

PART III

05 - MECHANICAL ENGINEERING

(Answer ALL questions)

56. The possible reactions at the Ball and socket joint support are
- $R_x, R_y, R_z, M_x, M_y, \text{ and } M_z$
 - $M_x, M_y, \text{ and } M_z$
 - $R_x, R_y \text{ and } R_z$
 - $R_x, R_y, \text{ and } M_z$
57. The purpose of the governor is
- To keep the output power constant at the crankshaft
 - To increase the power capacity of the engine
 - To increase the speed
 - To regulate the fuel supply
58. The force required to slide the body of weight 1000 N placed on horizontal surface of co-efficient friction 0.25 is
- 1000 N
 - 750 N
 - 500 N
 - 250 N
59. A body of mass 5 kg is thrown vertically upwards with the velocity 29.43 m/s from the ground. The time taken by it to reach the maximum height is
- 0
 - 2 s
 - 3 s
 - 4 s
60. Dynamic equilibrium or D'Alembert's principle for the body under rotation is expressed with the following equation (s)
- $\sum M = I\alpha$
 - $\sum F = 0$
 - $\sum F_x = 0, \sum F_y = 0, \sum F_z = 0, \sum M_x = 0, \sum M_y = 0, \sum M_z = 0$
 - $\sum F = ma$
61. For balancing of masses which are fixed on a shaft and rotating in the different planes perpendicular to the axis of the shaft, the following is to be satisfied
- Both force polygon and couple polygon are to be closed
 - D'Alembert's principle is to be satisfied
 - Inertia forces are to be balanced
 - Force polygon is to be closed
62. The circumferential stress induced in a thin-walled cylindrical vessel is
- $\frac{pD}{2t}$
 - $\frac{pD}{t}$
 - $\frac{pD}{4t}$
 - $\frac{pD}{3t}$
63. Centrifugal tension in belts
- reduces power transmission
 - increases power transmission
 - does not affect power transmission
 - increase power transmission at high speed and decreases it at lower speed
64. For a spur gear, the product of circular pitch and diametral pitch is equal to
- unity
 - module
 - π
 - $\frac{1}{\pi}$

65. If the lead angle of a worm is 20° , then helix angle will be
- 20°
 - 70°
 - 10°
 - 80°
66. When bevel gears having equal teeth and equal pitch angles connect two shafts whose axes intersect at right angles, then they are known as
- Angular bevel gears
 - Crown bevel gears
 - Internal bevel gears
 - Mitre gears
67. Write the structural formula for 12 speed gear box
- 3(1) 2(3) 2(6)
 - 3(1) 3(3) 2(9)
 - 4(1) 2(4) 2(8)
 - 3(1) 2(3)
68. When a helical compression spring is subjected to an axial compressive load, the stress induced in the wire is
- tensile stress
 - compressive stress
 - shear stress
 - bending stress
69. _____ designers must master in curve, surface, and solid concepts before they can truly create complex solid models and be productive in using CAD systems.
- CAD
 - CAM
 - CAE
 - CAD/CAM
70. _____ is described by sets of data points (control points) such as splines and Bezier curves.
- Circle
 - Analytic curve
 - Synthetic curve
 - Conics
71. A _____ should sort out precisely the edges and faces of a solid into hidden, visible and partially hidden/visible.
- hidden line algorithm
 - hidden surface algorithm
 - visibility techniques
 - homogeneity test
72. _____ is a planning technique, usually implemented by computer, that translates the end products into a detailed schedule for the raw materials and parts used in those end products.
- Aggregate production planning
 - Master production planning
 - Capacity planning
 - Material requirements planning
73. The _____ combines a fully integrated material handling system with automated processing stations.
- Flexible Manufacturing System
 - Group machine cell
 - Production flow analysis
 - Group technology

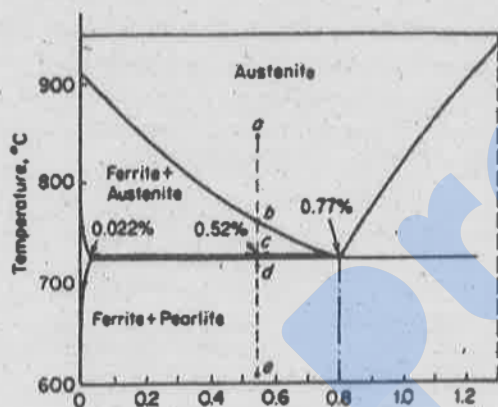
74. A quadrilateral elements has a minimum of four nodes and as many as _____ nodes.

- eleven
- twelve
- thirteen
- fourteen

75. The physical region of interest is divided into elements and element types and appropriate interpolation functions are selected and is known as

- formulation phase
- evaluation phase
- assembly phase
- solution phase

76. In the portion of iron-iron carbide phase diagram, what is the mass fraction of pearlite formed just below the eutectoid line for 0.52%C?



