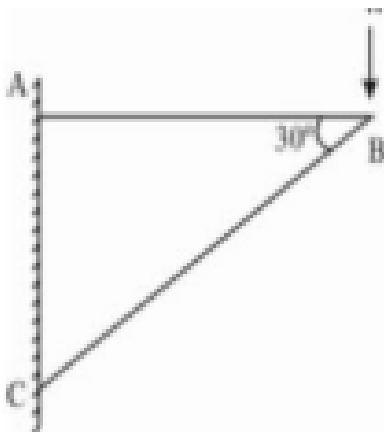
13. The range of projectile is maximum when the angle of projection is

- (A) 30°
 - (B) 45°
 - (C) 60°
 - (D) 90°
-

14. If the double threaded square screw is having mean diameter 8 cm and pitch 2 cm, then the lead of the double threaded square screw is

- (A) 1 cm
 - (B) 2 cm
 - (C) 6 cm
 - (D) 4 cm
-

15. The simple truss structure is shown below. The forces acting in the members AB and BC respectively are



- (A) 1.732 W compression & 2 W tensile
- (B) 1.414 W tensile and 1.732 W compression
- (C) 3.464 W compression & 2 W tensile

(D) 1.732 W tensile and 2 W compression

16. If a particle has the initial velocity of $v_0 = 12 \text{ m/s}$ to the right at $S_0 = 0$. Then what is the position when $t = 10 \text{ s}$ and $a = 2 \text{ m/s}^2$ to the left?

- (A) 10 m
 - (B) 15 m
 - (C) 20 m
 - (D) 25 m
-

17. The relation of three elastic constants of a metal in terms of Young's Modulus (E), Modulus of rigidity (G) and Bulk Modulus (K) is expressed as

- (A) $E = \frac{3KG}{(3K+G)}$
 - (B) $E = \frac{6KG}{(3K+G)}$
 - (C) $E = \frac{8KG}{(3K+G)}$
 - (D) $E = \frac{9KG}{(3K+G)}$
-

18. Which planes carry maximum normal stress and what is shear stress on these planes

- (A) Maximum shear planes, Maximum
 - (B) Principal planes, zero
 - (C) Oblique planes, Minimum
 - (D) Oblique planes, Maximum
-

19. Based on the limiting factor to prevent bursting in thin cylinder, the design is primarily made based on which stress

- (A) Maximum volumetric stress
 - (B) Maximum longitudinal stress
 - (C) Maximum shear stress
 - (D) Maximum hoop stress
-

20. A tapering bar varying from the diameters from ' d_1 ' to ' d_2 ' and a bar of uniform cross section ' d ' have the same length and subjected to same axial pull attains the same extension. Then the ' d ' is equal to

- (A) Geometric mean of d_1 and d_2
 - (B) Arithmetic mean of d_1 and d_2
 - (C) Harmonic mean of d_1 and d_2
 - (D) Meridian of d_1 and d_2
-

21. In general, a sudden jump in the bending moment diagram is due to the following type of loading condition?

- (A) Large point load acting at that point
 - (B) Concentrated couple acting at that point
 - (C) Starting point of the UDL
 - (D) Support reaction at that point
-

22. A circular shaft has been designed for the twisting moment of $5 \text{ kN} \cdot \text{m}$. If the twisting moment is reduced to $4 \text{ kN} \cdot \text{m}$, then what will be the maximum value of bending moment that can be applied for the same designed condition?

- (A) $1 \text{ kN} \cdot \text{m}$
 - (B) $1.5 \text{ kN} \cdot \text{m}$
 - (C) $2 \text{ kN} \cdot \text{m}$
 - (D) $3 \text{ kN} \cdot \text{m}$
-

23. A long steel column of uniform cross section is subjected to a crippling load of 10 kN as per the Euler designed condition. If the length of the column is reduced to half, then what would be the maximum Euler's crippling load?

