Total No. of Printed Pages : 21

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SET-X

A

Ph.D-EE-December, 2024
Mechanical Engineering

10013

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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SEAL

1. In the FBD of a simply supported beam, the reaction forces are located :
   (1) At the mid-span of the beam.
   (2) At the points of support.
   (3) Distributed along the entire length.
   (4) At the centroid of the beam.

2. In a truss, a zero-force member is identified when :
   (1) Two non-collinear members meet at a joint with no external force or support.
   (2) Three members meet at a joint under an external force.
   (3) All members are loaded equally.
   (4) The truss is symmetric

3. Virtual work is especially useful in analyzing :
   (1) Simple, determinate systems.
   (2) Systems with large deformations only.
   (3) Systems with multiple constraints and redundancies.
   (4) Systems with no external forces.

4. A disc of radius 0.5 m is initially at rest. It starts rotating with a constant angular acceleration of 4 rad/s^2. The linear velocity of a point on its edge after 2s is :
   (1) 2 m/s (2) 4 m/s
   (3) 6 m/s (4) 8 m/s

5. If the Young's modulus (E) of a material is 200 GPa and Poisson's ratio (v) is 0.3, the shear modulus (G) is approximately :
   (1) 76.9 GPa (2) 100 GPa
   (3) 153.8 GPa (4) 66.7 GPa

6. Which of the following materials exhibits a significant plastic region in the stress-strain curve ?

(1) Cast iron
(2) Glass
(3) Mild steel
(4) Concrete

7. The area under the stress-strain curve up to the proportional limit represents :

(1) Modulus of resilience
(2) Modulus of toughness
(3) Yield strength
(4) Factor of safety

8. Mohr's Circle is used to determine :

(1) Only shear stresses
(2) Principal stresses and principal planes
(3) Deflection of beams
(4) Strain energy

9. The diameter of Mohr's Circle represents :

(1) Maximum normal stress
(2) Minimum normal stress
(3) Maximum shear stress
(4) Von Mises stress

10. For a plane stress condition with $\sigma x=100$ MPa, $\sigma y=50$ MPa, and $\tau xy=25$ MPa, the centre of Mohr's Circle lies at:

(1) (50,25)
(2) (75, 0)
(3) (100,25)
(4) (0,50)

11. For a uniformly distributed load (UDL) on a simply supported beam, the bending moment diagram will be:

(1) Linear
(2) Parabolic
(3) Cubic
(4) Horizontal

12. The point of contraflexure in a beam is the point where :

(1) Shear force is maximum
(2) Shear force is zero
(3) Bending moment changes sign
(4) Bending moment is maximum

13. For a cantilever beam with a point load P at its free end, the bending moment at the fixed support is :

(1) Zero
(2) PL
(3) PL/2
(4) P/L

14. Deflection of a beam is inversely proportional to :

(1) Load on the beam
(2) Span of the beam
(3) Flexural rigidity (EI)
(4) Moment of inertia

15. The SI unit of beam deflection is:

(1) Newton (N)
(2) Meter (m)
(3) Newton-meter (N.m)
(4) Meter per second squared (m/s^2)

16. For beams with the same length and load, the beam with the smallest deflection has :

(1) The smallest moment of inertia
(2) The largest moment of inertia
(3) The smallest modulus of elasticity
(4) The largest modulus of rigidity

17. For the same weight and material, a hollow circular shaft is stronger than a solid circular shaft because :

(1) Hollow shafts have greater cross-sectional area
(2) Hollow shafts have larger polar moment of inertia
(3) Hollow shafts have lower radius of gyration
(4) Hollow shafts have uniform shear stress

18. The torsional critical speed of a shaft depends on :

(1) Length and material of the shaft

(2) Length and diameter of the shaft

(3) Diameter and polar moment of inertia

(4) Material and polar moment of inertia

19. The kinetic energy stored in a flywheel is proportional to :

(1) Square of its angular velocity

(2) Cube of its radius

(3) Inverse of its mass

(4) Inverse of its moment of inertia

20. Epicyclic gear trains are widely used in :

(1) Gear pumps

(2) Lathe machines

(3) Clocks

(4) Automatic transmissions

21. A reverted gear train is a special case where :

(1) All gears rotate in the same direction

(2) The input and output shafts are collinear

(3) Intermediate gears have the same number of teeth

(4) The input and output shafts have the same speed

22. The slider-crank mechanism consists of :

(1) 2 links and 1 pair

(2) 3 links and 2 pairs

(3) 4 links and 4 pairs

(4) 4 links and 3 pairs

23. Which of the following is NOT an inversion of the slider-crank mechanism ?

(1) Whitworth quick return mechanism (2) Oscillating cylinder engine

(3) Elliptical trammel (4) Rotary engine

24. If a bar is free to expand under a temperature increase, the thermal stress in the bar will be :

(1) Maximum

(2) Zero

(3) Equal to the yield strength of the material

(4) Equal to $E\alpha\Delta T$

25. The degree of freedom of a simple slider-crank mechanism is :

(1) 1 (2) 2

(3) 3 (4) 4

26. Entropy change during a reversible isothermal process is :

(1) Zero (2) Q/T

(3) T/Q (4) PV

27. Which of the following is an extensive property ?

(1) Temperature (2) Pressure

(3) Volume (4) Density

28. The Clausius statement of the second law of thermodynamics states that :

(1) It is impossible to transfer heat from a cold body to a hot body without doing work.

(2) It is impossible for a heat engine to convert all heat into work.

(3) The entropy of the universe remains constant.

(4) None of the above

29. During an isobaric process, the heat transferred to a gas is 500 kJ, and the work done by the gas is 300 kJ. What is the change in enthalpy of the gas ?

(1) 500 kJ (2) 300 kJ

(3) 200 kJ (4) 800 kJ

30. A wet steam mixture has a specific volume of 0.6 m^3/kg, with vf=0.001 m^3/kg and vg=1.0 m^3/kg. What is the quality of the mixture ?

(1) 0.59 (2) 0.60

(3) 0.50 (4) 0.75

31. In an ideal Otto cycle, the compression ratio is 8, and the ratio of specific heats $\gamma = 1.4$. What is the thermal efficiency of the cycle ?

(1) 56.25% (2) 60.2%

(3) 65.8% (4) 72.5%

32. An ideal gas undergoes an isothermal process at 300 K, expanding from 1 m^3 to 3 m^3. The work done by the gas is 200 kJ. What is the amount of heat transferred ?

(1) 200 kJ (2) 100 kJ

(3) 300 kJ (4) 0

33. A heat source at 1000 K transfers 500 kJ of heat to a reservoir at 500 K. What is the entropy change of the system ?

(1) +0.5 kJ/K (2) + 1.0 kJ/K

(3) +0.75 kJ/K (4) 0

34. For a reaction at constant temperature and pressure, if $\Delta H = -200$ kJ/mol and $\Delta S = -0.5$ kJ/mol.K at 300 K, what is ΔG ?

(1) –50 kJ/mol (2) –100 kJ/mol

(3) –150 kJ/mol (4) –200 kJ/mol

35. An aluminum fin with a thermal conductivity of 200 W/mK is attached to a surface at 100°C, with the surrounding air at 30°C. The convective heat transfer coefficient is 50 W /m^2K. Calculate the fin efficiency if the fin is 0.01 m thick and 0.1 m long.

(1) 70% (2) 80%

(3) 85% (4) 90%

36. A blackbody at 1000 K emits radiation with a total power of 500 W/m^2. If the temperature of the blackbody is doubled, the total power emitted will be :

(1) 1000 W/ m^2 (2) 4000 W/ m^2

(3) 16,000 W/ m^2 (4) 32,000 W/ m^2

37. A rectangular plane surface is submerged vertically in a liquid. The center of pressure is :

(1) At the centroid of the submerged area.

(2) Above the centroid of the submerged area.

(3) Below the centroid of the submerged area.

(4) None of the above.

38. A solid sphere with a diameter of 0.5 m and density 800 kg/m^3 is submerged in water. What is the net buoyant force acting on the sphere ? (ρ water=1000 kg/m^3, g=9.81 m/s^2.

(1) 1600 N (2) 1000 N

(3) 640 N (4) 320 N

39. A horizontal pipe has a diameter of 0.2 m at section 1 and 0.1 mat section 2. If the velocity at section 1 is 2 m/s, what is the velocity at section 2 ?

(1) 4 m/s (2) 8 m/s

(3) 2 m/s (4) 1 m/s

40. For a laminar flow of a Newtonian fluid in a pipe, the shear stress is :

(1) Maximum at the pipe wall and zero at the center.

(2) Maximum at the center and zero at the pipe wall.

(3) Uniform across the cross-section.

(4) Zero across the cross-section.

41. A closed system undergoes a thermodynamic cycle consisting of two processes. In the first process, the system absorbs 100 kJ of heat while performing 60 kJ of work. In the second process, 40 kJ of heat is rejected. The work done in the second process is :

(1) –20 kJ

(2) 20 kJ

(3) –60 kJ

(4) 60 kJ

42. For a heat engine operating between two reservoirs at temperatures T1 and T2, the efficiency is maximum when :

(1) The process is adiabatic.

(2) The process is reversible.

(3) Tl=T2.

(4) The entropy generation is maximum.

43. The slope of the phase boundary in a P–TP–TP–T diagram for a phase change involving solid to liquid is given by the Clapeyron equation. $dp/dT = \Delta H/T\Delta V$ For water, the slope is :

(1) Positive due to the increase in volume during melting.

(2) Positive due to the decrease in volume during melting.

(3) Negative due to the decrease in volume during melting.

(4) Negative due to the increase in volume during melting.

