

PROVISIONAL ANSWER KEY

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Note : Candidate must ensure the compliance to send all suggestion in the given format with reference to this paper with provisional answer key only. Any non compliance shall not be treated.

101. The maximum bending moment for a cantilever beam carrying a uniform distributed load of intensity w /unit length over its entire span is given as

(A) $\frac{wl}{4}$

(B) $\frac{wl^2}{8}$

(C) $\frac{wl^2}{2}$

(D) $-\frac{wl^2}{2}$

- 102.** Consider the following statements:
1. The area under T-S diagram represents the heat transferred in the process.
 2. For a natural process, change in entropy is always positive and is greater than zero.
 3. $\oint \frac{dQ}{T}$ is greater than zero for a reversible cycle.
 4. The entropy of an isolated system is maximum at the state of equilibrium.
- of these statements:
- (A) 1 alone is true. (B) 2 and 3 are true.
 (C) 1 and 3 are true. (D) 1, 2 and 4 are true.
- 103.** The area of the indicator diagram is measured by
- (A) Rotameter (B) Dynamometer
 (C) Planimeter (D) Viscometer
- 104.** Consider the following statements about dryness fraction:
1. It can be decreased with an increase in boiler pressure or a decrease in condenser pressure.
 2. Decreased dryness fraction can erode turbine blades.
 3. The turbine efficiency is decreased with low dryness fraction.
 4. It is a common practice to maintain at least 90% quality at the turbine exit. Of these statements:
- (A) 1 and 2 are true. (B) 1, 2 3 and 4 are true.
 (C) 1, 2 and 3 are true (D) 2, 3 and 4 are true.
- 105.** Which of the following is not a Boiler Mounting?
- (A) Pressure Gauge (B) Fusible Plug
 (C) Feed Pump (D) Man hole
- 106.** Coefficient of discharge of reciprocating pump in case of negative slip is
- (A) More than one (B) Equal to one
 (C) Less than one (D) Zero
- 107.** The atmospheric pressures at the top and the bottom of a building are read by a barometer to be 96.0 and 98.0 kPa. If the density of air is 1.0 kg/m^3 and specific gravity of mercury is 13.56, the height of the building is
- (A) 17 m (B) 20 m
 (C) 170 m (D) 204 m

108. At sea level, the weight of 1 kg mass in SI units is 9.81 N. The weight of 1 lbm mass in English units is
(A) 1 lbf (B) 9.81 lbf
(C) 32.2 lbf (D) 0.1 lbf
109. A fan is to accelerate quiescent air to a velocity to 12 m/s at a rate of 3 m³/min. If the density of air is 1.15 kg/m³, the minimum power that must be supplied to the fan is
(A) 248 W (B) 72 W
(C) 497 W (D) 216 W
110. A 2-kW pump is used to pump kerosene ($\rho = 0.820$ kg/L) from a tank on the ground to a tank at a higher elevation. Both tanks are open to the atmosphere, and the elevation difference between the free surfaces of the tanks is 30 m. The maximum volume flow rate of kerosene is
(A) 8.3 L/s (B) 7.2 L/s
(C) 6.8 L/s (D) 12.1 L/s
111. The pressure of an automobile tyre is measured to be 190 kPa (gage) before a trip and 215 kPa (gage) after the trip at a location where the atmospheric pressure is 95 kPa. If the temperature of air in the tyre before the trip is 25°C. the air temperature after the trip is
(A) 51.1°C (B) 64.2°C
(C) 27.2°C (D) 28.3°C
112. The specific volume of water when heated from 0°C
(A) first increases and then decreases.
(B) first decreases and then increases.
(C) increases steadily.
(D) decreases steadily.
113. Which type of welding is very widely used in rail track work?
(A) Laser Beam welding (B) Friction welding
(C) Electron Beam welding (D) Thermit welding
114. Lathe bed is made of
(A) Mild steel (B) Alloy steel
(C) Pig steel (D) Chilled Cast iron