- (A) 50 kN
 - (B) 40 kN
 - (C) 20 kN
 - (D) 10 kN
-

24. Two bars A and B made of different material have same length. The coefficient of expansion and Young's modulus of bar B is twice that of bar A. If the temperature of both bars is increased by the same amount while preventing any expansion, then the ratio of stress developed in bar A to that in bar B is

- (A) 16
 - (B) 8
 - (C) 4
 - (D) 2
-

25. In a given mechanism, the number of links are five. Then the number of instantaneous centres of the mechanism is

- (A) 10
 - (B) 6
 - (C) 5
 - (D) 15
-

26. Assume that the connecting rod and the crank of an engine forms as two sides of the triangle. If the area included in the triangle is maximum when the crank is at 60° , then the ratio of length of connecting rod to the radius of the crank is

- (A) 1
 - (B) 1.414
 - (C) 1.732
 - (D) 0.577
-

27. For the better dynamic performance of cam follower mechanism, the following displacement diagrams should be chosen

- (A) Simple harmonic motion
 - (B) Parabolic motion
 - (C) Cycloidal motion
 - (D) Uniform acceleration
-

28. The minimum number of teeth on the pinion in order to avoid interference for 20° full depth involute system is

- (A) 12
- (B) 14
- (C) 18

(D) 32

29. A flywheel is designed for engine speed variation from 190 rps to 210 rps. Calculate the inertia of the wheel if the kinetic energy stored in the flywheel is $400 \text{ N} \cdot \text{m}$.

- (A) $0.02 \text{ kg} \cdot \text{m}^2$
 - (B) $0.01 \text{ kg} \cdot \text{m}^2$
 - (C) $0.2 \text{ kg} \cdot \text{m}^2$
 - (D) $0.1 \text{ kg} \cdot \text{m}^2$
-

30. A governor is said to be stable, if the radius of rotation of balls

- (A) increases as the equilibrium speed decreases
 - (B) decreases as the equilibrium speed decreases
 - (C) increases as the equilibrium speed increases
 - (D) decreases as the equilibrium speed increases
-

31. Which of the following statements are associated with the complete dynamic balancing of rotating systems?

- I. Resultant couple due to all inertia forces is zero**
- II. Support reactions due to forces are zero but not due to couples**
- III. The system is automatically statically balanced**
- IV. Centre of masses of the system lies on the axis of rotation**

- (1) I, II, III and IV
 - (2) I, II and III only
 - (3) II, III and IV only
 - (4) I, III and IV only
-

32. Consider a single degree of freedom system with viscous damping excited by a harmonic force. At resonance, the phase angle of the displacement with respect to the exciting force in degrees is

- (1) 0
 - (2) 45
 - (3) 90
-

(4) 135

33. In Rayleigh's method, which of the following energy at the mean position is equal to the maximum potential energy (or strain energy) at the extreme position?

- (1) Maximum kinetic energy
 - (2) Minimum kinetic energy
 - (3) Maximum potential energy
 - (4) Minimum potential energy
-

34. The critical speed of the shaft is affected by the

- (1) Diameter and the eccentricity of the shaft
 - (2) Span and the eccentricity of the shaft
 - (3) Diameter and the span of the shaft
 - (4) Frequency of vibrations
-

35. If a radial ball bearing has a basic load rating of 50 kN and desired rating life is 6000 hours, then the equivalent radial load that the bearing can carry at 500 rpm is

- (1) 18.85 kN
 - (2) 8.85 kN
 - (3) 12 kN
 - (4) 10 kN
-

36. The difference between two principal stresses is 120 MPa, when a circular shaft is subjected to an axial force and shear force. What is the factor of safety based on maximum shear stress theory if elastic limit of the bar is 300 MPa?

- (1) 1.03
 - (2) 2.5
 - (3) 3.25
 - (4) 5.0
-

37. If the core diameter of threads equal to the diameter of unthreaded portion of the bolt, then it is known as

- (1) Bolt of uniform strength
 - (2) Bolt of fatigue strength
 - (3) Bolt of tensile strength
 - (4) Bolt of compressive strength
-

38. A shaft diameter 'd' is connected to the hub through a square key each of side 'd/4' and length 'l' and transmits a torque 'T'. Assume the length of key is equal to thickness of the pulley, the average shear stress developed in the key is

- (1) $\frac{T}{ld^2}$
 - (2) $\frac{2T}{ld^2}$
 - (3) $\frac{8T}{ld^2}$
 - (4) $\frac{4T}{ld^2}$
-