44. In forced convection, the heat transfer coefficient increases with :

(1) Decreasing Reynolds number.

(2) Increasing flow velocity.

(3) Decreasing surface roughness.

(4) Increasing thermal conductivity of the fluid.

45. The dimensionless parameter used to characterize forced convection is :

(1) Grashof number (Gr).
(2) Biot number (Bi).
(3) Reynolds number (Re).
(4) Stefan-Boltzmann constant.

46. A superheated vapor is characterized by:

(1) A temperature lower than the saturation temperature at the given pressure.
(2) A temperature equal to the saturation temperature at the given pressure.
(3) A temperature higher than the saturation temperature at the given pressure.
(4) No fixed temperature-pressure relationship

47. At the critical point of a pure substance :

(1) The specific volume of liquid and vapor are the same.
(2) The specific volume of liquid is greater than that of vapor.
(3) The specific volume of liquid is less than that of vapor.
(4) Specific volume cannot be defined.

48. The Number of Transfer Units (NTU) in a heat exchanger represents :

(1) The ratio of heat transfer area to the heat capacity rate.
(2) The effectiveness of the heat exchanger.
(3) The total heat transferred by the exchanger.
(4) The ratio of maximum possible heat transfer to actual heat transfer.

49. Which of the following is NOT an application of Bernoulli's principle ?

(1) Venturimeter.
(2) Orifice meter.
(3) Pitot tube.
(4) Hydraulic jump.

50. The apparent weight of a submerged object in a fluid is :

(1) Equal to its actual weight.

(2) Less than its actual weight by the buoyant force.

(3) Equal to the buoyant force.

(4) Greater than its actual weight by the buoyant force.

51. In a casting process, the function of the core is to :

(1) Form the external shape of the casting

(2) Form internal cavities or holes in the casting

(3) Improve the solidification rate of the metal

(4) Add strength to the casting

52. Which of the following is true about the gating system in casting ?

(1) It directs the molten metal into the mold cavity.

(2) It increases the pouring temperature of the molten metal.

(3) It eliminates the need for a riser.

(4) It decreases the fluidity of the molten metal.

53. Which of the following statements is true about the use of chills in casting ?

(1) Chills are used to increase the cooling rate of the metal.

(2) Chills are designed to trap gases during solidification.

(3) Chills are used to prevent metal shrinkage.

(4) Chills improve the surface finish of the casting.

54. Which of the following casting processes is best suited for high-precision parts with complex shapes ?

(1) Sand casting

(2) Investment casting

(3) Die casting

(4) Permanent mold casting

55. According to the Von Mises yield criterion, the material yields when :

(1) The maximum normal stress exceeds the yield stress

(2) The maximum shear stress exceeds half of the yield stress

(3) The equivalent stress (Von Mises stress) exceeds the yield stress

(4) The strain exceeds the yield strain

56. Which of the following is true about work hardening in the context of plastic deformation ?

(1) Work hardening leads to a decrease in the material strength.

(2) Work hardening is due to the increase in dislocation density.

(3) Work hardening occurs only when the material is heated above its recrystallization temperature.

(4) Work hardening reduces the yield point of the material.

57. Which of the following plastic deformation processes involves the application of compressive force to reduce the thickness of a material ?

(1) Rolling (2) Extrusion

(3) Forging (4) All of the above

58. The process of "work hardening" is primarily associated with :

(1) Hot working (2) Cold working

(3) Both hot and cold working (4) None of the above

59. Which of the following is NOT a type of metal forming process ?

(1) Rolling (2) Forging

(3) Extrusion (4) Welding

60. In which of the following metal forming processes is the material forced through a die to produce a continuous cross-sectional profile ?

(1) Extrusion
(2) Rolling
(3) Forging
(4) Drawing

61. During the rolling of a metal strip, which of the following phenomena occurs ?

(1) The strip length increases due to the volume of material remaining constant
(2) The temperature of the material decreases, leading to a reduction in ductility
(3) The material is compressed between two rolls, and the thickness of the strip decreases
(4) The friction between the rolls and the material is minimized to reduce power consumption

62. In powder metallurgy, the main purpose of the sintering process is to :

(1) Shape the powder into the desired form
(2) Increase the density and strength of the compacted powder
(3) Heat the powder to its melting point
(4) Remove impurities from the powder

63. Which of the following is a primary advantage of powder metallurgy ?

(1) High energy consumption during production
(2) Ability to produce complex shapes with little to no waste
(3) Limited to soft metals only
(4) Requires high-cost raw materials

64. Which of the following welding processes does ***not*** require the addition of filler metal ?

(1) Gas Tungsten Arc Welding (GTAW)

(2) Shielded Metal Arc Welding (SMAW)

(3) Gas Metal Arc Welding (GMAW)

(4) Oxy-fuel welding

65. Which of the following is a typical characteristic of brazing compared to welding ?

(1) Requires higher temperatures than welding

(2) Uses a filler metal with a melting point above the workpiece material

(3) Involves the melting of the base metal

(4) The workpieces do not melt, only the filler metal melts

66. Which of the following is true about flux in welding ?

(1) Flux prevents oxidation and contamination of the weld pool

(2) Flux is only used in brazing and soldering

(3) Flux is used to increase the temperature of the base metal

(4) Flux is used to strengthen the base metal

67. Which of the following is ***not*** a factor that affects the cutting force in a machining process ?

(1) Cutting speed

(2) Material of the tool

(3) Geometry of the workpiece

(4) Type of lubrication used

68. The shear force in machining is highest at :

(1) The cutting edge of the tool

(2) The point of chip formation

(3) The tool flank

(4) The point where the cutting force is applied

69. Which of the following is the main reason for using high-speed steel (HSS) tools in machining ?

(1) High wear resistance
(2) High thermal conductivity
(3) High toughness and flexibility
(4) High resistance to cutting forces

70. Which of the following is a typical application of a multipoint cutting tool ?

(1) Turning complex cylindrical shapes
(2) Drilling large holes
(3) Grinding hard materials
(4) Milling flat and contoured surfaces

71. In the context of tool wear, 'flank wear' is associated with :

(1) The front of the tool edge
(2) The side of the tool that faces the workpiece
(3) The top of the tool
(4) The tool's cutting edge that is in contact with the chip

72. The break-even analysis in machining is used to determine :

(1) The point where production cost equals selling price
(2) The optimal cutting speed for maximum tool life
(3) The number of tools required for a production run
(4) The time required to set up the machine

73. In Electrochemical Machining (ECM), material removal is primarily due to :

(1) Mechanical forces
(2) Chemical dissolution
(3) High-temperature melting
(4) Abrasive action

74. In Abrasive Water Jet Machining (AWJM), the material removal is due to :

(1) High-pressure water stream with abrasive particles
(2) High-frequency electrical discharge
(3) Laser heat interaction with the workpiece
(4) High-temperature gas jet

75. Friction Stir Welding (FSW) is particularly advantageous for welding :

(1) High-melting-point materials

(2) Materials with high thermal conductivity

(3) Non-ferrous materials with good formability

(4) All of the above

76. Which of the following is most closely associated with the "Just-in-Time (JIT)" inventory system ?

(1) Maximizing inventory levels to prevent stockouts

(2) Delivering products on time while keeping inventory low

(3) Increasing the production lead time

(4) Reducing machine downtime by increasing maintenance

77. What is the primary purpose of Capacity Planning in production planning and control (PPC) ?

(1) To determine the quantity of raw materials needed for production

(2) To ensure that production capacity aligns with demand

(3) To estimate future demand for products

(4) To schedule the delivery of goods to customer

78. In a Material Requirements Planning (MRP) system, the net requirements of an item are calculated by :

(1) Subtracting the available inventory from the gross requirements

(2) Adding the gross requirements to the on-hand inventory

(3) Adding the safety stock to the lead time demand

(4) Subtracting the forecast demand from the safety stock

79. In a Critical Ratio (CR) scheduling technique, the Critical Ratio is calculated by :

(1) Dividing the order due date by the lead time

(2) Dividing the remaining time until the due date by the remaining processing time

(3) Dividing the remaining processing time by the order quantity

(4) Dividing the order quantity by the remaining processing time

80. The Critical Path Method (CPM) is used in production planning to :

(1) Calculate the minimum number of machines required

(2) Determine the most efficient way to schedule production orders

(3) Identify the longest sequence of dependent activities to minimize delays

(4) Identify the least cost method for production

81. What is the purpose of Safety Stock in production planning ?

(1) To maintain the optimal level of inventory for raw materials

(2) To buffer against uncertainties in demand or supply lead time

(3) To reduce excess inventory costs

(4) To reduce the cost of holding finished goods in inventory

82. In a linear programming problem, if the feasible region is unbounded and the objective function increases indefinitely, the problem is :

(1) Feasible and bounded

(2) Feasible and unbounded

(3) Infeasible

(4) Unsolvable

83. In the Simplex Method, the entering variable is chosen based on :

(1) The smallest value in the objective function row

(2) The largest negative value in the objective function row (for maximization problems)

(3) The smallest positive value in the constraint rows

(4) The smallest coefficient in the right-hand side column

84. The Simplex Method can be used to solve :

(1) Only maximization problems

(2) Only minimization problems

(3) Both maximization and minimization problems

(4) Linear programming problems with non-linear objective functions

85. The critical path in a PERT chart is the path that :

(1) Has the longest total duration

(2) Has the shortest total duration

(3) Has the most number of tasks

(4) Is the easiest to complete

86. Which of the following is true about the "Slack" in a PERT chart ?

(1) Slack is the amount of time an activity can be delayed without affecting the overall project duration