115. Which of the following is required for Electric Arc welding:
(A) A low Amperage and high voltage combination
(B) A low Amperage and low voltage combination
(C) A high Amperage and low voltage combination
(D) None of these
116. A taper provided on the pattern for its easy and clean withdrawal from the mould is known as
(A) Machining Allowance (B) Draft Allowance
(C) Shrinkage Allowance (D) Distortion Allowance
117. A cone with an apex angle 2θ is cut by a cutting plane at an angle α . When α is greater than θ , the intersection curves is
(A) Ellipse (B) Parabola
(C) Hyperbola (D) Circle
118. A cone with an apex angle 2θ is cut by a cutting plane at an angle α . When the α is less than θ , the intersection curves is
(A) Ellipse (B) Parabola
(C) Hyperbola (D) Circle
119. What is the preferable inclination of hatching lines?
(A) 30° (B) 60°
(C) 75° (D) 45°
120. Half-sections are best used when the object is
(A) Irregular (B) Visualized
(C) Nonvisualized (D) Symmetrical
121. The free energy decrease during recrystallization comes mainly from
(A) excess point defects
(B) excess dislocations
(C) grain boundaries
(D) lower energy of the new crystal structure
122. On heating a rubber under tensile force, it
(A) Shrinks (B) Expands
(C) Expands rapidly (D) Show no change

123. Crystals like diamond and silicon are brittle, because
(A) they contain no dislocations
(B) they are noncrystalline
(C) the stress to move a dislocation is high in them
(D) they contain very few dislocations
124. The most suitable theory of failure for a ductile material is
(A) The maximum normal stress theory
(B) The Coulomb-Mohr's theory
(C) The maximum shear stress theory
(D) The maximum distortion energy theory
125. The endurance limit of a material can be improved by
(A) Polishing
(B) Heat treatment
(C) Knurling
(D) Introducing residual stresses
126. In which type of teeth, variation in centre-distance within limit does not affect the velocity ratio of the mating gears.
(A) Cycloidal
(B) Involute
(C) Hypoid
(D) None of the above
127. If both pinion and gear are made up of the same material, then the load transmission capacity is decided by
(A) The gear
(B) The pinion
(C) Both (A) and (B)
(D) None of the above
128. Maximum load on bolts of the connecting rod cap
(A) occurs at TDC of the suction stroke
(B) occurs at TDC of the expansion stroke
(C) occurs at BDC of the compression stroke
(D) is unpredictable.
129. A spherical pair allows
(A) 2 degree of freedom
(B) 4 degree of freedom
(C) 1 degree of freedom
(D) 3 degree of freedom
130. Coriolis component is considered if
(A) the point considered moves on a path that rotates
(B) the point considered moves along a path that is stationary
(C) the point considered moves along a circular path
(D) the point considered moves in any curvilinear path.

131. During taking a turn a cyclist inclines at an angle with the normal to the road. The equilibrium is maintained due to
 (A) weight of cyclist
 (B) centrifugal force alone
 (C) centrifugal force and gyrocouple
 (D) weight of cyclist, centrifugal force and gyrocouple.
132. When the pitching of a ship is upward, the effect of gyroscopic couple acting on it will be
 (A) to raise the bow and lower the stern
 (B) to move the ship towards star-board
 (C) to move the ship towards portside
 (D) to raise the stern and lower the bow.
133. The buoyant force for a floating body passes through the
 (A) Centroid of the displaced volume
 (B) Centre of gravity of the body
 (C) Centroid of volume of the body
 (D) Meta-centre of the body
134. Pascal second is the unit of
 (A) Drag
 (B) Dynamic viscosity
 (C) Kinematic viscosity
 (D) Pressure
135. The drag coefficient C_D is a non-dimensional parameter and is a function of drag force F_D , density ρ , velocity V , and area A . the drag coefficient is expressed as
 (A) $\frac{F_D V^2}{2\rho A}$
 (B) $\frac{2F_D}{\rho V A}$
 (C) $\frac{\rho V A^2}{F_D}$
 (D) $\frac{2F_D}{\rho V^2 A}$
136. The standard atmospheric pressure (at sea level) is not equal to
 (A) 760 mm Hg
 (B) 18.2 m of benzene
 (C) 10.3 m of H_2O
 (D) 101.325 kPa
137. Which of the following criteria need to be fulfilled for making two different pipe systems equivalent?
 (A) Same length and diameter
 (B) Same discharge and length
 (C) Same pressure loss and discharge
 (D) Same velocity and diameter