39. When brakes are applied to a moving vehicle, then the kinetic energy of the vehicle is converted to

- (1) Potential energy
 - (2) Mechanical energy
 - (3) Gravitational energy
 - (4) Heat energy
-

40. Generally, in welded joints, the maximum size of fillet weld is considered by

- (1) adding 1.5 mm to thickness of thinner member to be jointed
 - (2) adding 3 mm to thickness of thinner member to be jointed
 - (3) subtracting 3 mm from thickness of thinner member to be jointed
 - (4) subtracting 1.5 mm from thickness of thinner member to be jointed
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41. The close-coiled helical springs 'A' and 'B' are of same material, same coil diameter, same wire diameter and subjected to same load. If the number of turns of spring 'A' is half that of spring 'B', the ratio of deflection of spring 'A' to spring 'B' is

- (1) $\frac{1}{2}$
- (2) 1

(3) 2

(4) 4

42. The variation of volume of liquid with respect to the pressure and its reciprocal respectively are

(1) Compressibility & Young's modulus

(2) Young's modulus & Compressibility

(3) Compressibility & Bulk modulus

(4) Bulk modulus & Compressibility

43. If the net rotation of fluid particles about their mass centre remains zero, then such type of flow is known as

(1) Rotational flow

(2) Irrotational flow

(3) Laminar flow

(4) Turbulent flow

44. When a body is floating in the liquid and given a small angular displacement, then the body starts oscillating about a centre. That centre is called as

(1) Centre of pressure

(2) Centre of gravity

(3) Centre of buoyancy

(4) Metacentre

45. A pipe line has a diameter of 5 cm in which water flows at a pressure of 10^5 N/m^2 with a mean velocity of 2 m/s. If the head of the water at the cross section is 5 m above the datum line and consider $g = 10 \text{ m/s}^2$, then the total head is

(1) 15.2 m

(2) 5.2 m

(3) 18.2 m

(4) 21.2 m

46. For the fluid flowing over the flat plate, the state of boundary layer separation occurs when

- (1) Pressure gradient is zero
 - (2) Velocity gradient is zero
 - (3) Reynolds number is zero
 - (4) Flow is accelerating
-

47. A pipe friction test shows that, over the range of speeds used for the test, the non-dimensional friction factor varies inversely with Reynolds number. From this, one can conclude that the

- (1) Pipe must be smooth
 - (2) Flow must be laminar
 - (3) Flow must be turbulent
 - (4) Pipe must be rough
-

48. In turbulent flow, the loss of pressure head is approximately (where v is the velocity of flow)

- (1) Directly proportional to v
 - (2) Inversely proportional to v
 - (3) Directly proportional to v^2
 - (4) Inversely proportional to v^2
-

49. During a summer day a scooter rider feels more comfortable while on the move than while at rest at a stop light because

- (1) More heat is lost by convection while in motion
 - (2) Air is transparent to radiation, hence it is cooler than the body
 - (3) The object in motion captures less solar radiation
 - (4) Air has a low specific heat, hence it is cooler
-

50. For heat transfer calculation in fins, if the Biot number is very small ($Bi < 0.1$) it implies

- (1) Higher convective resistance
- (2) High temperature gradient in the fin

- (3) Fin is infinitely long
 - (4) Negligible internal conductive resistance
-

51. The characteristic length (L_c) for the calculation of Biot number (Bi) for a sphere of radius 'R' subjected to Newtonian cooling is

- (1) R
 - (2) $\frac{R}{2}$
 - (3) $\frac{R}{3}$
 - (4) 3R
-

52. For a fully developed flow through a pipe, how will the heat transfer coefficient (h) change, when the mean flow rate is doubled with all other conditions remaining the same?

- (1) h increases by 50% (approx)
 - (2) h increases by 74% (approx)
 - (3) h decreases by 87% (approx)
 - (4) h increases by 20% (approx)
-

53. If the surface temperature of hot body is doubled, then rate of radiation energy emitted will be enhanced by a factor of

- (1) 2
 - (2) 4
 - (3) 16
 - (4) 32
-

54. Expansion bellows are provided in the shell and tube heat exchangers in order to

- (1) Increase the surface area
 - (2) Relieve stresses caused by thermal expansion
 - (3) Increase the turbulence
 - (4) Reduce the pressure drop
-