(2) Slack is the total duration of the critical path

(3) Slack is always zero for activities on the critical path

(4) Slack is only relevant for non-critical activities

87. Which of the following is a characteristic of activities on the critical path in CPM ?

(1) They have slack or float

(2) They can be delayed without affecting the project duration

(3) They have no slack or float

(4) They represent non-critical activities

88. Which of the following is a limitation of the Critical Path Method (CPM) ?

(1) It requires that all activity durations be known with certainty

(2) It does not consider resource constraints

(3) It can only be used for projects with more than 10 tasks

(4) It only applies to construction projects

89. Which of the following is a key element of Supply Chain Management ?

(1) Marketing and advertising strategies

(2) Management of suppliers, logistics, and inventory

(3) Employee welfare programs

(4) Financial management and profitability

90. Which of the following is NOT a typical function of supply chain management ?

(1) Demand forecasting

(2) Order fulfillment

(3) Advertising and marketing

(4) Inventory management

91. The Economic Order Quantity (EOQ) model is used to determine :

(1) The optimal order quantity to minimize total inventory costs

(2) The maximum stock level to avoid overstocking

(3) The optimal inventory level to maximize sales

(4) The amount of safety stock needed for demand fluctuations

92. Which of the following is true about the FIFO method of inventory management ?

(1) The last units purchased are the first ones sold

(2) The first units purchased are the first ones sold

(3) It applies to perishable goods only

(4) It allows businesses to delay purchases until the last possible moment

93. In an ABC analysis of inventory control, what does the "A" category represent ?

(1) Items with the highest cost or value and the least number of units

(2) Items with the lowest cost or value

(3) Items with the most frequent use

(4) Items that are obsolete or no longer needed

94. What is the maximum number of intersection points in a graphical method problem with two variables and three constraints ?

(1) 3 (2) 4

(3) 6 (4) 2

95. In a graphical solution method, if two constraints are parallel, which of the following is true ?

(1) The problem has no solution (2) The feasible region is infinite

(3) The feasible region will be bounded (4) The feasible region will be a straight line

96. Which of the following is NOT a component of an MRP system ?

(1) Bill of Materials (BOM) (2) Master Production Schedule (MPS)

(3) Inventory records (4) Financial budget reports

97. In a flow shop-scheduling problem with two machines, what is the objective of Johnson's rule ?

(1) To minimize the makespan

(2) To minimize the total completion time

(3) To maximize machine utilization

(4) To minimize the number of jobs completed

98. In a production shift of 08 hours duration, the observed time per unit is 5 minutes and rating factor is 120%, The standard production units per shift will be

(1) 80 (2) 50

(3) 30 (4) 40

99. In a production system, the annual demand for a product is 24,000 units. The setup cost per production run is ₹1,000, and the inventory holding cost is ₹2 per unit per year. The production rate is 1,000 units per day, and the demand rate is 200 units per day. The Economic Production Quantity (EPQ) for this system is closest to :

(1) 1,732 (2) 2,449

(3) 2,886 (4) 3,162

100. A production line has 5 workstations. The cycle time is 2 minutes, and the total task time to assemble one product is 8 minutes. The efficiency of the line is :

(1) 50% (2) 80%

(3) 90% (4) 100%

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2. The break-even analysis in machining is used to determine :
   (1) The point where production cost equals selling price
   (2) The optimal cutting speed for maximum tool life
   (3) The number of tools required for a production run
   (4) The time required to set up the machine

3. In Electrochemical Machining (ECM), material removal is primarily due to :
   (1) Mechanical forces
   (2) Chemical dissolution
   (3) High-temperature melting
   (4) Abrasive action

4. In Abrasive Water Jet Machining (AWJM), the material removal is due to :
   (1) High-pressure water stream with abrasive particles
   (2) High-frequency electrical discharge
   (3) Laser heat interaction with the workpiece
   (4) High-temperature gas jet

5. Friction Stir Welding (FSW) is particularly advantageous for welding :
   (1) High-melting-point materials
   (2) Materials with high thermal conductivity
   (3) Non-ferrous materials with good formability
   (4) All of the above

6. Which of the following is most closely associated with the "Just-in-Time (JIT)" inventory system ?
   (1) Maximizing inventory levels to prevent stockouts
   (2) Delivering products on time while keeping inventory low
   (3) Increasing the production lead time
   (4) Reducing machine downtime by increasing maintenance

7. What is the primary purpose of Capacity Planning in production planning and control (PPC) ?

(1) To determine the quantity of raw materials needed for production

(2) To ensure that production capacity aligns with demand

(3) To estimate future demand for products

(4) To schedule the delivery of goods to customer

8. In a Material Requirements Planning (MRP) system, the net requirements of an item are calculated by :

(1) Subtracting the available inventory from the gross requirements

(2) Adding the gross requirements to the on-hand inventory

(3) Adding the safety stock to the lead time demand

(4) Subtracting the forecast demand from the safety stock

9. In a Critical Ratio (CR) scheduling technique, the Critical Ratio is calculated by :

(1) Dividing the order due date by the lead time

(2) Dividing the remaining time until the due date by the remaining processing time

(3) Dividing the remaining processing time by the order quantity

(4) Dividing the order quantity by the remaining processing time

10. The Critical Path Method (CPM) is used in production planning to :

(1) Calculate the minimum number of machines required

(2) Determine the most efficient way to schedule production orders

(3) Identify the longest sequence of dependent activities to minimize delays

(4) Identify the least cost method for production

11. In a casting process, the function of the core is to :

(1) Form the external shape of the casting

(2) Form internal cavities or holes in the casting

(3) Improve the solidification rate of the metal

(4) Add strength to the casting

12. Which of the following is true about the gating system in casting ?

(1) It directs the molten metal into the mold cavity.

(2) It increases the pouring temperature of the molten metal.

(3) It eliminates the need for a riser.

(4) It decreases the fluidity of the molten metal.

13. Which of the following statements is true about the use of chills in casting ?

(1) Chills are used to increase the cooling rate of the metal.

(2) Chills are designed to trap gases during solidification.

(3) Chills are used to prevent metal shrinkage.

(4) Chills improve the surface finish of the casting.

14. Which of the following casting processes is best suited for high-precision parts with complex shapes ?

(1) Sand casting

(2) Investment casting

(3) Die casting

(4) Permanent mold casting

15. According to the Von Mises yield criterion, the material yields when :

(1) The maximum normal stress exceeds the yield stress

(2) The maximum shear stress exceeds half of the yield stress

(3) The equivalent stress (Von Mises stress) exceeds the yield stress

(4) The strain exceeds the yield strain

16. Which of the following is true about work hardening in the context of plastic deformation ?

(1) Work hardening leads to a decrease in the material strength.

(2) Work hardening is due to the increase in dislocation density.

(3) Work hardening occurs only when the material is heated above its recrystallization temperature.

(4) Work hardening reduces the yield point of the material.

17. Which of the following plastic deformation processes involves the application of compressive force to reduce the thickness of a material ?

(1) Rolling (2) Extrusion

(3) Forging (4) All of the above

18. The process of "work hardening" is primarily associated with :

(1) Hot working (2) Cold working

(3) Both hot and cold working (4) None of the above

19. Which of the following is NOT a type of metal forming process ?

(1) Rolling (2) Forging

(3) Extrusion (4) Welding

20. In which of the following metal forming processes is the material forced through a die to produce a continuous cross-sectional profile ?

(1) Extrusion (2) Rolling

(3) Forging (4) Drawing

21. In an ideal Otto cycle, the compression ratio is 8, and the ratio of specific heats $\gamma = 1.4$. What is the thermal efficiency of the cycle ?

(1) 56.25% (2) 60.2%

(3) 65.8% (4) 72.5%

22. An ideal gas undergoes an isothermal process at 300 K, expanding from 1 m^3 to 3 m^3. The work done by the gas is 200 kJ. What is the amount of heat transferred ?

(1) 200 kJ (2) 100 kJ

(3) 300 kJ (4) 0

23. A heat source at 1000 K transfers 500 kJ of heat to a reservoir at 500 K. What is the entropy change of the system ?

(1) +0.5 kJ/K (2) + 1.0 kJ/K

(3) +0.75 kJ/K (4) 0

24. For a reaction at constant temperature and pressure, if $\Delta H = -200$ kJ/mol and $\Delta S = -0.5$ kJ/mol.K at 300 K, what is ΔG ?

(1) –50 kJ/mol (2) –100 kJ/mol

(3) –150 kJ/mol (4) –200 kJ/mol

25. An aluminum fin with a thermal conductivity of 200 W/mK is attached to a surface at 100°C, with the surrounding air at 30°C. The convective heat transfer coefficient is 50 W /m^2K. Calculate the fin efficiency if the fin is 0.01 m thick and 0.1 m long.

(1) 70% (2) 80%

(3) 85% (4) 90%

26. A blackbody at 1000 K emits radiation with a total power of 500 W/m^2. If the temperature of the blackbody is doubled, the total power emitted will be :

(1) 1000 W/ m^2 (2) 4000 W/ m^2

(3) 16,000 W/ m^2 (4) 32,000 W/ m^2

27. A rectangular plane surface is submerged vertically in a liquid. The center of pressure is :

(1) At the centroid of the submerged area.

(2) Above the centroid of the submerged area.

(3) Below the centroid of the submerged area.

(4) None of the above.

28. A solid sphere with a diameter of 0.5 m and density 800 kg/m^3 is submerged in water. What is the net buoyant force acting on the sphere ? (ρ water=1000 kg/m^3, g=9.81 m/s^2.

