

Mechanical Engineering

1. The principle of transmissibility of forces states that the effect of a force on a rigid body is the same if it is moved to any point on its line of action.

- A) True
- B) False
- C) Depends on the body
- D) Depends on the force magnitude

Answer: A) True

Explanation: This principle is a fundamental concept in statics, allowing forces to be analyzed at any convenient point along their line of action on a rigid body.

2. A couple is formed by two forces that are:

- A) Equal in magnitude and have the same line of action.
- B) Equal in magnitude, opposite in direction, and have the same line of action.
- C) Unequal in magnitude and parallel.
- D) Equal in magnitude, opposite in direction, and separated by a distance.

Answer: D) Equal in magnitude, opposite in direction, and separated by a distance.

Explanation: A couple produces a pure turning effect or moment, without any net translation, because the forces cancel each other out.

3. The coefficient of friction depends on:

- A) The area of contact.
- B) The shape of the surfaces.
- C) The nature of the surfaces in contact.
- D) The speed of sliding.

Answer: C) The nature of the surfaces in contact.

Explanation: The coefficient of friction is an empirical property that quantifies the roughness and adhesion between two specific surfaces.

4. D'Alembert's principle is used for:

- A) Reducing a problem in statics to a problem in dynamics.

- B) Reducing a problem in dynamics to a problem in statics.
- C) Solving problems involving conservative forces only.
- D) Solving problems involving trusses.

Answer: B) Reducing a problem in dynamics to a problem in statics.

Explanation: It states that the sum of the external forces and the 'inertia force' is zero, allowing dynamic problems to be treated with static equilibrium equations.

5. The center of gravity of a uniform solid hemisphere lies on the central radius at a distance of:

- A) $3r/8$ from the plane base.
- B) $r/2$ from the plane base.
- C) $3r/4$ from the plane base.
- D) $r/3$ from the plane base.

Answer: A) $3r/8$ from the plane base.

Explanation: This is a standard result derived from integrating the moments of elemental disks that make up the hemisphere.

6. The unit of angular momentum is:

- A) N-m
- B) kg-m/s
- C) kg-m²/s
- D) N/s

Answer: C) kg-m²/s

Explanation: Angular momentum is the product of the moment of inertia (kg-m²) and angular velocity (rad/s), resulting in units of kg-m²/s.

7. Hooke's Law states that within the elastic limit, stress is:

- A) Inversely proportional to strain.
- B) Directly proportional to strain.
- C) Equal to strain.
- D) Independent of strain.

Answer: B) Directly proportional to strain.

Explanation: This fundamental principle of linear elasticity is expressed as $\sigma = E\epsilon$, where E is the modulus of elasticity.

8. The ratio of lateral strain to longitudinal strain is known as:

- A) Modulus of Elasticity
- B) Shear Modulus
- C) Bulk Modulus
- D) Poisson's Ratio

Answer: D) Poisson's Ratio

Explanation: Poisson's ratio (ν) describes the tendency of a material to deform in directions perpendicular to the direction of loading.

9. The point on the stress-strain curve where the material starts to deform without any increase in load is called the:

- A) Elastic Limit
- B) Proportional Limit
- C) Yield Point
- D) Ultimate Stress Point

Answer: C) Yield Point

Explanation: At the yield point, the material undergoes plastic deformation, and the strain increases significantly for a small or no increase in stress.

10. A cantilever beam is one which is:

- A) Supported at both ends.
- B) Supported on more than two supports.
- C) Fixed at one end and free at the other.
- D) Supported by a hinge and a roller.

Answer: C) Fixed at one end and free at the other.

Explanation: This type of support creates a moment and reaction forces at the fixed end, making it a common structural element.

11. The maximum bending moment in a simply supported beam carrying a uniformly distributed load 'w' over its entire span 'L' is:

A) $wL^2/4$

B) $wL^2/8$

C) $wL^2/2$

D) $wL^2/12$

Answer: B) $wL^2/8$

Explanation: The maximum bending moment occurs at the center of the beam and is a standard formula derived from shear and moment diagrams.

12. Torsional rigidity of a shaft is defined as the product of:

A) Modulus of elasticity and moment of inertia.

B) Modulus of rigidity and polar moment of inertia.

C) Modulus of elasticity and polar moment of inertia.

D) Modulus of rigidity and moment of inertia.