138. Engine of different cylinder dimensions, power and speed are compared on the basis of
 (A) Maximum pressure (B) Fuel consumption
 (C) Mean effective pressure (D) Unit power
139. Inlet valve Mach index usually relates
 (A) Mechanical efficiency (B) Volumetric efficiency
 (C) Brake thermal efficiency (D) Relative efficiency
140. When the engines are built to withstand the same thermal and mechanical stresses
 (A) $\eta_{\text{Otto}} > \eta_{\text{Dual}} > \eta_{\text{Diesel}}$ (B) $\eta_{\text{Dual}} > \eta_{\text{Diesel}} > \eta_{\text{Otto}}$
 (C) $\eta_{\text{Diesel}} > \eta_{\text{Dual}} > \eta_{\text{Otto}}$ (D) $\eta_{\text{Otto}} > \eta_{\text{Diesel}} > \eta_{\text{Dual}}$
141. Mean effective pressure of Otto cycle is
 (A) Inversely proportional to pressure ratio
 (B) Directly proportional to pressure ratio
 (C) Does not depend on pressure ratio
 (D) Proportional to square root of pressure ratio
142. For SI engine fuels most preferred are
 (A) Aromatics (B) Paraffins
 (C) Olefins (D) Napthenes
143. Stoichiometric air-fuel ratio of alcohol when compared to gasoline is
 (A) Higher (B) Lower
 (C) Equal (D) None of the above
144. In the coil spring rear suspension for a rear drive vehicle, the axle housing is kept in place by
 (A) U-bolts (B) The stabilizer bar
 (C) Control arms (D) The shock absorbers
145. For maximum thermal efficiency, the fuel-air mixture in SI engine should be
 (A) Lean (B) Rich
 (C) Stoichiometric (D) May be rich or lean
146. With increase in compression ratio flame speed
 (A) Increases (B) Decreases
 (C) Remain the same (D) None of the above

147. The type of rear axle used on trucks is
(A) Semi-floating (B) Three-quarter floating
(C) Fully-floating (D) None of above
148. Which stage of vehicle emission norms presently applicable in India in Internal Combustion Engine?
(A) Bharat Stage V (B) Bharat Stage II
(C) Bharat Stage IV (D) Bharat Stage III
149. If the compressor runs, little or no difference in temperature between the low pressure and the high pressure lines indicates
(A) A full refrigerant charge (B) Normal system operation
(C) Low or no refrigerant (D) An overcharge of refrigerant oil
150. The part that rotates to circulate coolant between the radiator and water jackets is the
(A) Bypass valve (B) Propeller
(C) Expeller (D) Impeller
151. The inertia of the rotating parts of the clutch should be
(A) Minimum (B) Maximum
(C) Zero (D) None of above
152. Cushion spring in automotive clutch plate are required to reduce
(A) Vehicle speed (B) Torsional vibrations
(C) Jerk starts (D) None of the above
153. In an automobile, if the vehicle makes a left turn, the gyroscopic torque
(A) Decreases the forces on the outer wheels
(B) Increases the forces on the outer wheels
(C) Does not affect the forces on the outer wheels
(D) None of above
154. A machine member used to connect engine shaft to gear box is called
(A) Differential (B) Clutch
(C) Flywheel (D) Propeller shaft
155. What is a byproduct of producing biodiesel?
(A) Polymer (B) Methanol
(C) Glycerin (D) Salt