(1) 1600 N

(2) 1000 N

(3) 640 N

(4) 320 N

29. A horizontal pipe has a diameter of 0.2 m at section 1 and 0.1 mat section 2. If the velocity at section 1 is 2 m/s, what is the velocity at section 2 ?

(1) 4 m/s

(2) 8 m/s

(3) 2 m/s

(4) 1 m/s

30. For a laminar flow of a Newtonian fluid in a pipe, the shear stress is :

(1) Maximum at the pipe wall and zero at the center.

(2) Maximum at the center and zero at the pipe wall.

(3) Uniform across the cross-section.

(4) Zero across the cross-section.

31. For a uniformly distributed load (UDL) on a simply supported beam, the bending moment diagram will be:

(1) Linear

(2) Parabolic

(3) Cubic

(4) Horizontal

32. The point of contraflexure in a beam is the point where :

(1) Shear force is maximum
(2) Shear force is zero
(3) Bending moment changes sign
(4) Bending moment is maximum

33. For a cantilever beam with a point load P at its free end, the bending moment at the fixed support is :

(1) Zero
(2) PL
(3) PL/2
(4) P/L

34. Deflection of a beam is inversely proportional to :

(1) Load on the beam
(2) Span of the beam
(3) Flexural rigidity (EI)
(4) Moment of inertia

35. The SI unit of beam deflection is:

(1) Newton (N)
(2) Meter (m)
(3) Newton-meter (N.m)
(4) Meter per second squared (m/s^2)

36. For beams with the same length and load, the beam with the smallest deflection has :

(1) The smallest moment of inertia
(2) The largest moment of inertia
(3) The smallest modulus of elasticity
(4) The largest modulus of rigidity

37. For the same weight and material, a hollow circular shaft is stronger than a solid circular shaft because :

(1) Hollow shafts have greater cross-sectional area
(2) Hollow shafts have larger polar moment of inertia
(3) Hollow shafts have lower radius of gyration
(4) Hollow shafts have uniform shear stress

38. The torsional critical speed of a shaft depends on :

(1) Length and material of the shaft

(2) Length and diameter of the shaft

(3) Diameter and polar moment of inertia

(4) Material and polar moment of inertia

39. The kinetic energy stored in a flywheel is proportional to :

(1) Square of its angular velocity

(2) Cube of its radius

(3) Inverse of its mass

(4) Inverse of its moment of inertia

40. Epicyclic gear trains are widely used in :

(1) Gear pumps

(2) Lathe machines

(3) Clocks

(4) Automatic transmissions

41. The Economic Order Quantity (EOQ) model is used to determine :

(1) The optimal order quantity to minimize total inventory costs

(2) The maximum stock level to avoid overstocking

(3) The optimal inventory level to maximize sales

(4) The amount of safety stock needed for demand fluctuations

42. Which of the following is true about the FIFO method of inventory management ?

(1) The last units purchased are the first ones sold

(2) The first units purchased are the first ones sold

(3) It applies to perishable goods only

(4) It allows businesses to delay purchases until the last possible moment

43. In an ABC analysis of inventory control, what does the "A" category represent ?

(1) Items with the highest cost or value and the least number of units

(2) Items with the lowest cost or value

(3) Items with the most frequent use

(4) Items that are obsolete or no longer needed

44. What is the maximum number of intersection points in a graphical method problem with two variables and three constraints ?

(1) 3 (2) 4

(3) 6 (4) 2

45. In a graphical solution method, if two constraints are parallel, which of the following is true ?

(1) The problem has no solution (2) The feasible region is infinite

(3) The feasible region will be bounded (4) The feasible region will be a straight line

46. Which of the following is NOT a component of an MRP system ?

(1) Bill of Materials (BOM) (2) Master Production Schedule (MPS)

(3) Inventory records (4) Financial budget reports

47. In a flow shop-scheduling problem with two machines, what is the objective of Johnson's rule ?

(1) To minimize the makespan

(2) To minimize the total completion time

(3) To maximize machine utilization

(4) To minimize the number of jobs completed

48. In a production shift of 08 hours duration, the observed time per unit is 5 minutes and rating factor is 120%, The standard production units per shift will be

(1) 80 (2) 50

(3) 30 (4) 40

49. In a production system, the annual demand for a product is 24,000 units. The setup cost per production run is ₹1,000, and the inventory holding cost is ₹2 per unit per year. The production rate is 1,000 units per day, and the demand rate is 200 units per day. The Economic Production Quantity (EPQ) for this system is closest to :

(1) 1,732 (2) 2,449

(3) 2,886 (4) 3,162

50. A production line has 5 workstations. The cycle time is 2 minutes, and the total task time to assemble one product is 8 minutes. The efficiency of the line is :

(1) 50% (2) 80%

(3) 90% (4) 100%

51. During the rolling of a metal strip, which of the following phenomena occurs ?

(1) The strip length increases due to the volume of material remaining constant

(2) The temperature of the material decreases, leading to a reduction in ductility

(3) The material is compressed between two rolls, and the thickness of the strip decreases

(4) The friction between the rolls and the material is minimized to reduce power consumption

52. In powder metallurgy, the main purpose of the sintering process is to :

(1) Shape the powder into the desired form

(2) Increase the density and strength of the compacted powder

(3) Heat the powder to its melting point

(4) Remove impurities from the powder

53. Which of the following is a primary advantage of powder metallurgy ?

(1) High energy consumption during production

(2) Ability to produce complex shapes with little to no waste

(3) Limited to soft metals only

(4) Requires high-cost raw materials

54. Which of the following welding processes does ***not*** require the addition of filler metal ?

(1) Gas Tungsten Arc Welding (GTAW)

(2) Shielded Metal Arc Welding (SMAW)

(3) Gas Metal Arc Welding (GMAW)

(4) Oxy-fuel welding

55. Which of the following is a typical characteristic of brazing compared to welding ?

(1) Requires higher temperatures than welding

(2) Uses a filler metal with a melting point above the workpiece material

(3) Involves the melting of the base metal

(4) The workpieces do not melt, only the filler metal melts

56. Which of the following is true about flux in welding ?

(1) Flux prevents oxidation and contamination of the weld pool

(2) Flux is only used in brazing and soldering

(3) Flux is used to increase the temperature of the base metal

(4) Flux is used to strengthen the base metal

57. Which of the following is *not* a factor that affects the cutting force in a machining process ?

(1) Cutting speed
(2) Material of the tool
(3) Geometry of the workpiece
(4) Type of lubrication used

58. The shear force in machining is highest at :

(1) The cutting edge of the tool
(2) The point of chip formation
(3) The tool flank
(4) The point where the cutting force is applied

59. Which of the following is the main reason for using high-speed steel (HSS) tools in machining ?

(1) High wear resistance
(2) High thermal conductivity
(3) High toughness and flexibility
(4) High resistance to cutting forces

60. Which of the following is a typical application of a multipoint cutting tool ?

(1) Turning complex cylindrical shapes
(2) Drilling large holes
(3) Grinding hard materials
(4) Milling flat and contoured surfaces

61. What is the purpose of Safety Stock in production planning ?

(1) To maintain the optimal level of inventory for raw materials
(2) To buffer against uncertainties in demand or supply lead time
(3) To reduce excess inventory costs
(4) To reduce the cost of holding finished goods in inventory

62. In a linear programming problem, if the feasible region is unbounded and the objective function increases indefinitely, the problem is :

(1) Feasible and bounded

(2) Feasible and unbounded

(3) Infeasible

(4) Unsolvable

63. In the Simplex Method, the entering variable is chosen based on :

(1) The smallest value in the objective function row

(2) The largest negative value in the objective function row (for maximization problems)

(3) The smallest positive value in the constraint rows

(4) The smallest coefficient in the right-hand side column

64. The Simplex Method can be used to solve :

(1) Only maximization problems

(2) Only minimization problems

(3) Both maximization and minimization problems

(4) Linear programming problems with non-linear objective functions

65. The critical path in a PERT chart is the path that :

(1) Has the longest total duration

(2) Has the shortest total duration

(3) Has the most number of tasks

(4) Is the easiest to complete

66. Which of the following is true about the "Slack" in a PERT chart ?

(1) Slack is the amount of time an activity can be delayed without affecting the overall project duration

(2) Slack is the total duration of the critical path

(3) Slack is always zero for activities on the critical path

(4) Slack is only relevant for non-critical activities

67. Which of the following is a characteristic of activities on the critical path in CPM ?

(1) They have slack or float

(2) They can be delayed without affecting the project duration

(3) They have no slack or float

(4) They represent non-critical activities

68. Which of the following is a limitation of the Critical Path Method (CPM) ?

(1) It requires that all activity durations be known with certainty

(2) It does not consider resource constraints

(3) It can only be used for projects with more than 10 tasks

(4) It only applies to construction projects

69. Which of the following is a key element of Supply Chain Management ?

(1) Marketing and advertising strategies

(2) Management of suppliers, logistics, and inventory

(3) Employee welfare programs

(4) Financial management and profitability

70. Which of the following is NOT a typical function of supply chain management ?

(1) Demand forecasting

(2) Order fulfillment

(3) Advertising and marketing

(4) Inventory management

71. A closed system undergoes a thermodynamic cycle consisting of two processes. In the first process, the system absorbs 100 kJ of heat while performing 60 kJ of work. In the second process, 40 kJ of heat is rejected. The work done in the second process is :

(1) –20 kJ (2) 20 kJ

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81. A reverted gear train is a special case where :

(1) All gears rotate in the same direction

(2) The input and output shafts are collinear

(3) Intermediate gears have the same number of teeth

(4) The input and output shafts have the same speed

82. The slider-crank mechanism consists of :

(1) 2 links and 1 pair (2) 3 links and 2 pairs

(3) 4 links and 4 pairs (4) 4 links and 3 pairs

83. Which of the following is NOT an inversion of the slider-crank mechanism ?

(1) Whitworth quick return mechanism (2) Oscillating cylinder engine

(3) Elliptical trammel (4) Rotary engine

84. If a bar is free to expand under a temperature increase, the thermal stress in the bar will be :

(1) Maximum

(2) Zero

(3) Equal to the yield strength of the material

(4) Equal to $E\alpha\Delta T$

85. The degree of freedom of a simple slider-crank mechanism is :

(1) 1 (2) 2

(3) 3 (4) 4

86. Entropy change during a reversible isothermal process is :

(1) Zero (2) Q/T

(3) T/Q (4) PV

87. Which of the following is an extensive property ?

(1) Temperature
(2) Pressure
(3) Volume
(4) Density

88. The Clausius statement of the second law of thermodynamics states that :

(1) It is impossible to transfer heat from a cold body to a hot body without doing work.
(2) It is impossible for a heat engine to convert all heat into work.
(3) The entropy of the universe remains constant.
(4) None of the above

89. During an isobaric process, the heat transferred to a gas is 500 kJ, and the work done by the gas is 300 kJ. What is the change in enthalpy of the gas ?