Answer: B) Modulus of rigidity and polar moment of inertia.

Explanation: Torsional rigidity (GJ) represents the resistance of a shaft to twisting or torsional deformation.

13. The continuity equation ($\rho AV = \text{constant}$) is based on the principle of conservation of:

A) Energy

B) Mass

C) Momentum

D) Angular Momentum

Answer: B) Mass

Explanation: It states that the mass flow rate entering a control volume must equal the mass flow rate leaving it for steady flow.

14. Bernoulli's equation deals with the conservation of:

A) Mass

B) Momentum

C) Energy

D) Force

Answer: C) Energy

Explanation: It relates the pressure, velocity, and elevation between two points in a moving fluid, representing the conservation of mechanical energy per unit volume.

15. A fluid in which the shear stress is directly proportional to the rate of shear strain is called a:

- A) Ideal fluid
- B) Newtonian fluid
- C) Non-Newtonian fluid
- D) Thixotropic fluid

Answer: B) Newtonian fluid

Explanation: This defines the linear relationship between stress and strain rate, with the constant of proportionality being the fluid's viscosity. Water and air are common examples.

16. The pressure at a point in a static fluid is equal in all directions. This statement is known as:

- A) Bernoulli's Law
- B) Archimedes' Principle
- C) Pascal's Law
- D) Newton's Law of Viscosity

Answer: C) Pascal's Law

Explanation: This principle is fundamental to hydrostatics and is the basis for hydraulic systems like lifts and presses.

17. The flow in which fluid particles move in well-defined paths or streamlines is called:

- A) Turbulent flow
- B) Laminar flow
- C) Transitional flow
- D) Unsteady flow

Answer: B) Laminar flow

Explanation: Laminar flow is characterized by smooth, orderly layers of fluid sliding past one another, typically occurring at low Reynolds numbers.

18. The loss of head due to a sudden enlargement in a pipe is given by:

- A) $(V_1 - V_2)^2 / 2g$

- B) $V_1^2/2g$
- C) $V_2^2/2g$
- D) $(V_1^2 - V_2^2)/2g$

Answer: A) $(V_1 - V_2)^2/2g$

Explanation: This is a minor loss equation, where V_1 and V_2 are the velocities before and after the enlargement. The loss is due to turbulence in the separation zone.

19. A Pelton wheel is a type of:

- A) Impulse turbine
- B) Reaction turbine
- C) Axial flow turbine
- D) Centrifugal pump

Answer: A) Impulse turbine

Explanation: In an impulse turbine, the total head of the fluid is converted into kinetic energy in a nozzle, and this high-velocity jet strikes the turbine buckets.

20. A Francis turbine is a:

- A) Tangential flow impulse turbine
- B) Tangential flow reaction turbine
- C) Radial flow impulse turbine
- D) Mixed flow reaction turbine

Answer: D) Mixed flow reaction turbine

Explanation: Water enters the runner radially and leaves axially. It is a reaction turbine because pressure changes across the runner blades.

21. The function of a draft tube in a reaction turbine is to:

- A) Increase the flow rate.
- B) Prevent cavitation.
- C) Convert kinetic energy into pressure energy.
- D) Guide water to the runner.

Answer: C) Convert kinetic energy into pressure energy.

Explanation: The draft tube allows the turbine to be set above the tailrace level without losing head, by converting the exit kinetic energy back into useful pressure head.

22. Cavitation in hydraulic machines is caused by:

- A) High pressure
- B) Low pressure below vapor pressure
- C) High velocity
- D) High temperature

Answer: B) Low pressure below vapor pressure

Explanation: When the local pressure drops to the fluid's vapor pressure, vapor bubbles form and then collapse violently, causing erosion and noise.

23. Which of the following pumps is suitable for high head and low discharge?

- A) Centrifugal pump
- B) Axial flow pump
- C) Reciprocating pump
- D) Mixed flow pump

Answer: C) Reciprocating pump

Explanation: Reciprocating pumps are positive displacement pumps that can generate very high pressures, making them ideal for high-head applications.

24. The specific speed of a centrifugal pump is given by:

- A) $N\sqrt{Q} / H^{3/4}$
- B) $N\sqrt{H} / Q^{3/4}$
- C) $N\sqrt{Q} / H^{5/4}$
- D) $N\sqrt{P} / H^{5/4}$

Answer: A) $N\sqrt{Q} / H^{3/4}$

Explanation: Specific speed is a dimensionless parameter used to classify pumps based on their performance characteristics at the best efficiency point.

