(Answer ALL questions)

56. In a slider-crank mechanism the maximum acceleration of slider is obtained when the crank is
1. at the inner dead centre position
2. at the outer dead centre position
3. exactly midway position between the two dead centres
4. slightly in advance of the midway position between the two dead centres

57. $F = 3(n-1) - 2j$. In the Grubler's equation for planar mechanisms given, j is the
1. Number of mobile links
2. Number of links
3. Number of lower pairs
4. Length of the longest link

58. The centre of gravity of the coupler link in a 4-bar mechanism would experience
1. No acceleration
2. only linear acceleration
3. only angular acceleration
4. both linear and angular accelerations

59. A system in dynamic balance implies that
1. the system is critically damped
2. there is no critical speed in the system
3. the system is also statically balanced
4. there will be absolutely no wear of bearings

60. A rotating disc of 1 m diameter has two eccentric masses of 0.5 kg each at the radii of 50 mm and 60 mm at angular positions 0° and 150°, respectively. A balancing mass of 0.1 kg is to be used to balance the rotor. What is the radial position of the balancing mass?
1. 50 mm
2. 120 mm
3. 150 mm
4. 280 mm

61. An automotive engine weighing 240 kg is supported on four springs with linear characteristics. Each of the front two springs have a stiffness of 16 MN/m while the stiffness of each rear spring is 32 MN/m. The engine speed (in rpm), at which resonance is likely to occur, is
1. 6040
2. 3020
3. 1424
4. 955

62. A cantilever beam having 5 m length is so loaded that it develops a shearing force of 20 T and a bending moment of 20 T-m at a section 2 m from the free end. Maximum shearing force and maximum bending moment developed in the beam under this load are respectively 50 T and 125 T-m. The load on the beam is
1. 25 T concentrated load at free end
2. 20 T concentrated load at free end
3. 5 T concentrated load at free end and 2 T/m load over entire length
4. 10 T/m udl over entire length

63. The ratio of Euler's buckling loads of columns with the same parameters having (i) both ends fixed, and (ii) both ends hinged is
1. 2
2. 4
3. 6
4. 8

64. Two helical tensile springs of the same material and also having identical mean coil diameter and weight, have wire diameters d and d/2. The ratio of their stiffness is
1. 1
2. 4
3. 64
4. 128

65. The outside diameter of a hollow shaft is twice its inside diameter. The ratio of its torque carrying capacity to that of a solid shaft of the same material and the same outside diameter is

1. 15/16
2. 3/4
3. 1/2
4. 1/16

66. If a spring-mass-dashpot system is subjected to excitation by a constant harmonic force, then at resonance, its amplitude of vibration be

1. Infinity
2. Inversely proportional to damping
3. Directly proportional to damping
4. Decreasing exponentially with time

67. Minimum number of teeth for involute rack and pinion arrangement for pressure angle of 20° is

1. 18
2. 20
3. 30
4. 34

68. In a flat belt drive, the belt can be subjected to a maximum tension T and centrifugal tension T_c. What is the condition for transmission of maximum power?

1. $T = T_c$
2. $T = 2T_c$
3. $T = \sqrt{3}\,T_c$
4. $T = 3T_c$

69. In a multiple disc clutch, if there are 6 discs on the driving shaft and 5 discs on the driven shaft, then the number of pairs of contact surfaces will be equal to

1. 11
2. 12
3. 10
4. 22

70. A 60 mm long and 6 mm thick fillet weld carries a steady load of 15 kN along the weld. The shear strength of the weld material is equal to 200 MPa. The factor of safety is

1. 2.4
2. 3.4
3. 4.8
4. 6.8

71. A circular section rod ABC is fixed at ends A and C. It is subjected to torque T at B. AB = BC = L and the polar moment of inertia of portions AB and BC are 2 J and J respectively. If G is the modulus of rigidity, what is the angle of twist at point B?