(1) 500 kJ
(2) 300 kJ
(3) 200 kJ
(4) 800 kJ

90. A wet steam mixture has a specific volume of 0.6 m^3/kg, with vf=0.001 m^3/kg and vg=1.0 m^3/kg. What is the quality of the mixture ?

(1) 0.59
(2) 0.60
(3) 0.50
(4) 0.75

91. In the FBD of a simply supported beam, the reaction forces are located :

(1) At the mid-span of the beam.
(2) At the points of support.
(3) Distributed along the entire length.
(4) At the centroid of the beam.

92. In a truss, a zero-force member is identified when :

(1) Two non-collinear members meet at a joint with no external force or support.

(2) Three members meet at a joint under an external force.

(3) All members are loaded equally.

(4) The truss is symmetric

93. Virtual work is especially useful in analyzing :

(1) Simple, determinate systems.

(2) Systems with large deformations only.

(3) Systems with multiple constraints and redundancies.

(4) Systems with no external forces.

94. A disc of radius 0.5 m is initially at rest. It starts rotating with a constant angular acceleration of 4 rad/s^2. The linear velocity of a point on its edge after 2s is :

(1) 2 m/s

(2) 4 m/s

(3) 6 m/s

(4) 8 m/s

95. If the Young's modulus (E) of a material is 200 GPa and Poisson's ratio (v) is 0.3, the shear modulus (G) is approximately :

(1) 76.9 GPa

(2) 100 GPa

(3) 153.8 GPa

(4) 66.7 GPa

96. Which of the following materials exhibits a significant plastic region in the stress-strain curve ?

(1) Cast iron

(2) Glass

(3) Mild steel

(4) Concrete

97. The area under the stress-strain curve up to the proportional limit represents :

(1) Modulus of resilience
(2) Modulus of toughness
(3) Yield strength
(4) Factor of safety

98. Mohr's Circle is used to determine :

(1) Only shear stresses
(2) Principal stresses and principal planes
(3) Deflection of beams
(4) Strain energy

99. The diameter of Mohr's Circle represents :

(1) Maximum normal stress
(2) Minimum normal stress
(3) Maximum shear stress
(4) Von Mises stress

100. For a plane stress condition with σx=100 MPa, σy=50 MPa, and τxy=25 MPa, the centre of Mohr's Circle lies at:

(1) (50,25)
(2) (75, 0)
(3) (100,25)
(4) (0,50)

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Ph.D-EE-December, 2024
Mechanical Engineering

10011

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Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There shall be negative marking. A deduction of 0.25 marks shall be there for each wrong answer. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

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(1) 2 links and 1 pair (2) 3 links and 2 pairs

(3) 4 links and 4 pairs (4) 4 links and 3 pairs

13. Which of the following is NOT an inversion of the slider-crank mechanism ?

(1) Whitworth quick return mechanism (2) Oscillating cylinder engine

(3) Elliptical trammel (4) Rotary engine

14. If a bar is free to expand under a temperature increase, the thermal stress in the bar will be :

(1) Maximum

(2) Zero

(3) Equal to the yield strength of the material

(4) Equal to $E\alpha\Delta T$

15. The degree of freedom of a simple slider-crank mechanism is :

(1) 1 (2) 2

(3) 3 (4) 4

16. Entropy change during a reversible isothermal process is :

(1) Zero (2) Q/T

(3) T/Q (4) PV

17. Which of the following is an extensive property ?

(1) Temperature (2) Pressure

(3) Volume (4) Density

18. The Clausius statement of the second law of thermodynamics states that :

(1) It is impossible to transfer heat from a cold body to a hot body without doing work.

(2) It is impossible for a heat engine to convert all heat into work.

(3) The entropy of the universe remains constant.

(4) None of the above

19. During an isobaric process, the heat transferred to a gas is 500 kJ, and the work done by the gas is 300 kJ. What is the change in enthalpy of the gas ?

(1) 500 kJ (2) 300 kJ

(3) 200 kJ (4) 800 kJ

20. A wet steam mixture has a specific volume of 0.6 m^3/kg, with vf=0.001 m^3/kg and vg=1.0 m^3/kg. What is the quality of the mixture ?

(1) 0.59 (2) 0.60

(3) 0.50 (4) 0.75

21. In the FBD of a simply supported beam, the reaction forces are located :

(1) At the mid-span of the beam.

(2) At the points of support.

(3) Distributed along the entire length.

(4) At the centroid of the beam.

22. In a truss, a zero-force member is identified when :

(1) Two non-collinear members meet at a joint with no external force or support.

(2) Three members meet at a joint under an external force.

(3) All members are loaded equally.

(4) The truss is symmetric

23. Virtual work is especially useful in analyzing :

(1) Simple, determinate systems.

(2) Systems with large deformations only.

(3) Systems with multiple constraints and redundancies.

(4) Systems with no external forces.

24. A disc of radius 0.5 m is initially at rest. It starts rotating with a constant angular acceleration of 4 rad/s^2. The linear velocity of a point on its edge after 2s is :

(1) 2 m/s (2) 4 m/s

(3) 6 m/s (4) 8 m/s

25. If the Young's modulus (E) of a material is 200 GPa and Poisson's ratio (v) is 0.3, the shear modulus (G) is approximately :

(1) 76.9 GPa (2) 100 GPa

(3) 153.8 GPa (4) 66.7 GPa

26. Which of the following materials exhibits a significant plastic region in the stress-strain curve ?

(1) Cast iron (2) Glass

(3) Mild steel (4) Concrete

27. The area under the stress-strain curve up to the proportional limit represents :

(1) Modulus of resilience (2) Modulus of toughness

(3) Yield strength (4) Factor of safety

28. Mohr's Circle is used to determine :

(1) Only shear stresses (2) Principal stresses and principal planes

(3) Deflection of beams (4) Strain energy

29. The diameter of Mohr's Circle represents :

(1) Maximum normal stress (2) Minimum normal stress

(3) Maximum shear stress (4) Von Mises stress

30. For a plane stress condition with $\sigma x=100$ MPa, $\sigma y=50$ MPa, and $\tau xy=25$ MPa, the centre of Mohr's Circle lies at:

(1) (50,25) (2) (75, 0)

(3) (100,25) (4) (0,50)

31. The Economic Order Quantity (EOQ) model is used to determine :

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(3) 90% (4) 100%

41. During the rolling of a metal strip, which of the following phenomena occurs ?

(1) The strip length increases due to the volume of material remaining constant

(2) The temperature of the material decreases, leading to a reduction in ductility

(3) The material is compressed between two rolls, and the thickness of the strip decreases

(4) The friction between the rolls and the material is minimized to reduce power consumption

42. In powder metallurgy, the main purpose of the sintering process is to :

(1) Shape the powder into the desired form

(2) Increase the density and strength of the compacted powder

(3) Heat the powder to its melting point

(4) Remove impurities from the powder

43. Which of the following is a primary advantage of powder metallurgy ?

(1) High energy consumption during production

(2) Ability to produce complex shapes with little to no waste

(3) Limited to soft metals only

(4) Requires high-cost raw materials

44. Which of the following welding processes does ***not*** require the addition of filler metal ?

(1) Gas Tungsten Arc Welding (GTAW)

(2) Shielded Metal Arc Welding (SMAW)

(3) Gas Metal Arc Welding (GMAW)

(4) Oxy-fuel welding

45. Which of the following is a typical characteristic of brazing compared to welding ?

(1) Requires higher temperatures than welding

(2) Uses a filler metal with a melting point above the workpiece material

(3) Involves the melting of the base metal

(4) The workpieces do not melt, only the filler metal melts

46. Which of the following is true about flux in welding ?

(1) Flux prevents oxidation and contamination of the weld pool

(2) Flux is only used in brazing and soldering

(3) Flux is used to increase the temperature of the base metal

(4) Flux is used to strengthen the base metal

47. Which of the following is ***not*** a factor that affects the cutting force in a machining process ?

(1) Cutting speed

(2) Material of the tool

(3) Geometry of the workpiece

(4) Type of lubrication used

48. The shear force in machining is highest at :

(1) The cutting edge of the tool

(2) The point of chip formation

(3) The tool flank

(4) The point where the cutting force is applied

49. Which of the following is the main reason for using high-speed steel (HSS) tools in machining ?

(1) High wear resistance

(2) High thermal conductivity

(3) High toughness and flexibility

(4) High resistance to cutting forces

50. Which of the following is a typical application of a multipoint cutting tool ?

(1) Turning complex cylindrical shapes

(2) Drilling large holes

(3) Grinding hard materials

(4) Milling flat and contoured surfaces

51. In an ideal Otto cycle, the compression ratio is 8, and the ratio of specific heats $\gamma = 1.4$. What is the thermal efficiency of the cycle ?