25. The First Law of Thermodynamics is based on the principle of:

- A) Conservation of mass

- B) Conservation of energy
- C) Conservation of momentum
- D) The second law of thermodynamics

Answer: B) Conservation of energy

Explanation: It states that energy can neither be created nor destroyed, only changed in form. The total energy of an isolated system is constant.

26. A process in which there is no heat transfer is called an:

- A) Isothermal process
- B) Isobaric process
- C) Adiabatic process
- D) Isochoric process

Answer: C) Adiabatic process

Explanation: In an adiabatic process, $Q=0$. This can occur if the system is perfectly insulated or if the process happens very rapidly.

27. The efficiency of a Carnot engine depends only on:

- A) The working substance.
- B) The temperatures of the source and sink.
- C) The engine design.
- D) The pressure and volume of the gas.

Answer: B) The temperatures of the source and sink.

Explanation: The Carnot efficiency is given by $\eta = 1 - (T_{\text{cold}} / T_{\text{hot}})$, which represents the maximum possible efficiency for any heat engine.

28. Entropy is a measure of:

- A) The available energy in a system.
- B) The total heat content of a system.
- C) The disorder or randomness of a system.
- D) The pressure of a system.

Answer: C) The disorder or randomness of a system.

Explanation: According to the second law of thermodynamics, the entropy of an isolated system always tends to increase over time.

29. For an ideal gas, the specific heat at constant pressure (C_p) is always:

- A) Less than the specific heat at constant volume (C_v).
- B) Equal to the specific heat at constant volume (C_v).
- C) Greater than the specific heat at constant volume (C_v).
- D) Equal to zero.

Answer: C) Greater than the specific heat at constant volume (C_v).

Explanation: When heat is added at constant pressure, the gas expands and does work, so more energy is required to achieve the same temperature rise compared to a constant volume process.

30. The triple point is a point where:

- A) A substance exists in liquid form only.
- B) A substance exists in three phases (solid, liquid, gas) in equilibrium.
- C) A substance exists in gaseous form only.
- D) A substance exists in solid and liquid form in equilibrium.

Answer: B) A substance exists in three phases (solid, liquid, gas) in equilibrium.

Explanation: For water, the triple point occurs at a unique temperature (273.16 K) and pressure (611.7 Pa).

31. Which of the following is a water tube boiler?

- A) Cochran boiler
- B) Lancashire boiler
- C) Babcock and Wilcox boiler
- D) Cornish boiler

Answer: C) Babcock and Wilcox boiler

Explanation: In a water tube boiler, water flows inside the tubes, and hot gases flow over the outside. This design allows for higher pressures and faster steam generation.

32. The function of a safety valve in a boiler is to:

- A) Control the steam flow.

- B) Blow off steam when the pressure exceeds the safe limit.
- C) Measure the steam pressure.
- D) Remove impurities from the water.

Answer: B) Blow off steam when the pressure exceeds the safe limit.

Explanation: It is a critical safety device that prevents the boiler from exploding due to excessive internal pressure.

33. The process of removing non-condensable gases from a condenser is called:

- A) Deaeration
- B) Condensation
- C) Priming
- D) Foaming

Answer: A) Deaeration

Explanation: The presence of air and other non-condensable gases in a condenser reduces the vacuum and impairs heat transfer efficiency.

34. The Rankine cycle is the ideal cycle for a:

- A) Gas turbine
- B) Spark-ignition engine
- C) Steam power plant
- D) Jet engine

Answer: C) Steam power plant

Explanation: It is a thermodynamic cycle that describes the process by which heat energy is converted into mechanical work in a steam engine or turbine.

35. The dryness fraction of steam is the ratio of:

- A) The mass of water vapor to the mass of liquid water.
- B) The mass of liquid water to the total mass of the mixture.
- C) The mass of dry steam to the total mass of the mixture.
- D) The total mass of the mixture to the mass of dry steam.

Answer: C) The mass of dry steam to the total mass of the mixture.

Explanation: A dryness fraction of 1 indicates saturated steam, while a value of 0 indicates saturated liquid.