55. On the specified surface, if 35% of incident radiation energy is reflected and the transmissivity of the body is 0.3, then the emissivity of the surface is

- (1) 0.35
 - (2) 0.3
 - (3) 1.0
 - (4) 0.65
-

56. In a combined cycle for power generation, if the topping cycle has an efficiency of 45% and for bottoming cycle 30%, then the combined efficiency of the cycle is

- (A) 45%
 - (B) 30%
 - (C) 75%
 - (D) 61.5%
-

57. A real gas undergoes throttling from 50 bar to 10 bar from an initial temperature of 300 K. If $\mu_{JT} = -0.05$ K/bar for the initial condition, what is the approximate value of the exit temperature?

- (A) 298 K
 - (B) 302 K
 - (C) 300 K
 - (D) 304 K
-

58. A mixture of gas expands from 0.03 m^3 to 0.06 m^3 at a constant pressure of 1 MPa and absorbs 84 kJ of heat during the process. The change in internal energy of the mixture is

- (A) 30 kJ
 - (B) 54 kJ
 - (C) 114 kJ
 - (D) 84 kJ
-

59. Two reversible heat engines are operated with same heat input and heat output. One of the engine is operated between the temperature limits of T_2 and 200 K & another is between 800 K and T_2 . Then the value of T_2 is

- (A) 100 K
 - (B) 200 K
-

- (C) 400 K
 - (D) 500 K
-

60. If a substance is perfect crystal and existing at absolute zero K, then the specific entropy of the substance is

- (A) Infinite
 - (B) Positive
 - (C) Negative
 - (D) Zero
-

61. The maximum amount of low grade energy, which is convertible into work is known as

- (A) Anergy
 - (B) Exergy
 - (C) Entropy
 - (D) Energy loss
-

62. A balloon containing an ideal gas is initially kept in an evacuated and insulated room. If the balloon ruptures and the gas fills the entire room, what is the correct statement at the end of the process?

- (A) The internal energy of the gas decreases from its initial value, but the enthalpy remains constant
 - (B) The internal energy of the gas increases from its initial value, but the enthalpy remains constant
 - (C) Internal energy and enthalpy of the gas remain constant
 - (D) Internal energy and enthalpy of the gas increase
-

63. Based on second law of thermodynamics the loss in available energy is being quantified as

- (A) Irreversibility
 - (B) Decrease in available energy
 - (C) Entropy loss
 - (D) Energy loss
-

64. The clearance is provided in the reciprocating compressor with clearance ratio of 'k'. If the pressure ratio is $\frac{P_2}{P_1}$, then the volumetric efficiency in terms of clearance ratio k, is

- (A) $1 + k - k \left(\frac{P_2}{P_1} \right)^{(1/n)}$
(B) $1 - k + k \left(\frac{P_2}{P_1} \right)^{(1/n)}$
(C) $1 - k - k \left(\frac{P_2}{P_1} \right)^{(1/n)}$
(D) $1 + k + k \left(\frac{P_2}{P_1} \right)^{(1/n)}$
-

65. In an axial flow compressor, if the air stream is not able to follow the blade contour such phenomena is known as

- (A) Surging
(B) Haulling
(C) Stalling
(D) Chocking
-

66. In an ideal Brayton power cycle operated for the gas turbine plant, if T_1 is the minimum temperature, T_3 is the maximum temperature and pressure ratio is r_p , then the net work ratio is given as

- (A) $1 - \left(\frac{T_3}{T_1} \right) (r_p)^{(\gamma-1)/\gamma}$
(B) $1 - \left(\frac{T_1}{T_3} \right) (r_p)^{(\gamma-1)/\gamma}$
(C) $1 - \left(\frac{T_3}{T_1} \right) (r_p)^{\gamma/(\gamma-1)}$
(D) $1 - \left(\frac{T_1}{T_3} \right) (r_p)^{\gamma/(\gamma-1)}$
-

67. If regenerator is added to a Brayton cycle, the thermal efficiency is improved due to

- (A) Increase in temperature of gases at turbine inlet
(B) Decrease in compressor input
(C) Increase in turbine output
(D) Decrease in quantity of heat in combustion chamber
-