- 62.25%
- 33.42%
- 66.57%
- 65%

77. Holloman-Jaffe parameter is (T-absolute temperature; t-time in hrs)

- $T(\log t + 18) \times 10^{-3}$
- $t(\log T + 18) \times 10^{-3}$
- $T(\log t + 18) \times 10^{-2}$
- $t(\log T + 18) \times 10^{-2}$

78. Mechanical twins are found in

- SC
- FCC
- BCC and HCP
- All of the above

79. Choose the wrong statement with respect to ceramics

- the strength of ceramics is higher than metals because their covalent and ionic bonding types are stronger than metallic bonding
- Bonding in ceramics is more rigid and does not permit slip under stress
- The inability to slip makes it much more difficult for ceramics to absorb stresses
- The ceramics are more tougher than metals

80. The titanium above 883°C transforms to _____ structure from _____

- BCC, HCP
- FCC, HCP
- BCC, FCC
- FCC, BCC

81. Maraging steels are strengthened due to

- A fine, highly dislocated and strong martensite
- Fine dispersions of intermetallic of Fe, Ni, Ti, etc.
- fine dispersions of alloy carbides in ferrite matrix
- fine dispersions of Fe_3C nucleated on dislocations in austenite

82. Microalloyed steel in which carbon percentage is

- <0.2
- 0.2 – 0.4
- 0.4 – 0.6
- 0.6 – 0.77

83. The tool angle which helps in reducing the rubbing of the machined surface to the flank of the tool is

- Rake angle
- Cutting edge angle
- Clearance angle
- Nose radius

84. If the surface tension of the liquid increases with increase in temperature, then its effect on welding results in
- Weld fluid flows outwards
 - Weld pool becomes deeper
 - Weld pool becomes shallower
 - None of the above
85. An Aluminium material whose density is 2.7 gram/cm^3 is welded with an electrode of diameter of 1.2 mm at a feed rate of 50 mm per second. If the electrode efficiency is 0.75, then the deposition rate is
- $5 \times 10^{-4} \text{ kg/s}$
 - $1.14 \times 10^{-4} \text{ kg/s}$
 - $0.12 \times 10^{-4} \text{ kg/s}$
 - $2.85 \times 10^{-4} \text{ kg/s}$
86. Specific power consumption in metal cutting is reduced with increase of
- Cutting speed
 - Hardness and strength of metal
 - Surface finish
 - Feed rate/ depth of cut
87. A cubical casting of side 3 cm each takes 8 seconds for complete solidification. How much time a cube of same material with 6 cm each side will take for complete solidification?
- 16 seconds
 - 32 seconds
 - 64 seconds
 - 128 seconds
88. A CNC lathe is programmed and set to turn a diameter of 60 mm, but on trial run the diameter is found to be 60.1 mm. Which one of the following will ensure correct diameter during production?
- Increase the tool offset by 0.1 mm
 - decrease the tool offset by 0.1 mm
 - Increase the tool offset by 0.051 mm
 - decrease the tool offset by 0.05 mm
89. Which of the following can be used for checking the geometric accuracy of machine tool tables?
- CMM
 - Autocollimator
 - Laser interferometer
 - Laser micrometer
- 1, 2 and 4 only
 - 1, 3 and 4 only
 - 2 and 3 only
 - 1, 2 and 3 only
90. The height (in mm) for a 100 mm sine bar to measure a taper of 30° on a flat work piece is
- 33.33 mm
 - 86.6 mm
 - 100 mm
 - 50 mm
91. Assume that the surface roughness profile is triangular as shown schematically in the figure. If the peak to valley height is $10 \mu\text{m}$, the value of the surface roughness parameter R_t (in μm) is
- 
- 5
 - 10
 - 6.67
 - 20
92. A cylindrical pin of $30^{+0.02}_{+0.01} \text{ mm}$ diameter is electroplated. Plating thickness is $1.0 \pm 0.005 \text{ mm}$. The maximum diameter of the pin after plating is
- 31.025 mm
 - 31.0
 - 32.025
 - 32.03
93. Feeler gauge is used to measure
- diameter of a shaft
 - diameter of a hole
 - clearance or gap between parts
 - thickness of a part