36. An economizer in a steam power plant is used to:

- A) Heat the feedwater using flue gases.
- B) Superheat the steam.
- C) Condense the exhaust steam.
- D) Heat the air supplied for combustion.

Answer: A) Heat the feedwater using flue gases.

Explanation: By recovering waste heat from the exhaust flue gases, the economizer improves the overall thermal efficiency of the boiler.

37. A nozzle is a device that converts:

- A) Kinetic energy into pressure energy.
- B) Pressure energy into kinetic energy.
- C) Heat energy into work.
- D) Work into heat energy.

Answer: B) Pressure energy into kinetic energy.

Explanation: As the fluid passes through the converging section of a nozzle, its pressure drops, and its velocity increases.

38. The flow through a nozzle is generally considered to be:

- A) Isothermal
- B) Isobaric
- C) Isentropic
- D) Isochoric

Answer: C) Isentropic

Explanation: The process is assumed to be both adiabatic (no heat transfer) and reversible (no friction), which defines an isentropic process.

39. The critical pressure ratio for a nozzle is the ratio of the outlet pressure to the inlet pressure that results in:

- A) Minimum velocity at the throat.

- B) Zero velocity at the throat.
- C) Subsonic velocity at the throat.
- D) Sonic velocity at the throat.

Answer: D) Sonic velocity at the throat.

Explanation: When the back pressure drops to the critical pressure, the flow at the narrowest point (throat) reaches the speed of sound (Mach 1), and the mass flow rate is maximized.

40. De Laval turbine is a type of:

- A) Simple impulse turbine.
- B) Simple reaction turbine.
- C) Pressure-compounded impulse turbine.
- D) Velocity-compounded impulse turbine.

Answer: A) Simple impulse turbine.

Explanation: It consists of a single set of nozzles and a single row of moving blades, where the entire pressure drop occurs in the nozzles.

41. Compounding in steam turbines is done to:

- A) Reduce the rotational speed.
- B) Increase the rotational speed.
- C) Increase the efficiency.
- D) Reduce the size of the turbine.

Answer: A) Reduce the rotational speed.

Explanation: By staging the pressure drop or velocity drop over several rows of blades, the rotor speed is brought down to a practical and safe level.

42. Blade friction in a turbine nozzle causes a decrease in:

- A) The exit enthalpy.
- B) The exit kinetic energy.
- C) The mass flow rate.
- D) The exit pressure.

Answer: B) The exit kinetic energy.

Explanation: Friction is an irreversible process that converts some of the kinetic energy into internal energy, resulting in a lower exit velocity than in an ideal (isentropic) nozzle.

43. The design of a cotter joint is based on which failure modes?

- A) Tension and shear only.
- B) Crushing and bending only.
- C) Tension, shear, and crushing.
- D) Torsion and bending.

Answer: C) Tension, shear, and crushing.

Explanation: A designer must check the joint for failure in tension of the rods, shear of the cotter, and crushing between the cotter and the rods.

44. A key is a machine element used to connect a transmission shaft to a rotating element to transmit:

- A) Axial force
- B) Bending moment
- C) Torque
- D) Thrust

Answer: C) Torque

Explanation: The key prevents relative rotational motion between the shaft and the hub of an element like a gear or pulley.

45. The type of thread most commonly used for power transmission is:

- A) V-thread
- B) Square thread
- C) Whitworth thread
- D) BSF thread

Answer: B) Square thread

Explanation: Square threads have the highest efficiency for power transmission because their flanks are perpendicular to the axis, resulting in minimal radial or bursting pressure.

46. A bearing is a machine element that:

- A) Transmits torque.

- B) Joins two shafts.
- C) Constrains relative motion and reduces friction between moving parts.
- D) Stores energy.

Answer: C) Constrains relative motion and reduces friction between moving parts.

Explanation: Bearings support shafts and allow them to rotate freely with minimal friction and wear.

4s. The endurance limit of a material is the maximum stress it can withstand for an infinite number of cycles without failure under:

- A) Static loading
- B) Impact loading
- C) Completely reversed cyclic loading
- D) Torsional loading

Answer: C) Completely reversed cyclic loading

Explanation: This property is crucial for designing components subjected to fatigue, such as axles and springs.

48. A leaf spring is an example of a:

- A) Beam of uniform strength.
- B) Cantilever beam.
- C) Simply supported beam.
- D) Helical spring.