68. Generally, in spark ignition engines, the compression ratio cannot be enhanced beyond certain limit because to avoid

- (A) Auto ignition
(B) Over heating
(C) Knocking
-

(D) Preheating

69. In a CI engine, the delay period in the combustion process mainly corresponds to

- (A) Time taken for fuel injection into the cylinder
 - (B) Time taken between the start of fuel injection and start of combustion
 - (C) Time between the end of fuel injection and start of combustion
 - (D) Time between the start of combustion and attaining maximum pressure
-

70. The refrigerant and absorbent used in Vapour absorption refrigeration system respectively are

- (A) Water and water
 - (B) Lithium bromide and water
 - (C) Ammonia and lithium bromide
 - (D) Ammonia and water
-

71. An air conditioning system mixes 30% fresh air at 35 °C DBT and 50% RH with 70% recirculated air at 35 °C DBT and 50% RH. Which of the following statements about "mixed air condition" is true?

- (A) The mixed air DBT will be 25 °C
 - (B) The mixed air humidity ratio will be equal to the arithmetic mean of two humidity ratios
 - (C) The mixed air state point will lie on the straight line joining the two states on the psychrometric chart
 - (D) The relative humidity of the mixed air will be equal to 50%
-

72. The whirl component of turbine blades is zero for the following turbine.

- (A) Parson's reaction turbine
 - (B) Curtis turbine
 - (C) Axial flow turbine
 - (D) Impulse turbine with equal blade angles at the inlet and outlet
-

73. A single stage impulse turbine with a diameter of 1.2 m runs at 3000 rpm. If the blade speed ratio is 0.42, the inlet velocity of steam will be (in ms^{-1})

- (A) 450
 - (B) 900
 - (C) 200
 - (D) 600
-

74. In order to increase the corrosion resistance of stainless steel, the following element is added

- (A) Nickel
 - (B) Molybdenum
 - (C) Carbon
 - (D) Chromium
-

75. If the material has the tendency to fracture without any appreciable deformation is known as

- (A) Stiffness
 - (B) Brittleness
 - (C) Toughness
 - (D) Malleability
-

76. The heat treatment process used to enrich the steel surface by addition of Nitrogen is known as

- (A) Annealing
 - (B) Surface hardening
 - (C) Tempering
 - (D) Nitriding
-

77. In a linearly hardening plastic material, the true stress beyond the initial yielding

- (A) Decreases linearly with the true strain
 - (B) Increases linearly with the true strain
 - (C) Remains constant with true strain
 - (D) Increases exponentially with true strain
-

78. The area under the linear curve of stress-strain diagram within the elastic limit is known as

- (A) Strain energy
 - (B) Kinetic energy
 - (C) Potential energy
 - (D) Gravitational energy
-

79. Which one of the following metal has maximum value of yield strength?

- (A) Copper alloy
 - (B) High-carbon steel
 - (C) Mild steel
 - (D) Medium-carbon steel
-

80. Based on Iron-Carbon diagram, when austenite decomposes during cooling process, an eutectoid mixture is formed. The nature of the element is

- (A) Ferrite
 - (B) Cementite
 - (C) Martensite
 - (D) Pearlite
-

81. In casting process, the covering passage is used for feeding the liquid metal into the mould to

- (A) Decrease the waste of cast metal
 - (B) Avoid the aspiration of air
 - (C) Increase rate of feeding
 - (D) Quickly break off the protecting portion of the casting
-

82. A low projection on the drag surface of a casting commencing near the gate by erosion of sand due to the high velocity liquid metal in the bottom gating. This defect is known as:

- (A) Cold shut
- (B) Swell

- (C) Blow holes
 - (D) Wash
-

83. The shrinkage allowance has been provided on the pattern to compensate the shrinkage when:

- (A) The temperature of liquid metal drops from pouring to freezing temperature
 - (B) The metal changes from liquid to solid state at freezing temperature
 - (C) The temperature of solid phase drops from freezing to room temperature
 - (D) The temperature of metal drops from pouring to room temperature
-

84. The commonly used casting process for producing intricate and detailed sculptures is:

- (A) Sand casting
 - (B) Investment casting
 - (C) Die casting
 - (D) Permanent mould casting
-