(1) 56.25%

(2) 60.2%

(3) 65.8%

(4) 72.5%

52. An ideal gas undergoes an isothermal process at 300 K, expanding from 1 m^3 to 3 m^3. The work done by the gas is 200 kJ. What is the amount of heat transferred ?

(1) 200 kJ (2) 100 kJ

(3) 300 kJ (4) 0

53. A heat source at 1000 K transfers 500 kJ of heat to a reservoir at 500 K. What is the entropy change of the system ?

(1) +0.5 kJ/K (2) + 1.0 kJ/K

(3) +0.75 kJ/K (4) 0

54. For a reaction at constant temperature and pressure, if $\Delta H = -200$ kJ/mol and $\Delta S = -0.5$ kJ/mol.K at 300 K, what is ΔG ?

(1) –50 kJ/mol (2) –100 kJ/mol

(3) –150 kJ/mol (4) –200 kJ/mol

55. An aluminum fin with a thermal conductivity of 200 W/mK is attached to a surface at 100°C, with the surrounding air at 30°C. The convective heat transfer coefficient is 50 W /m^2K. Calculate the fin efficiency if the fin is 0.01 m thick and 0.1 m long.

(1) 70% (2) 80%

(3) 85% (4) 90%

56. A blackbody at 1000 K emits radiation with a total power of 500 W/m^2. If the temperature of the blackbody is doubled, the total power emitted will be :

(1) 1000 W/ m^2 (2) 4000 W/ m^2

(3) 16,000 W/ m^2 (4) 32,000 W/ m^2

57. A rectangular plane surface is submerged vertically in a liquid. The center of pressure is :

(1) At the centroid of the submerged area.

(2) Above the centroid of the submerged area.

(3) Below the centroid of the submerged area.

(4) None of the above.

58. A solid sphere with a diameter of 0.5 m and density 800 kg/m^3 is submerged in water. What is the net buoyant force acting on the sphere ? (ρ water=1000 kg/m^3, g=9.81 m/s^2.

(1) 1600 N

(2) 1000 N

(3) 640 N

(4) 320 N

59. A horizontal pipe has a diameter of 0.2 m at section 1 and 0.1 mat section 2. If the velocity at section 1 is 2 m/s, what is the velocity at section 2 ?

(1) 4 m/s

(2) 8 m/s

(3) 2 m/s

(4) 1 m/s

60. For a laminar flow of a Newtonian fluid in a pipe, the shear stress is :

(1) Maximum at the pipe wall and zero at the center.

(2) Maximum at the center and zero at the pipe wall.

(3) Uniform across the cross-section.

(4) Zero across the cross-section.

61. In the context of tool wear, 'flank wear' is associated with :

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(2) The side of the tool that faces the workpiece

(3) The top of the tool

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(1) High-melting-point materials

(2) Materials with high thermal conductivity

(3) Non-ferrous materials with good formability

(4) All of the above

66. Which of the following is most closely associated with the "Just-in-Time (JIT)" inventory system ?

(1) Maximizing inventory levels to prevent stockouts

(2) Delivering products on time while keeping inventory low

(3) Increasing the production lead time

(4) Reducing machine downtime by increasing maintenance

67. What is the primary purpose of Capacity Planning in production planning and control (PPC) ?

(1) To determine the quantity of raw materials needed for production

(2) To ensure that production capacity aligns with demand

(3) To estimate future demand for products

(4) To schedule the delivery of goods to customer

68. In a Material Requirements Planning (MRP) system, the net requirements of an item are calculated by :

(1) Subtracting the available inventory from the gross requirements

(2) Adding the gross requirements to the on-hand inventory

(3) Adding the safety stock to the lead time demand

(4) Subtracting the forecast demand from the safety stock

69. In a Critical Ratio (CR) scheduling technique, the Critical Ratio is calculated by :

(1) Dividing the order due date by the lead time

(2) Dividing the remaining time until the due date by the remaining processing time

(3) Dividing the remaining processing time by the order quantity

(4) Dividing the order quantity by the remaining processing time

70. The Critical Path Method (CPM) is used in production planning to :

(1) Calculate the minimum number of machines required

(2) Determine the most efficient way to schedule production orders

(3) Identify the longest sequence of dependent activities to minimize delays

(4) Identify the least cost method for production

71. What is the purpose of Safety Stock in production planning ?

(1) To maintain the optimal level of inventory for raw materials

(2) To buffer against uncertainties in demand or supply lead time

(3) To reduce excess inventory costs

(4) To reduce the cost of holding finished goods in inventory

72. In a linear programming problem, if the feasible region is unbounded and the objective function increases indefinitely, the problem is :

(1) Feasible and bounded

(2) Feasible and unbounded

(3) Infeasible

(4) Unsolvable

73. In the Simplex Method, the entering variable is chosen based on :

(1) The smallest value in the objective function row

(2) The largest negative value in the objective function row (for maximization problems)

(3) The smallest positive value in the constraint rows

(4) The smallest coefficient in the right-hand side column

74. The Simplex Method can be used to solve :

(1) Only maximization problems

(2) Only minimization problems

(3) Both maximization and minimization problems

(4) Linear programming problems with non-linear objective functions

75. The critical path in a PERT chart is the path that :

(1) Has the longest total duration

(2) Has the shortest total duration

(3) Has the most number of tasks

(4) Is the easiest to complete

76. Which of the following is true about the "Slack" in a PERT chart ?

(1) Slack is the amount of time an activity can be delayed without affecting the overall project duration

(2) Slack is the total duration of the critical path

(3) Slack is always zero for activities on the critical path

(4) Slack is only relevant for non-critical activities

77. Which of the following is a characteristic of activities on the critical path in CPM ?

(1) They have slack or float

(2) They can be delayed without affecting the project duration

(3) They have no slack or float

(4) They represent non-critical activities

78. Which of the following is a limitation of the Critical Path Method (CPM) ?

(1) It requires that all activity durations be known with certainty

(2) It does not consider resource constraints

(3) It can only be used for projects with more than 10 tasks

(4) It only applies to construction projects

79. Which of the following is a key element of Supply Chain Management ?

(1) Marketing and advertising strategies

(2) Management of suppliers, logistics, and inventory

(3) Employee welfare programs

(4) Financial management and profitability

80. Which of the following is NOT a typical function of supply chain management ?

(1) Demand forecasting

(2) Order fulfillment

(3) Advertising and marketing

(4) Inventory management

81. For a uniformly distributed load (UDL) on a simply supported beam, the bending moment diagram will be:

(1) Linear

(2) Parabolic

(3) Cubic

(4) Horizontal

82. The point of contraflexure in a beam is the point where :

(1) Shear force is maximum

(2) Shear force is zero

(3) Bending moment changes sign

(4) Bending moment is maximum

83. For a cantilever beam with a point load P at its free end, the bending moment at the fixed support is :

(1) Zero

(2) PL

(3) PL/2

(4) P/L

84. Deflection of a beam is inversely proportional to :

(1) Load on the beam

(2) Span of the beam

(3) Flexural rigidity (EI)

(4) Moment of inertia

85. The SI unit of beam deflection is:

(1) Newton (N)
(2) Meter (m)
(3) Newton-meter (N.m)
(4) Meter per second squared (m/s^2)

86. For beams with the same length and load, the beam with the smallest deflection has :

(1) The smallest moment of inertia
(2) The largest moment of inertia
(3) The smallest modulus of elasticity
(4) The largest modulus of rigidity

87. For the same weight and material, a hollow circular shaft is stronger than a solid circular shaft because :

(1) Hollow shafts have greater cross-sectional area
(2) Hollow shafts have larger polar moment of inertia
(3) Hollow shafts have lower radius of gyration
(4) Hollow shafts have uniform shear stress

88. The torsional critical speed of a shaft depends on :

(1) Length and material of the shaft
(2) Length and diameter of the shaft
(3) Diameter and polar moment of inertia
(4) Material and polar moment of inertia

89. The kinetic energy stored in a flywheel is proportional to :

(1) Square of its angular velocity
(2) Cube of its radius
(3) Inverse of its mass
(4) Inverse of its moment of inertia

90. Epicyclic gear trains are widely used in :

(1) Gear pumps
(2) Lathe machines
(3) Clocks
(4) Automatic transmissions

91. In a casting process, the function of the core is to :

(1) Form the external shape of the casting

(2) Form internal cavities or holes in the casting

(3) Improve the solidification rate of the metal

(4) Add strength to the casting

92. Which of the following is true about the gating system in casting ?

(1) It directs the molten metal into the mold cavity.

(2) It increases the pouring temperature of the molten metal.

(3) It eliminates the need for a riser.

(4) It decreases the fluidity of the molten metal.

93. Which of the following statements is true about the use of chills in casting ?

(1) Chills are used to increase the cooling rate of the metal.

(2) Chills are designed to trap gases during solidification.

(3) Chills are used to prevent metal shrinkage.

(4) Chills improve the surface finish of the casting.

94. Which of the following casting processes is best suited for high-precision parts with complex shapes ?

(1) Sand casting

(2) Investment casting

(3) Die casting

(4) Permanent mold casting

95. According to the Von Mises yield criterion, the material yields when :

(1) The maximum normal stress exceeds the yield stress

(2) The maximum shear stress exceeds half of the yield stress

(3) The equivalent stress (Von Mises stress) exceeds the yield stress

(4) The strain exceeds the yield strain

96. Which of the following is true about work hardening in the context of plastic deformation ?

(1) Work hardening leads to a decrease in the material strength.