Answer: A) Beam of uniform strength.

Explanation: It is designed such that the maximum bending stress is the same at every section along its length, leading to efficient material usage.

49. In a four-stroke spark-ignition (SI) engine, the ignition of the fuel-air mixture takes place at:

- A) The beginning of the suction stroke.
- B) The end of the compression stroke.
- C) The beginning of the expansion stroke.
- D) The end of the exhaust stroke.

Answer: B) The end of the compression stroke.

Explanation: The spark plug ignites the compressed mixture just before the piston reaches the top dead center to allow time for combustion to develop pressure for the power stroke.

50. The function of a carburetor in an SI engine is to:

- A) Supply lubricating oil.
- B) Mix fuel and air in the correct proportion.
- C) Ignite the fuel.
- D) Cool the engine.

Answer: B) Mix fuel and air in the correct proportion.

Explanation: The carburetor atomizes the fuel and mixes it with incoming air to form a combustible mixture for the engine cylinders.

51. The thermal efficiency of a Diesel cycle is higher than that of an Otto cycle for the:

- A) Same compression ratio and heat input.
- B) Same compression ratio and heat rejection.
- C) Same peak pressure and temperature.
- D) Same maximum pressure and heat input.

Answer: A) Same compression ratio and heat input.

Explanation: For the same compression ratio, the Otto cycle is more efficient. However, diesel engines can operate at much higher compression ratios, making them more efficient in practice.

52. In a nuclear power plant, the function of a moderator is to:

- A) Absorb neutrons.
- B) Speed up neutrons.
- C) Slow down fast-moving neutrons.
- D) Reflect neutrons.

Answer: C) Slow down fast-moving neutrons.

Explanation: Neutrons released during fission are too fast to cause further fission efficiently. The moderator (like water or graphite) slows them down to thermal energies, increasing the probability of a chain reaction.

53. Supercharging is the process of:

- A) Supplying air to the engine at a pressure below atmospheric pressure.

- B) Supplying air to the engine at a pressure above atmospheric pressure.
- C) Supplying excess fuel to the engine.
- D) Increasing the engine speed.

Answer: B) Supplying air to the engine at a pressure above atmospheric pressure.

Explanation: This increases the density of the air charge, allowing more fuel to be burned, thus increasing the engine's power output.

54. The material used for control rods in a nuclear reactor should have the property of:

- A) High neutron absorption cross-section.
- B) Low neutron absorption cross-section.
- C) High thermal conductivity.
- D) High strength.

Answer: A) High neutron absorption cross-section.

Explanation: Control rods (made of materials like boron or cadmium) are used to absorb excess neutrons to control the rate of the fission reaction.

55. The property of a material by which it can be drawn into wires is called:

- A) Malleability
- B) Ductility
- C) Elasticity
- D) Hardness

Answer: B) Ductility

Explanation: Ductility is a measure of a material's ability to undergo significant plastic deformation before rupture, typically quantified by percent elongation.

56. Cast iron is a ferrous alloy with a carbon content of:

- A) Less than 0.2%
- B) Between 0.2% and 2.1%
- C) More than 2.1%
- D) Exactly 2.1%

Answer: C) More than 2.1%

Explanation: This high carbon content makes cast iron hard and brittle, but gives it excellent castability and damping properties.

57. The process of heating steel above its upper critical temperature and then cooling it slowly in the furnace is known as:

- A) Hardening
- B) Normalizing
- C) Annealing
- D) Tempering

Answer: C) Annealing

Explanation: Annealing is a heat treatment process used to relieve internal stresses, soften the material, increase ductility, and refine the grain structure.

58. Brass is an alloy of:

- A) Copper and tin
- B) Copper and zinc
- C) Copper and nickel
- D) Copper and aluminum

Answer: B) Copper and zinc

Explanation: Brass is widely used for its corrosion resistance, acoustic properties, and appearance in applications like fittings, plumbing, and musical instruments.

59. A ceramic is a material that is:

- A) Metallic and organic.
- B) Inorganic and non-metallic.
- C) Metallic and inorganic.
- D) Organic and polymeric.

Answer: B) Inorganic and non-metallic.

Explanation: Ceramics are typically hard, brittle, and have high melting points. Examples include alumina, silica, and porcelain.

