(Answer ALL questions).

56. The natural frequency of a vibration system is depends on the following
    (i)   Mass
    (ii) Damper
    (iii) Stiffness
    1. (i), (ii) only
    2. (ii), (iii) only
    3. (i), (iii) only
    4. (i), (ii), (iii)

57. Match the following for a single-degree-of-freedom system with $m = 50$, $k = 5000$, and $c = 600$
    (a) Natural frequency, w_n (i)   8
    (b) Critical damping constant, C_c (ii) 0.6
    (c) Damping ratio, ζ (iii) 1000
    (d) Damped frequency, w_d (iv) 10
    1. (a) – (iv), (b) – (ii), (c) – (iii), (d) – (i)
    2. (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)
    3. (a) – (i), (b) – (iii), (c) – (ii), (d) – (iv)
    4. (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)

58. The tire spring stiffness of a car is 100 kN/m. The front and rear suspension stiffness are 25 kN/m and 20 kN/m respectively. The front and rear suspension ride rates are
    1. 16.67 kN/m and 16.67 kN/m respectively
    2. 16.67 kN/m and 20.00 kN/m respectively
    3. 20.00 kN/m and 16.67 kN/m respectively
    4. 20.00 kN/m and 20.00 kN/m respectively

59. The total weight of the vehicle is 15 kN. The wheel base is 2.5m. If the front and rear reaction forces are 8.0 kN and 7.0 kN respectively, then the distance from front axle to CG and CG to rear axle are given by
    1. 1.167m and 1.333m respectively
    2. 1.167m and 1.167m respectively
    3. 1.333m and 1.167m respectively
    4. 1.333m and 1.333m respectively

60. The vehicle having a passenger cabin with two rows of seats and integrated cargo space, accessed from behind by a single tail gate is
    1. Saloon
    2. Limousine
    3. Estate car
    4. Coupe

61. Sill panel is
    1. Panel directly below the bottom of the door
    2. The side panel extending from the door to the rear end of the body
    3. A raised floor panel section for drive shaft clearance
    4. Panel between the bonnet and windscreen

62. A cycle consisting of one constant pressure, one constant volume and two isentropic processes is known as
    1. Carnot cycle
    2. Stirling cycle
    3. Otto cycle
    4. Diesel cycle

63. The efficiency and work ratio of a simple gas turbine cycle are
    1. Low
    2. Very low
    3. High
    4. Very high

64. The amount of heat required to raise the temperature of the unit mass of gas through one degree at constant volume, is called
    1. Specific heat at constant volume
    2. Specific heat at constant pressure
    3. Kilo Joule
    4. None of the above

65. An adiabatic process is one in which
   1. No heat enters or leaves the gas
   2. The temperature of the gas changes
   3. The change in internal energy is equal to the mechanical work done
   4. All of the above

66. The processes occurring in open system which permit the transfer of mass to and from the system, are known as
   1. Flow processes
   2. Non-flow processes
   3. Adiabatic processes
   4. None of these

67. Work done in a free expansion process is
   1. Zero
   2. Minimum
   3. Maximum
   4. Positive

68. Which one of the following is a criterion in the design of hydrodynamic journal bearing?
   1. Sommerfeld number
   2. Rating life
   3. Rotation factor
   4. Specific dynamic capacity

69. In case of spur gears static tool load as compared to dynamic load should be
   1. Same
   2. Less
   3. More
   4. Varies with tooth thickness

70. The face angle of a bevel gear is equal to
   1. Pitch angle – addendum angle
   2. Pitch angle + addendum angle
   3. Pitch angle – dedendum angle
   4. Pitch angle + dedendum angle

71. The cross section of the flywheel arms is usually
   1. Elliptical
   2. Rectangular
   3. I – Section
   4. L – Section

72. In leaf springs the longest leaf is known as
   1. Upper leaf
   2. Lower leaf
   3. Master leaf
   4. None of the above

73. The length of piston usually varies between (where D is the diameter of the piston)
   1. D and 1.5 D
   2. 1.5 D and 2 D
   3. 2 D and 2.5 D
   4. 2.5 D and 3 D

74. Size of the cam depends upon
   1. Base circle
   2. Pressure angle
   3. Pitch point
   4. None of the above

75. Which among the following is a lower pair?
   1. Pair of friction discs
   2. Ball and roller bearings
   3. Piston and cylinder
   4. Gear

76. Which of the following factors normally affect the critical speed of a shaft?
   1. Eccentricity
   2. Span of the shaft
   3. Diameter of the disc
   4. All of the above

77. In case of higher pairs
   1. There is no contact only at higher point of the two elements while in motion
   2. There is surface contact between two elements
   3. There is no contact between two elements
   4. There is only line or point contact between the two elements

78. If two pulleys of different diameters are connected by means of an open belt drive, then in this case angle of contact to be considered is of
   1. Both pulleys
   2. The smaller pulley
   3. The larger pulley
   4. None of the above

79. Which of the following is inversion of slider crank mechanism?

1. Reciprocating internal combustion engine
2. Crank and slotted lever mechanism
3. Whitworth quick return mechanism
4. All of the above

80. The rear end suspension arrangement in which the rear end torque is absorbed by the rear springs is called

1. Torque tube drive
2. Semi-Hotchkiss drive
3. Hotchkiss drive
4. de-Dion drive

81. The driveshaft's are connected to the differential and wheel hubs through universal joints because the universal joints

1. Compensate for variations in the relative positions of the differential and the wheels which result from bumpy road surfaces or other similar driving conditions.
2. Absorb the vibrations transferred from the surface of the road
3. Absorb any difference in speed between the left and right wheels when the vehicle is turning
4. All of the above