1. TL/3GJ
2. TL/2GJ
3. TL/GJ
4. 2 TL/GJ

72. Which of the following is not a part of design for manufacturability?

1. Minimise the number of parts
2. Use horizontal assembly whenever possible
3. Reduce or eliminate fasteners
4. Use modular design

73. Which type of model is likely to be created with rapid prototyping systems?

1. Mathematical model
2. Wire frame model
3. Surface model
4. Scale model

74. CAD/CAM is the inter-relationship between

1. Marketing and Design
2. Manufacturing and Marketing
3. Engineering and Marketing
4. Engineering and Manufacturing

75. Development of which field has contributed most to the development of robotics

1. Aircraft Industry
2. Medicine Manufacture
3. Space Science
4. Astronomy

76. _____ is responsible for very large increase in yield strength.
1. Dislocation interaction
2. Dislocation movement
3. Dislocation multiplication
4. None

77. The property cannot be obtained from tensile test is
1. Young's modulus
2. Yield strength
3. UTS
4. Endurance limit

78. Alloying element that decreases eutectoid temperature in Fe-C system
1. Mo
2. Si
3. Ti
4. Ni

79. Solubility of carbon in alpha ferrite is
1. 0.025%
2. 2%
3. 6.67%
4. 0.4

80. Barium titanate is
1. Ferro-electric
2. Piezo-electric
3. Ferro-electric as well as piezo-electric
4. None of the above

81. Muntz metal contains
1. 50% copper and 50% zinc
2. 60.45 copper, 35.2% zinc and 4.35% nickel
3. 60% copper and 40% zinc
4. 70% copper and 30% zinc

82. The most popular and standard type or all purpose tool steels is 18 : 4 : 1 high speed steel which contains
1. 18% chromium, 4% tungsten and 1% vanadium
2. 18% tungsten, 4% vanadium and 1% chromium
3. 18% tungsten, 4% chromium and 1% vanadium
4. 18% vanadium, 4% chromium and 1% tungsten

83. In a low alloy steel weldment, if the base metal hardness is H1. HAZ hardness is H2 and weld metal hardness is H3, then
1. H1 > H3 > H2
2. H2 > H1 > H3
3. H3 > H2 > H1
4. H2 > H3 > H1

84. In grinding operation, for grinding harder material
1. fine grain size is used
2. coarser grain size is used
3. medium grain size is used
4. none of the above

85. The process, which is used to produce geometrically true surfaces is known as
1. Reaming
2. Honing
3. Broaching
4. Lapping

86. For small and intricate castings, the sand grains should be
1. Fine
2. Medium
3. Coarse
4. Rounded

87. The purpose of sprue is to
1. act as a reservoir for molten metal
2. feed molten metal form pouring basin to gate
3. removing pattern from the mould
4. split the pattern into parts

88. For making thin gears from sheet metals up to thickness 3 mm, the method is
1. casting
2. stamping
3. extruding
4. coining

89. Solidification cracking in weldments occurs at
1. moderate temperature
2. very high temperature
3. very low temperature
4. does not depend on temperature

90. The following is used to check the diameters of holes
1. Plug gauge
2. Ring gauge
3. Slip gauge
4. Standard screw pitch gauge

91. Error of measurement =
1. True value – Measured value
2. Precision – True value
3. Measured value – Precision
4. None of the above

92. Auto collimter is used to check
1. Roughness
2. Flatness
3. Angle
4. Automobile balance

93. When a cylinder is located in a vee-block, the number of degrees of freedom which are arrested is
1. 2
2. 4
3. 7
4. 8

94. What is the ominent direction of the tool marks in a surface texture having a directional quality called?
1. Primary texture
2. Secondary texture
3. Lay
4. Flaw

95. The appropriate instrument to check the flatness of a slip gauge is
1. dial indicator
2. ,pneumatic comparator
3. optical interferometer
4. tool maker's microscope with projection facility

96. A liquid is boiling in a airtight vessel. Using an exhaust tube the vapour is pumped out at a faster rate. What will happen to the liquid?
1. Temperature will go down but boiling will continue
2. Temperature will rise and boiling will continue
3. Boiling will stop
4. Whatever vapour inside will condense