85. While designing the gating system, the ratio of 1 : 2 : 4 represents:

- (A) Sprue base area : runner area : ingate area
 - (B) Pouring basin area : ingate area : runner area
 - (C) Sprue base area : ingate area : casting area
 - (D) Runner area : ingate area : casting area
-

86. The extrusion process used to manufacture the short length components like paste tubes, gun shells etc., is

- (A) Direct extrusion
 - (B) Continuous extrusion
 - (C) Hydrostatic extrusion
 - (D) Indirect extrusion
-

87. The phenomenon where a metal part tends to partially return to its original shape after the forming tool is removed is known as

- (A) Spring back
 - (B) Elastic recovery
 - (C) Strain hardening
 - (D) Plastic deformation
-

88. The secondary operation which is used to improve the self-lubricating capacity of the sintered part in powder metallurgy is

- (A) Infiltration
 - (B) Impregnation
 - (C) Repressing
 - (D) Coining
-

89. In MIG welding process, the commonly used gases for shielding are

- (A) Argon and Helium
 - (B) Oxygen and Acetylene
 - (C) Nitrogen and Hydrogen
 - (D) Carbon dioxide and Nitrogen
-

90. The welding process used for joining railway tracks is

- (A) TIG welding
 - (B) Spot welding
 - (C) Submerged welding
 - (D) Thermit welding
-

91. What is the key requirement for an adhesive to properly bond to a surface?

- (A) High surface roughness
 - (B) High surface tension
 - (C) Good wetting
 - (D) Friction free surface
-

92. According to the Taylor's tool life equation, if the cutting speed is halved with index $n = 0.25$, then the tool life:

- (A) Increases by 8 times
 - (B) Decreases by 8 times
 - (C) Decreases by 16 times
 - (D) Increases by 16 times
-

93. The Titanium Nitride or Titanium Carbonitride coated cutting tools are majorly used to

- (A) Make the tool ductile
 - (B) Reduce friction and wear resistance
 - (C) Increase tool toughness
 - (D) Increase thermal conductivity
-

94. As the cutting speed increases, how do the machining cost and tooling cost behave?

- (A) Machining cost decreases while tooling cost increases
 - (B) Both machining cost and tooling cost both increases
 - (C) Both machining cost and tooling cost both decreases
 - (D) Machining cost increases while tooling cost decreases
-

95. The vacuum is a mandatory requirement for which of the following non traditional machining process?

- (A) Laser beam machining
 - (B) Water jet machining
 - (C) Electron beam machining
 - (D) Plasma Arc machining
-

96. A device/mechanism used to position a work piece in the same position, cycle after the cycle is called

- (A) Indexing device
 - (B) Guiding device
 - (C) Clamping device
 - (D) Locating device
-

97. The main purpose of an Automatic Tool Changer (ATC) in CNC machining process is to reduce:

- (A) Machining maintenance
 - (B) Cutting speed
 - (C) Tool change time and idle time
 - (D) Material hardness
-

98. Which type of jig is generally used for machining in more than one plane without changing the setting?

- (A) Box jig
 - (B) Channel jig
 - (C) Template jig
 - (D) Plate jig
-

99. Which of the following parameters is NOT the essential requirement for accuracy of the measurement with the sine bar?

- (A) Flatness of upper surface, equality of size and roundness of rollers
 - (B) Exact distance between the roller axes and mutual parallelism
 - (C) Parallelism between top surface and bottom surface
 - (D) Parallelism of the roller axes to the upper surface
-

100. The instrument used for the direct measurement of surface quality by dragging a stylus across the surface is:

- (A) Clinometer
 - (B) Sine bar
 - (C) Autocollimator
 - (D) Profile meter
-

101. As per the Indian standards, the limits and fits specify how many grades of tolerances?

- (A) 10
- (B) 18

(C) 22

(D) 28

102. Which of the following is NOT a common probe type used in a coordinate measuring machine?

(A) Electromagnetic

(B) Laser

(C) Scanning

(D) Touch-trigger

103. What is the primary purpose of direct numerical control in the context of CAD/CAM integration?

(A) Generating G codes automatically

(B) Converting the analog signals into digital

(C) Designing 3D models

(D) Networking multiple CNC machines to a single computer

104. Which of the additive manufacturing techniques uses a laser to cure liquid photopolymer resin in a vat?

(A) Stereolithography

(B) Fused Deposition modelling

(C) Selective Laser Sintering

(D) Binding Jetting

105. Find out the correct sequence for the additive manufacturing process chain?

(A) Build, post processing, STL conversion, CAD

(B) CAD, STL conversion, Build, Post processing

(C) Post processing, Build, STL conversion, CAD

(D) CAD, Build, STL conversion, Post processing

106. In time series analysis of forecasting technique, which of the source variation can be estimated by ratio to trend method?