94. Which of the following material is used to make stylus in CMMs?
- diamond
 - ruby
 - sapphire
 - inconel
95. The radius of the tip of the stylus in contact type surface roughness tester is usually
- 2 or 5 μm
 - 1 or 2 μm
 - 20 or 25 μm
 - < 1 μm
96. Which of the following is not the property of point functions?
- They have exact differential
 - They are independent of the path
 - They depend on initial and final states
 - They depend on the path followed
97. The relation between COP of heat pump and COP of a refrigerator is given as
- $(\text{COP})_{\text{HP}} = 1 - (\text{COP})_{\text{ref}}$
 - $(\text{COP})_{\text{HP}} = (\text{COP})_{\text{ref}}$
 - $(\text{COP})_{\text{HP}} = 1 + (\text{COP})_{\text{ref}}$
 - $(\text{COP})_{\text{HP}} = (\text{COP})_{\text{ref}} - 1$
98. A window air conditioner that consumes 1 kW of electricity when running and has a coefficient of performance of 4 is placed in the middle of a room, and is plugged in. The rate of cooling or heating this air conditioner will provide to the air in the room when running is
- 4 kJ/s, cooling
 - 1 kJ/s, cooling
 - 0.25 kJ/s, heating
 - 1 kJ/s, heating
99. According to Maxwell relations
- $\left(\frac{\partial T}{\partial V}\right)_S - \left(\frac{\partial P}{\partial S}\right)_V = 0$
 - $\left(\frac{\partial T}{\partial V}\right)_S + \left(\frac{\partial P}{\partial S}\right)_V = 0$
 - $\left(\frac{\partial V}{\partial T}\right)_S - \left(\frac{\partial S}{\partial P}\right)_V = 0$
 - $\left(\frac{\partial V}{\partial T}\right)_S + \left(\frac{\partial S}{\partial P}\right)_V = 0$
100. Air is throttled from 50° C and 800 kPa to a pressure of 200 kPa at a rate of 0.5 kg/s in an environment at 25° C. The change in kinetic energy is negligible, and no heat transfer occurs during the process. The power potential wasted (irreversibility) during this process is
- 59 kW
 - 0 kW
 - 47 kW
 - 119 kW
101. Water is boiling at 1 atm pressure in a stainless-steel pan on an electric range. It is observed that 2 kg of liquid water evaporates in 30 min. The rate of heat transfer in the water is
- 3.12 kW
 - 2.97 kW
 - 3.00 kW
 - 2.51 kW
102. Propane (C_3H_8) is burned with 150 percent theoretical air. The air-fuel mass ratio for this combustion process is
- 5.5
 - 23.4
 - 10.5
 - 15.7
103. Which one of the following expresses the thermal diffusivity of a substance?
- $k/\rho c$
 - $\rho c/k$
 - $1/\rho k c$
 - $\rho/c k$
104. If heat and mass transfer take place simultaneously, the ratio of heat transfer coefficient to the mass transfer coefficient is a function of the ratio of
- Schmidt and Reynolds numbers
 - Schmidt and Prandtl numbers
 - Nusselt and Lewis numbers
 - Reynolds and Lewis numbers

105. A cross flow type air heater has an area of 60 m^2 . The overall heat transfer coefficient is $100 \text{ W/m}^2\text{K}$ and heat capacity of both hot and cold stream is 1000 W/m K . The value of NTU is
- 0.6
 - 60
 - 6
 - 600
106. A steel ball of mass 1 kg and specific heat 0.5 kJ/kgK is at temperature of 60° C . It is dropped into 1 kg of water at 20° C . The final steady state temperature of water ($C_{\text{water}} = 4 \text{ kJ/kg K}$) is
- 25° C
 - 20° C
 - 30° C
 - 35° C
107. If the temperature of a solid state changes from 127° C to 527° C , then the change in emissive power is
- 1:8
 - 1:16
 - 1:32
 - 1:64
108. For air at a given temperature, as the relative humidity is increased isothermally,
- wet bulb temperature and specific enthalpy decreases
 - wet bulb temperature and specific enthalpy increases
 - wet bulb temperature increases and specific enthalpy decreases
 - wet bulb temperature decreases and specific enthalpy increases
109. If the thermal efficiency of a Carnot heat engine is 40% , the ratio of temperature of sink to that of source is
- 0.5
 - 0.6
 - 0.7
 - 0.4
110. Which one of the following is the dimension of specific weight of a liquid?
- $[\text{ML}^{-3} \text{ T}^{-2}]$
 - $[\text{ML}^3 \text{ T}^{-2}]$
 - $[\text{ML}^{-2} \text{ T}^{-2}]$
 - $[\text{ML}^2 \text{ T}^{-2}]$
111. How can relatively denser object be made to float on the less dense fluid?
- By altering the shape
 - By altering the forces acting on the object
 - By altering the shear forces acting on the object
 - None of the above
112. The continuity equation is based on the principle of
- conservation of mass
 - conservation of momentum
 - conservation of energy
 - conservation of force
113. Which property of the fluid accounts for the major losses in pipes?
- density
 - specific gravity
 - viscosity
 - compressibility
114. What is the relationship between Orificemeter diameter and pipe diameter?
- Orificemeter diameter is 0.5 times the pipe diameter
 - Orificemeter diameter is one third times the pipe diameter
 - Orificemeter diameter is one fourth times the pipe diameter
 - Orificemeter diameter is equal to the pipe diameter
115. Which forces are neglected to obtain Euler's equation of motion from Newton's second law of motion?
- Viscous force, Turbulence force, Compressible force
 - Gravity force, Turbulence force, Compressible force
 - Body force, Gravity force, Turbulence force
 - Viscous force, Turbulence force, Body force