(2) Work hardening is due to the increase in dislocation density.

(3) Work hardening occurs only when the material is heated above its recrystallization temperature.

(4) Work hardening reduces the yield point of the material.

97. Which of the following plastic deformation processes involves the application of compressive force to reduce the thickness of a material ?

(1) Rolling (2) Extrusion

(3) Forging (4) All of the above

98. The process of "work hardening" is primarily associated with :

(1) Hot working (2) Cold working

(3) Both hot and cold working (4) None of the above

99. Which of the following is NOT a type of metal forming process ?

(1) Rolling (2) Forging

(3) Extrusion (4) Welding

100. In which of the following metal forming processes is the material forced through a die to produce a continuous cross-sectional profile ?

(1) Extrusion (2) Rolling

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Total No. of Printed Pages : 21

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SET-X

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Ph.D-EE-December, 2024
Mechanical Engineering

10012

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

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_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There shall be negative marking. A deduction of 0.25 marks shall be there for each wrong answer. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
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SEAL

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(3) Non-ferrous materials with good formability

(4) All of the above

26. Which of the following is most closely associated with the "Just-in-Time (JIT)" inventory system ?

(1) Maximizing inventory levels to prevent stockouts

(2) Delivering products on time while keeping inventory low

(3) Increasing the production lead time

(4) Reducing machine downtime by increasing maintenance

27. What is the primary purpose of Capacity Planning in production planning and control (PPC) ?

(1) To determine the quantity of raw materials needed for production

(2) To ensure that production capacity aligns with demand

(3) To estimate future demand for products

(4) To schedule the delivery of goods to customer

28. In a Material Requirements Planning (MRP) system, the net requirements of an item are calculated by :

(1) Subtracting the available inventory from the gross requirements

(2) Adding the gross requirements to the on-hand inventory

(3) Adding the safety stock to the lead time demand

(4) Subtracting the forecast demand from the safety stock

29. In a Critical Ratio (CR) scheduling technique, the Critical Ratio is calculated by :

(1) Dividing the order due date by the lead time

(2) Dividing the remaining time until the due date by the remaining processing time

(3) Dividing the remaining processing time by the order quantity

(4) Dividing the order quantity by the remaining processing time

30. The Critical Path Method (CPM) is used in production planning to :

(1) Calculate the minimum number of machines required

(2) Determine the most efficient way to schedule production orders

(3) Identify the longest sequence of dependent activities to minimize delays

(4) Identify the least cost method for production

31. In a casting process, the function of the core is to :

(1) Form the external shape of the casting

(2) Form internal cavities or holes in the casting

(3) Improve the solidification rate of the metal

(4) Add strength to the casting

32. Which of the following is true about the gating system in casting ?

(1) It directs the molten metal into the mold cavity.

(2) It increases the pouring temperature of the molten metal.

(3) It eliminates the need for a riser.

(4) It decreases the fluidity of the molten metal.

33. Which of the following statements is true about the use of chills in casting ?

(1) Chills are used to increase the cooling rate of the metal.

(2) Chills are designed to trap gases during solidification.

(3) Chills are used to prevent metal shrinkage.

(4) Chills improve the surface finish of the casting.

34. Which of the following casting processes is best suited for high-precision parts with complex shapes ?

(1) Sand casting

(2) Investment casting

(3) Die casting

(4) Permanent mold casting

35. According to the Von Mises yield criterion, the material yields when :

(1) The maximum normal stress exceeds the yield stress

(2) The maximum shear stress exceeds half of the yield stress

(3) The equivalent stress (Von Mises stress) exceeds the yield stress

(4) The strain exceeds the yield strain

36. Which of the following is true about work hardening in the context of plastic deformation ?

(1) Work hardening leads to a decrease in the material strength.

(2) Work hardening is due to the increase in dislocation density.

(3) Work hardening occurs only when the material is heated above its recrystallization temperature.

(4) Work hardening reduces the yield point of the material.

37. Which of the following plastic deformation processes involves the application of compressive force to reduce the thickness of a material ?

(1) Rolling

(2) Extrusion

(3) Forging

(4) All of the above

38. The process of "work hardening" is primarily associated with :

(1) Hot working

(2) Cold working

(3) Both hot and cold working

(4) None of the above

39. Which of the following is NOT a type of metal forming process ?

(1) Rolling

(2) Forging

(3) Extrusion

(4) Welding

40. In which of the following metal forming processes is the material forced through a die to produce a continuous cross-sectional profile ?

(1) Extrusion

(2) Rolling

(3) Forging

(4) Drawing

41. In an ideal Otto cycle, the compression ratio is 8, and the ratio of specific heats $\gamma = 1.4$. What is the thermal efficiency of the cycle ?

(1) 56.25% (2) 60.2%

(3) 65.8% (4) 72.5%

42. An ideal gas undergoes an isothermal process at 300 K, expanding from 1 m^3 to 3 m^3. The work done by the gas is 200 kJ. What is the amount of heat transferred ?

(1) 200 kJ (2) 100 kJ

(3) 300 kJ (4) 0

43. A heat source at 1000 K transfers 500 kJ of heat to a reservoir at 500 K. What is the entropy change of the system ?

(1) +0.5 kJ/K (2) + 1.0 kJ/K

(3) +0.75 kJ/K (4) 0

44. For a reaction at constant temperature and pressure, if $\Delta H = -200$ kJ/mol and $\Delta S = -0.5$ kJ/mol.K at 300 K, what is ΔG ?

(1) –50 kJ/mol (2) –100 kJ/mol

(3) –150 kJ/mol (4) –200 kJ/mol

45. An aluminum fin with a thermal conductivity of 200 W/mK is attached to a surface at 100°C, with the surrounding air at 30°C. The convective heat transfer coefficient is 50 W /m^2K. Calculate the fin efficiency if the fin is 0.01 m thick and 0.1 m long.

(1) 70% (2) 80%

(3) 85% (4) 90%

46. A blackbody at 1000 K emits radiation with a total power of 500 W/m^2. If the temperature of the blackbody is doubled, the total power emitted will be :

(1) 1000 W/ m^2 (2) 4000 W/ m^2

(3) 16,000 W/ m^2 (4) 32,000 W/ m^2

47. A rectangular plane surface is submerged vertically in a liquid. The center of pressure is :

(1) At the centroid of the submerged area.

(2) Above the centroid of the submerged area.

(3) Below the centroid of the submerged area.

(4) None of the above.

48. A solid sphere with a diameter of 0.5 m and density 800 kg/m^3 is submerged in water. What is the net buoyant force acting on the sphere ? (ρ water=1000 kg/m^3, g=9.81 m/s^2.

(1) 1600 N

(2) 1000 N

(3) 640 N

(4) 320 N

49. A horizontal pipe has a diameter of 0.2 m at section 1 and 0.1 mat section 2. If the velocity at section 1 is 2 m/s, what is the velocity at section 2 ?

(1) 4 m/s

(2) 8 m/s

(3) 2 m/s

(4) 1 m/s

50. For a laminar flow of a Newtonian fluid in a pipe, the shear stress is :

(1) Maximum at the pipe wall and zero at the center.

(2) Maximum at the center and zero at the pipe wall.

(3) Uniform across the cross-section.

(4) Zero across the cross-section.

51. A reverted gear train is a special case where :

(1) All gears rotate in the same direction

(2) The input and output shafts are collinear

(3) Intermediate gears have the same number of teeth

(4) The input and output shafts have the same speed

52. The slider-crank mechanism consists of :

(1) 2 links and 1 pair (2) 3 links and 2 pairs

(3) 4 links and 4 pairs (4) 4 links and 3 pairs

53. Which of the following is NOT an inversion of the slider-crank mechanism ?

(1) Whitworth quick return mechanism (2) Oscillating cylinder engine

(3) Elliptical trammel (4) Rotary engine

54. If a bar is free to expand under a temperature increase, the thermal stress in the bar will be :

(1) Maximum

(2) Zero

(3) Equal to the yield strength of the material

(4) Equal to $E\alpha\Delta T$

55. The degree of freedom of a simple slider-crank mechanism is :

(1) 1 (2) 2

(3) 3 (4) 4

56. Entropy change during a reversible isothermal process is :

(1) Zero (2) Q/T

(3) T/Q (4) PV

57. Which of the following is an extensive property ?

(1) Temperature (2) Pressure

(3) Volume (4) Density

58. The Clausius statement of the second law of thermodynamics states that :

(1) It is impossible to transfer heat from a cold body to a hot body without doing work.

(2) It is impossible for a heat engine to convert all heat into work.

(3) The entropy of the universe remains constant.

(4) None of the above

59. During an isobaric process, the heat transferred to a gas is 500 kJ, and the work done by the gas is 300 kJ. What is the change in enthalpy of the gas ?

(1) 500 kJ

(2) 300 kJ

(3) 200 kJ

(4) 800 kJ

60. A wet steam mixture has a specific volume of 0.6 m^3/kg, with vf=0.001 m^3/kg and vg=1.0 m^3/kg. What is the quality of the mixture ?

(1) 0.59

(2) 0.60

(3) 0.50

(4) 0.75

61. A closed system undergoes a thermodynamic cycle consisting of two processes. In the first process, the system absorbs 100 kJ of heat while performing 60 kJ of work. In the second process, 40 kJ of heat is rejected. The work done in the second process is :

(1) –20 kJ

(2) 20 kJ

(3) –60 kJ

(4) 60 kJ

62. For a heat engine operating between two reservoirs at temperatures T1 and T2, the efficiency is maximum when :

(1) The process is adiabatic.