82. The upper wishbone is mounted slightly behind the lower one in the unequal double transverse wishbone suspension to obtain

1. Positive Caster angle
2. Constant Caster angle
3. Positive Camber angle
4. Constant Camber angle

83. In Ackermann linkage for a 10 degrees set track rod arm if the outer wheel turns for 40 degrees the inner wheel rotates

1. 40 degrees
2. 41 degrees
3. 50 degrees
4. 51 degrees

84. The material used for making torsion bar is

1. Steel
2. Cast iron
3. High carbon steel
4. All of the above

85. The component that connects the steering rack to the knuckles is

1. Tie-rod
2. Sector gear
3. Pivot
4. Spline

86. What is the maximum power transmitted by a single plate clutch at speed of 3600 rev/min if the coefficient of friction is 0.4 and the linings have a radii of 160mm inner and 190mm outer. The total spring force is 2.5 kN.

1. 132 kW
2. 123 kW
3. 1320 kW
4. 1230 kW

87. The friction disc is splined to the

1. transmission input shaft
2. Pressure plate
3. Flywheel
4. Crank shaft

88. To help reduce the shock of engagement in clutch, the friction disc has a series of waved

1. Cushion pads
2. Facings
3. Cushion springs
4. Discs

89. In the friction disc, tortional vibration is observed by the

1. Cushion bolts
2. Coil springs
3. Waved pads
4. Friction pads

90. When the gear ration through the transmission is 1:1, the transmission is in
    1. Overdrive
    2. Direct drive
    3. Under drive
    4. Neutral

91. The main function of transmission is
    1. to provide means to vary the torque ratio between the engine and the road wheels
    2. to provide neutral position
    3. to provide means to back the car
    4. all of the above

92. Modern digital PID controllers are mostly in
    1. Parallel form
    2. Series form
    3. Cascade form
    4. Feed forward form

93. Actuator saturation is a common nonlinearity that creates
    1. Proportional kick
    2. High frequency noise
    3. Low frequency noise
    4. Windup effect

94. The velocity of the rotating shaft is measured by using
    1. Inertia type sensor
    2. Inductive sensor
    3. Capacitive sensor
    4. Piezo type sensor

95. The acceleration and vibration sensor in air bag application measuring ranges in
    1. 50 g
    2. 1 to 10 g
    3. 10 g
    4. 4 g

96. The response time of zirconium dioxide sensor ranges from
    1. 1 to 3 ms
    2. 15 to 30 ms
    3. 1 to 3 sec
    4. 15 to 30 ms

97. Which type of sensor depends on material temperature and oxygen partial pressure
    1. Strontium Titanate
    2. Zirconium Dioxide
    3. Magnetic type
    4. Oxygen sensor

98. Biogas consists mainly of
    1. Methane
    2. Ethane
    3. Propane
    4. Butane

99. The following acid component is present in vegetable oils
    1. Oleic acid
    2. Palmitic acid
    3. Linoleic acid
    4. All the above

100. Micro-explosion phenomenon occurs in
    1. Esterified fuels
    2. Emulsified fuels
    3. Nano fuels
    4. Alcohol-vegetable oil blends

101. The increase in CO emission with vegetable oils as fuel in CI engines is due to
    1. The incomplete combustion of the fuel
    2. The flame quenching
    3. The fuel richness
    4. Poor atomization of the fuel

102. The unwanted components present in the raw biogas are
    1. Carbon dioxide
    2. Hydrogen sulfide
    3. Traces of water
    4. All the above

103. LPG is stored in domestic cylinders at the pressure of
    1. 2 bars
    2. 6 bars
    3. 10 bars
    4. 12 bars

104. A lead-screw with half nuts in a lathe, free to rotate in both directions has
    1. V-threads
    2. Whitworth threads
    3. Buttress threads
    4. Acme threads

105. Hot rolling of mild steel is carried out
    1. At recrystallization temperature
    2. Between 100°C to 150°C
    3. Between recrystallization temperature
    4. Above recrystallization temperature

106. The object of caulking in a riveted joint is to make the joint
    1. Free from corrosion
    2. Stronger in tension
    3. Free from stresses
    4. Leak-proof

107. What is the method of brazing used to join relatively small assemblies made from materials that either do not oxidize at the brazing temperature or can be protected from oxidation with a flux?
    1. Torch brazing
    2. Dip brazing
    3. Resistance brazing
    4. Furnace brazing

108. A CNC vertical milling machine has to cut a straight slot of 10 mm width and 2 mm depth by a cutter of 10 mm diameter between points (0,0) and (100,100) on the XY plane (dimensions in mm). The feed rate used for milling is 50 mm/min, milling time for the slot (in seconds) is
    1. 120
    2. 170
    3. 180
    4. 240

109. A solid cylinder of diameter 100 mm and height 50 mm is forged between two frictionless flat dies to a height of 25 mm. The percentage change in diameter is
    1. 0
    2. 2.07
    3. 41.4
    4. 20.7

110. NOx emission in SI engines will be lowest during
    1. Cruising
    2. Idling
    3. Acceleration
    4. Deceleration

111. Photochemical smog is mainly due to
    1. NOx and HC
    2. Soot and particulate matter
    3. CO and CO_2
    4. Excess O_2

112. Blue smoke in diesel engines indicate
    1. NOx
    2. HC
    3. CO
    4. Unburnt oil

113. Chemiluminescence technique is used to measure
    1. NOx
    2. CO
    3. CO_2
    4. Smoke intensity

114. Flame ionization detector is used for measuring
    1. CO
    2. HC
    3. NOx
    4. CO_2

115. Non-dispersive infra-red analyzer is widely accepted instrument for measuring
    1. NOx
    2. HC
    3. CO
    4. CO_2