- (A) Cyclical
 - (B) Irregular
 - (C) Trend
 - (D) Seasonal
-

107. The correct order of series of operations to be carried out in production planning control is:

- (A) Dispatching – Routing – Scheduling – Follow up
 - (B) Routing – Scheduling – Follow up – Dispatching
 - (C) Routing – Scheduling – Dispatching – Follow up
 - (D) Scheduling – Routing – Dispatching – Follow up
-

108. In the first come first service (FCFS) scheduling algorithm, which process is executed first?

- (A) The process with the shortest burst time
 - (B) The process that arrives first
 - (C) The process with the highest priority
 - (D) The process with the longest burst time
-

109. The term Therbligs are generally relevant with

- (1) Fatigue allowance in work measurement
 - (2) Scheduling processes
 - (3) Elementary motions of time study
 - (4) Efficiency of the operator
-

110. If the objective is maximizing the quality production by ensuring production machine availability and reducing machine breakdowns, which of the following lean tool will best work for this?

- (1) Kaizen
- (2) Visual controls
- (3) Control plan
- (4) Total productive maintenance

111. For an assembly line, the inventory was calculated by considering the production rate as 4 pieces per hour and the average processing time as 60 minutes. Now, if the production rate is kept the same and the average processing time is brought down by 30%, then the change in inventory is

- (1) Decreased by 25%
- (2) Increased by 25%
- (3) Decreased by 30%
- (4) Increased by 30%

112. To issue and running balance of certain items of stock in inventory, which of the following keeps a record of items?

- (1) Bin cards
- (2) Stock items
- (3) Quantity account
- (4) Value account

113. The demand for a commodity is 100 units per day. Every time an order is placed, a fixed cost of Rs 400 is incurred and the holding cost is Rs 0.08 per unit per day. If the lead time is 13 days, then the economic lot size and the reorder point are in units

- (1) 800 and 130
- (2) 840 and 100
- (3) 890 and 300
- (4) 1000 and 300

114. Average stock level required to maintain the inventory is calculated as

- (1) Minimum stock level + half of the reorder cost
- (2) Maximum stock level + half of the reorder cost
- (3) Minimum stock level + one fourth of the reorder cost
- (4) Maximum stock level + one fourth of the reorder cost

115. Which of the following relationships hold correct for the safety stock of inventory?

- (1) The greater the risk of running out of stock, the small the safety of stock
 - (2) The larger the opportunity cost of the funds invested inventory, the larger the safety stock
 - (3) The greater the uncertainty associated with forecasted demand, the higher the safety stock
 - (4) None of the options are correct
-

116. The pessimistic time and optimistic time of completion of an activity are given as 10 days and 4 days respectively. Then the variance of the activity is

- (1) 14
 - (2) 6
 - (3) 2
 - (4) 1
-

117. In a graphical solution of solving Linear Programming Problem to convert inequalities into equations, they

- (1) Use slack variables
 - (2) Use surplus variables
 - (3) Use artificial surplus variables
 - (4) Assume them to be equations
-

118. The penalty of a row in a transportation problem is obtained by

- (1) Deducting smallest element in the row from all other elements of the row
 - (2) Deducting smallest element in the row from the next highest element of the row
 - (3) Adding smallest element in the row to all other elements of the row
 - (4) None of the options are correct
-

119. Which of the cost estimates and performance measures are not used for economic analysis of a queuing system?

- (1) Cost per server per unit of time
 - (2) Average waiting time of customers in the system
 - (3) Cost per unit time for a customer waiting in the system
 - (4) The average number of customers in the system
-

120. The activities of W, X, Y and Z are the direct precursors of A. What is the earliest starting time for A, if the activities of earliest finishing times are 12, 15, 10 and 6?

- (1) 6
 - (2) 10
 - (3) 15
 - (4) 12
-