(2) The process is reversible.

(3) Tl=T2.

(4) The entropy generation is maximum.

63. The slope of the phase boundary in a P–TP–TP–T diagram for a phase change involving solid to liquid is given by the Clapeyron equation. $dp/dT = \Delta H/T\Delta V$ For water, the slope is :

(1) Positive due to the increase in volume during melting.

(2) Positive due to the decrease in volume during melting.

(3) Negative due to the decrease in volume during melting.

(4) Negative due to the increase in volume during melting.

64. In forced convection, the heat transfer coefficient increases with :

(1) Decreasing Reynolds number.

(2) Increasing flow velocity.

(3) Decreasing surface roughness.

(4) Increasing thermal conductivity of the fluid.

65. The dimensionless parameter used to characterize forced convection is :

(1) Grashof number (Gr).

(2) Biot number (Bi).

(3) Reynolds number (Re).

(4) Stefan-Boltzmann constant.

66. A superheated vapor is characterized by:

(1) A temperature lower than the saturation temperature at the given pressure.

(2) A temperature equal to the saturation temperature at the given pressure.

(3) A temperature higher than the saturation temperature at the given pressure.

(4) No fixed temperature-pressure relationship

67. At the critical point of a pure substance :

(1) The specific volume of liquid and vapor are the same.

(2) The specific volume of liquid is greater than that of vapor.

(3) The specific volume of liquid is less than that of vapor.

(4) Specific volume cannot be defined.

68. The Number of Transfer Units (NTU) in a heat exchanger represents :

(1) The ratio of heat transfer area to the heat capacity rate.

(2) The effectiveness of the heat exchanger.

(3) The total heat transferred by the exchanger.

(4) The ratio of maximum possible heat transfer to actual heat transfer.

69. Which of the following is NOT an application of Bernoulli's principle ?

(1) Venturimeter.

(2) Orifice meter.

(3) Pitot tube.

(4) Hydraulic jump.

70. The apparent weight of a submerged object in a fluid is :

(1) Equal to its actual weight.

(2) Less than its actual weight by the buoyant force.

(3) Equal to the buoyant force.

(4) Greater than its actual weight by the buoyant force.

71. During the rolling of a metal strip, which of the following phenomena occurs ?

(1) The strip length increases due to the volume of material remaining constant

(2) The temperature of the material decreases, leading to a reduction in ductility

(3) The material is compressed between two rolls, and the thickness of the strip decreases

(4) The friction between the rolls and the material is minimized to reduce power consumption

72. In powder metallurgy, the main purpose of the sintering process is to :

(1) Shape the powder into the desired form

(2) Increase the density and strength of the compacted powder

(3) Heat the powder to its melting point

(4) Remove impurities from the powder

73. Which of the following is a primary advantage of powder metallurgy ?

(1) High energy consumption during production

(2) Ability to produce complex shapes with little to no waste

(3) Limited to soft metals only

(4) Requires high-cost raw materials

74. Which of the following welding processes does ***not*** require the addition of filler metal ?

(1) Gas Tungsten Arc Welding (GTAW)

(2) Shielded Metal Arc Welding (SMAW)

(3) Gas Metal Arc Welding (GMAW)

(4) Oxy-fuel welding

75. Which of the following is a typical characteristic of brazing compared to welding ?

(1) Requires higher temperatures than welding

(2) Uses a filler metal with a melting point above the workpiece material

(3) Involves the melting of the base metal

(4) The workpieces do not melt, only the filler metal melts

76. Which of the following is true about flux in welding ?

(1) Flux prevents oxidation and contamination of the weld pool

(2) Flux is only used in brazing and soldering

(3) Flux is used to increase the temperature of the base metal

(4) Flux is used to strengthen the base metal

77. Which of the following is ***not*** a factor that affects the cutting force in a machining process ?

(1) Cutting speed

(2) Material of the tool

(3) Geometry of the workpiece

(4) Type of lubrication used

78. The shear force in machining is highest at :

(1) The cutting edge of the tool

(2) The point of chip formation

(3) The tool flank

(4) The point where the cutting force is applied

79. Which of the following is the main reason for using high-speed steel (HSS) tools in machining ?

(1) High wear resistance

(2) High thermal conductivity

(3) High toughness and flexibility

(4) High resistance to cutting forces

80. Which of the following is a typical application of a multipoint cutting tool ?

(1) Turning complex cylindrical shapes

(2) Drilling large holes

(3) Grinding hard materials

(4) Milling flat and contoured surfaces

81. In the FBD of a simply supported beam, the reaction forces are located :

(1) At the mid-span of the beam.

(2) At the points of support.

(3) Distributed along the entire length.

(4) At the centroid of the beam.

82. In a truss, a zero-force member is identified when :

(1) Two non-collinear members meet at a joint with no external force or support.

(2) Three members meet at a joint under an external force.

(3) All members are loaded equally.

(4) The truss is symmetric

83. Virtual work is especially useful in analyzing :

(1) Simple, determinate systems.

(2) Systems with large deformations only.

(3) Systems with multiple constraints and redundancies.

(4) Systems with no external forces.

84. A disc of radius 0.5 m is initially at rest. It starts rotating with a constant angular acceleration of 4 rad/s^2. The linear velocity of a point on its edge after 2s is :

(1) 2 m/s (2) 4 m/s

(3) 6 m/s (4) 8 m/s

85. If the Young's modulus (E) of a material is 200 GPa and Poisson's ratio (v) is 0.3, the shear modulus (G) is approximately :

(1) 76.9 GPa (2) 100 GPa

(3) 153.8 GPa (4) 66.7 GPa

86. Which of the following materials exhibits a significant plastic region in the stress-strain curve ?

(1) Cast iron (2) Glass

(3) Mild steel (4) Concrete

87. The area under the stress-strain curve up to the proportional limit represents :

(1) Modulus of resilience (2) Modulus of toughness

(3) Yield strength (4) Factor of safety

88. Mohr's Circle is used to determine :

(1) Only shear stresses (2) Principal stresses and principal planes

(3) Deflection of beams (4) Strain energy

89. The diameter of Mohr's Circle represents :

(1) Maximum normal stress

(2) Minimum normal stress

(3) Maximum shear stress

(4) Von Mises stress

90. For a plane stress condition with $\sigma x=100$ MPa, $\sigma y=50$ MPa, and $\tau xy=25$ MPa, the centre of Mohr's Circle lies at:

(1) (50,25)

(2) (75, 0)

(3) (100,25)

(4) (0,50)

91. What is the purpose of Safety Stock in production planning ?

(1) To maintain the optimal level of inventory for raw materials

(2) To buffer against uncertainties in demand or supply lead time

(3) To reduce excess inventory costs

(4) To reduce the cost of holding finished goods in inventory

92. In a linear programming problem, if the feasible region is unbounded and the objective function increases indefinitely, the problem is :

(1) Feasible and bounded

(2) Feasible and unbounded

(3) Infeasible

(4) Unsolvable

93. In the Simplex Method, the entering variable is chosen based on :

(1) The smallest value in the objective function row

(2) The largest negative value in the objective function row (for maximization problems)

(3) The smallest positive value in the constraint rows

(4) The smallest coefficient in the right-hand side column

94. The Simplex Method can be used to solve :

(1) Only maximization problems

(2) Only minimization problems

(3) Both maximization and minimization problems

(4) Linear programming problems with non-linear objective functions

95. The critical path in a PERT chart is the path that :

(1) Has the longest total duration

(2) Has the shortest total duration

(3) Has the most number of tasks

(4) Is the easiest to complete

96. Which of the following is true about the "Slack" in a PERT chart ?

(1) Slack is the amount of time an activity can be delayed without affecting the overall project duration

(2) Slack is the total duration of the critical path

(3) Slack is always zero for activities on the critical path

(4) Slack is only relevant for non-critical activities

97. Which of the following is a characteristic of activities on the critical path in CPM ?

(1) They have slack or float

(2) They can be delayed without affecting the project duration

(3) They have no slack or float

(4) They represent non-critical activities

98. Which of the following is a limitation of the Critical Path Method (CPM) ?

(1) It requires that all activity durations be known with certainty

(2) It does not consider resource constraints

(3) It can only be used for projects with more than 10 tasks

(4) It only applies to construction projects

99. Which of the following is a key element of Supply Chain Management ?

(1) Marketing and advertising strategies

(2) Management of suppliers, logistics, and inventory

(3) Employee welfare programs

(4) Financial management and profitability

100. Which of the following is NOT a typical function of supply chain management ?

(1) Demand forecasting

(2) Order fulfillment

(3) Advertising and marketing

(4) Inventory management

Answer keys of PH.D (MECHANICAL ENGG.)-UIET entrance exam dated 05.12.2024				
Q. NO.	A	B	C	D
1	2	2	1	2
2	1	1	2	3
3	3	2	3	2
4	2	1	2	3
5	1	3	3	2
6	3	2	3	2
7	1	2	1	2
8	2	1	1	1
9	3	2	4	1
10	2	3	2	4
11	2	2	2	1
12	3	1	4	2
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46	3	4	1	3
47	1	1	4	3
48	1	1	2	3
49	4	3	3	2
50	2	2	4	1

Answer keys of PH.D (MECHANICAL ENGG.)-UIET entrance exam dated 05.12.2024				
Q. NO.	A	B	C	D
51	2	3	1	2
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96	4	3	2	1
97	1	1	4	3
98	1	2	2	2
99	3	3	4	2
100	2	2	1	3

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