97. A standard vapour is compressed to half its volume without changing its temperature. The result is that
1. All the vapour condenses to liquid
2. Some of the liquid evaporates and the pressure does not change
3. The pressure is twice that of its initial value
4. Some of the vapour condenses and the pressure does not change

98. A mass balance for energy conservation does not consider which of the following?
1. Steam
2. Water
3. Raw materials
4. Lubricating oil

99. It is impossible in any way to diminish the entropy of a system of bodies without thereby leaving behind changes in other bodies – Statement by

1. Plancks
2. Lewis
3. Clausius
4. Fourier

100. The amount of excess air to be supplied to any combustion equipment depends on

1. Expected variations in fuel properties and in fuel and air supply rates
2. Equipment application
3. Degree of operator supervision required or available
4. All of the above

101. The combustion analysis carried out by the Orsat Apparatus renders which one of the following?

1. The percentage composition by weight on the dry basis
2. The percentage composition by volume on the dry basis
3. The percentage composition by weight on the wet basis
4. The percentage composition by volume on the wet basis

102. In a mixture of dry air and water vapour, when the air has diffused the maximum amount of water vapour into it, is called

1. Dry air
2. Moist air
3. Saturated air
4. Specific humidity

103. A refrigeration plant uses a condenser with heat rejection ratio of 1.2. If the capacity of the plant is 210 kJ/min, then what is the value of the COP of the refrigeration plant?

1. 3
2. 5
3. 7
4. 9

104. The efficiency of superheat Rankine cycle is higher than that of simple Rankine cycle because

1. The enthalpy of main steam is higher for superheat cycle
2. The mean temperature of heat addition is higher for superheat cycle
3. The temperature of steam in the condenser is high
4. The quality of steam in the condenser is low

105. A diesel engine has a compression ratio of 17 and cut-off take place at 10% of the stroke. Assuming ratio of specific heats (γ) as 1.4, the air-standard efficiency (in percent) is

1. 55 to 58
2. 58 to 62
3. 62 to 64
4. 64 to 66

106. In a heat exchanger with one fluid evaporating or condensing, the surface area required will be minimum in

1. Parallel flow
2. Counter flow
3. Cross flow
4. Same in all the above

107. In the region of the boundary layer nearest to the wall, where vorticity is not equal to zero, the viscous forces are

1. Of the same order of magnitude as the initial forces
2. More than the initial forces
3. Less than the initial forces
4. Negligible

108. In an ideal impulse turbine, the
1. Absolute velocity at the inlet of moving blade is equal to that at the outlet
2. Relative velocity at the inlet of the moving blade is equal to that at the outlet
3. Axial, velocity at the inlet is equal to that at the outlet
4. Whirl velocity at the inlet is equal to that at the outlet

109. In free convection heat transfer transition from laminar to turbulent flow is governed by the critical value of the
1. Reynolds number
2. Grashoff's number
3. Reynolds number, Grashoff number
4. Prandtl number, Grashoff number

110. 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
1. Schmidt and Reynolds numbers
2. Schmidt and Prandtl numbers
3. Nusselt and Lewis numbers
4. Reynolds and Lewis numbers

111. In case of liquids, what is the binary diffusion coefficient proportional to?
1. Pressure only
2. Temperature only
3. Volume only
4. All the above

112. In the region of the boundary layer nearest to the wall where velocity is not equal to zero, the viscous forces are
1. Of the same order of magnitude as the inertial forces
2. More than inertial forces
3. Less than inertial forces
4. Negligible

113. The shear stress in turbulent flow is
1. Linearly proportional to the velocity gradient
2. Proportional to the square of the velocity gradient
3. Dependent on the mean velocity of flow
4. Due to the exchange of energy between the molecules

114. The head loss in turbulent flow in pipe varies
1. Directly as the velocity
2. Inversely as the square of the velocity
3. Inversely as the square
4. Approximately as the square of the velocity of the diameter

115. The following is the arrangement of rotary pumps in descending order of specific speed at their best efficiency
1. Positive displacement, centrifugal, axial
2. Centrifugal, positive displacement, axial
3. Axial, centrifugal, positive displacement
4. Axial, positive displacement, centrifugal