156. According to Aronhold Kennedy's theorem, if three bodies move relatively to each other, their instantaneous centres will lie on a
(A) straight line (B) parabolic curve
(C) Ellipse (D) none of these
157. Oldham's coupling is used to connect two shafts which are
(A) Intersecting (B) Parallel
(C) Perpendicular (D) Co-axial
158. Two spur gears have a velocity ratio of $1/3$. The driven gear has 72 teeth of 8 mm module and rotates at 300 rpm. Calculate the number of teeth of the driver.
(A) 23 (B) 22
(C) 25 (D) 24
159. What is the minimum number of teeth required on each wheel to avoid interference, if the addendum of wheel is equal to 1, and equal number of teeth on the pinion and the wheel, and pressure angle is 20 degree?
(A) 14 (B) 13
(C) 11 (D) None of the above
160. Two intersecting shafts can be connected by gears?
(A) Straight spur (B) Spiral
(C) Cross helical (D) Straight bevel
161. The crowning of a pulley is done to
(A) Increase the tightness of belt on the pulley
(B) To prevent belt running off the pulley
(C) To increase the torque transmitted
(D) To improve the shape and strength of the pulley
162. At resonance, the amplitude of vibration is
(A) Very large (B) Small
(C) Zero (D) Depends upon frequency
163. Which one of the following materials is used as the bonding material for grinding wheels?
(A) Silicon carbide bond materials (B) Silicate bond materials
(C) Boron carbide bond materials (D) Aluminium oxide bond materials

164. A 160 mm long 15 mm diameter rod is reduced to 1.4 mm diameter in a single pass straight turning. If the spindle speed is 450 rpm and feed rate is 225 mm/min, calculate the material removal rate in mm³/min.
- (A) 5301.4 (B) 5509.3
(C) 6509.3 (D) 5687.21
165. An ideal fluid
- (A) Has no viscosity
(B) Satisfies the relationship ($p v = R T$)
(C) Obey the Newton's law of viscosity
(D) Is both incompressible and non viscous
166. Surface tension is a phenomenon due to
- (A) Viscous force
(B) Cohesion between the liquid molecules
(C) Adhesion between the liquid and solid molecules
(D) Adhesion and cohesion both
167. One torr pressure is equivalent to
- (A) 1 mm of Hg (B) 1 atmosphere
(C) 1 Pascal (D) 10 m of water
168. A square plate 3X3 m² is just held submerged below water in a vertical position. The total pressure on one face is approximately in kN
- (A) 33 (B) 65
(C) 132 (D) 265
169. Euler's dimensionless number relates
- (A) Inertia and gravity force (B) Viscous and inertia force
(C) Pressure and inertia force (D) Buoyant and viscous force.
170. According to Indian Standards., total number of tolerance grades are
- (A) 8 (B) 12
(C) 18 (D) 20
171. In case of a multiple disc clutch, if n_1 are the number of discs on the driving shaft and n_2 are the number of the discs on the driven shaft, then the number of pairs of contact surfaces will be
- (A) $n_1 + n_2$ (B) $n_1 + n_2 - 1$
(C) $n_1 + n_2 + 1$ (D) none of these

172. In designing a sleeve and cotter joint, the outside diameter of the sleeve is taken as, where d is diameter of the rod
(A) $1.5 d$ (B) $2.5 d$
(C) $3 d$ (D) $4 d$
173. What is the value of Poisson's ratio for steel
(A) 0.25 to 0.33 (B) 0.5 to 0.66
(C) 0.75 to 0.85 (D) 0.10 to 0.16
174. What is the effect of adding Phosphorus in cast iron
(A) Improve hardness (B) Improve brittleness
(C) Reduce hardness (D) Improve fluidity
175. The carbon % carry by the dead mild steel are in the order of
(A) 0.45 to 0.8 (B) 0.85 to 1.0
(C) Up to 0.15 (D) None of these
176. Which one is not the main objective of annealing
(A) soften the steel (B) refine the grain structure
(C) relieve internal stresses (D) improve brittleness
177. The portion of the piston below the ring section is known as
(A) Piston crown (B) Oil ring
(C) Compression ring (D) Piston skirt
178. Two blocks which are at different states are brought into contact with each other and allowed to reach a final state of thermal equilibrium. The final attained is specified by the
(A) zeroth law of thermodynamics (B) first law of thermodynamics
(C) second law of thermodynamics (D) third law of thermodynamics
179. Which one of the following is the extensive property of a thermodynamic system?
(A) Volume (B) Pressure
(C) Temperature (D) Density
180. Which one of the following thermodynamic processes approximates the steaming of food in a pressure cooker?
(A) Isenthalpic (B) Isobaric
(C) Isochoric (D) Isothermal

181. Identify the correct statement for movement in lathe machine
(A) Longitudinal feed - through carriage movement
(B) Cross feed - through cross slide movement
(C) Angular feed - through top slide movement
(D) All of the above
182. An insulated box containing 0.5 kg of a gas having $C_v = 0.98 \text{ KJ/KgK}$ falls from a balloon 4 km above the earth's surface. The temperature rise of the gas when the box hits the ground is
(A) 0 K (B) 20 K
(C) 40 K (D) 60 K
183. A gas is compressed in a cylinder by a movable piston to a volume one-half of its original volume. During the process, 300 KJ heat left the gas and internal energy remained same. The work done on the gas is
(A) 100 KN-m (B) 150 KN-m
(C) 200 KN-m (D) 300 KN-m
184. Change in internal energy in a reversible process occurring in a closed system is equal to the heat transferred if the process occurred at constant:
(A) Pressure (B) Volume
(C) Temperature (D) Enthalpy
185. Which one of the following is correct? The cyclic integral of $(\delta Q - \delta W)$ for a process is
(A) Positive (B) Negative
(C) Zero (D) Unpredictable
186. At critical point enthalpy of vaporization is
(A) Dependent on temperature only (B) Maximum
(C) Minimum (D) Zero
187. $TdS = dU + p dV$, this equation holds good for
(A) Any process, undergone by a closed system
(B) Reversible process, undergone by a closed system
(C) Quasi-static process, undergone by a closed system
(D) None of the above

188. For the same compression ratio or the same heat rejection, which power cycle is more efficient?
(A) Diesel cycle (B) Dual cycle
(C) Otto cycle (D) None of the above
189. The advantages of cold working of metals, except
(A) Improve surface finish (B) Closer dimensional
(C) Scale free and bright surface (D) Refine the grain structure
190. Find the cutting time required for drilling a 18 mm hole in a workpiece having thickness 50 mm, assume cutting speed 12 m/min and feed 0.2 mm/revolution. Neglect the length of approach.
(A) 1.18 minute (B) 1 minute
(C) 1.15 minute (D) 2.12 minute
191. The act of restoring the cutting face of a grinding wheel by removing the abrasive materials from the cutting face and sides of the wheel is known as:
(A) Wheel truing (B) Wheel dressing
(C) Wheel metal crushers (D) None of these
192. What is approximate value of octane number of Natural gas
(A) Less than 100 (B) 120 to 130
(C) Around 150 (D) 85 to 105
193. The air / fuel ratio, at which maximum power output is available
(A) Near stoichiometric mixture (B) 16
(C) Less than 10 (D) Near to 12
194. A 42.5 kW engine has a mechanical efficiency of 85%. What is the value of friction power in kW
(A) 8.5 (B) 8
(C) 7.5 (D) 7
195. Which one is double flue tube boiler:
(A) Lancashire boiler (B) Babcock and Wilcox boiler
(C) Benson boiler (D) All of the above

196. Which one is incorrect in vapour compression refrigeration system?
(A) COP decreases with decreasing evaporator pressure
(B) COP decreases with increasing condenser pressure
(C) Both a and b
(D) None of the above
197. One Btu of Energy is equal to kJ:
(A) 1.055 (B) 4.1868
(C) 1.2 (D) 4.5
198. The top portion of the tyre is called
(A) Tread (B) Rayon cords
(C) Bead wire (D) None of these
199. Which type of pump is most suitable for high pressure and moderate capacity pumping?
(A) Rotary positive displacement (B) Centrifugal
(C) Reciprocating (D) None of these
200. Hypsometer works on the principle of
(A) Boiling temperature of water varies with atmospheric pressure
(B) Independent of Boiling Temperature
(C) Atmospheric pressure varies with altitude
(D) None of the above