60. Adding chromium to steel primarily improves its:

- A) Hardness

- B) Ductility
- C) Corrosion resistance
- D) Machinability

Answer: C) Corrosion resistance

Explanation: Chromium forms a passive, protective oxide layer on the surface of the steel, which is the basis for stainless steels.

61. The process of increasing the pressure of a fluid at the expense of its kinetic energy is called:

- A) Diffusion
- B) Expansion
- C) Nozzling
- D) Throttling

Answer: A) Diffusion

Explanation: A diffuser is a device with an increasing cross-sectional area that slows down a fluid, thereby increasing its static pressure.

62. A reciprocating compressor is best suited for:

- A) High discharge and low pressure.
- B) Low discharge and high pressure.
- C) High discharge and high pressure.
- D) Low discharge and low pressure.

Answer: B) Low discharge and high pressure.

Explanation: As a positive displacement machine, it can generate very high pressures but has a lower flow rate compared to centrifugal compressors.

63. The ratio of the velocity of an object to the velocity of sound in the surrounding medium is called the:

- A) Reynolds number
- B) Mach number
- C) Froude number
- D) Weber number

Answer: B) Mach number

Explanation: Mach number is a critical parameter in gas dynamics, defining the flow regime: subsonic ($M < 1$), sonic ($M = 1$), or supersonic ($M > 1$).

64. Intercooling in a multi-stage compressor is done to:

- A) Increase the work of compression.
- B) Decrease the volumetric efficiency.
- C) Reduce the work of compression.
- D) Cool the delivered air.

Answer: C) Reduce the work of compression.

Explanation: By cooling the gas between stages, its volume is reduced, which means less work is required to compress it to the final pressure, thereby improving overall efficiency.

65. A gas turbine works on the:

- A) Otto cycle
- B) Carnot cycle
- C) Rankine cycle
- D) Brayton cycle

Answer: D) Brayton cycle

Explanation: The Brayton cycle is the ideal thermodynamic cycle for a gas turbine, consisting of isentropic compression, constant pressure heat addition, isentropic expansion, and constant pressure heat rejection.

66. Surging in a centrifugal compressor is a phenomenon of:

- A) Steady and stable flow.
- B) Unstable, periodic reversal of flow.
- C) Maximum efficiency operation.
- D) Choked flow.

Answer: B) Unstable, periodic reversal of flow.

Explanation: Surging occurs at low flow rates and can cause severe vibrations and damage to the compressor.

67. A kinematic pair is a joint of two links that permits:

- A) No relative motion.

B) Only rotational motion.

C) Relative motion between them.

D) Only sliding motion.

Answer: C) Relative motion between them.

Explanation: Kinematic pairs are the building blocks of mechanisms, and the nature of the allowed relative motion (e.g., sliding, turning) defines the type of pair.

68. The number of degrees of freedom of a planar mechanism is given by Grubler's criterion as:

A) $n = 3(l-1) - 2j - h$

B) $n = 2(l-1) - 3j - h$

C) $n = 3l - 2j - 4$

D) $n = l - j - 1$

Answer: A) $n = 3(l-1) - 2j - h$

Explanation: This equation, also known as the Kutzbach criterion, calculates the mobility (degrees of freedom) of a planar linkage based on the number of links (l), lower pairs (j), and higher pairs (h).

69. A cam and follower is a mechanism that converts:

A) Rotary motion into rotary motion.

B) Rotary motion into reciprocating or oscillating motion.

C) Reciprocating motion into rotary motion.

D) Oscillating motion into linear motion.

Answer: B) Rotary motion into reciprocating or oscillating motion.

Explanation: Cams are used extensively in IC engines (for valve timing) and automated machinery to produce complex, precisely timed motions.

70. The gear train in which the axes of the first and last gears are co-axial is called a:

A) Simple gear train

B) Compound gear train

C) Reverted gear train

D) Epicyclic gear train

Answer: C) Reverted gear train

Explanation: This arrangement is commonly used in machine tool gearboxes and clocks where the input and output shafts need to be aligned.

71. A governor is used in an engine to regulate the:

- A) Torque
- B) Power
- C) Mean speed
- D) Fuel consumption

Answer: C) Mean speed

Explanation: It automatically controls the supply of fuel to the engine to maintain a constant mean speed despite variations in load.

72. Interference in gears can be avoided by:

- A) Using a smaller pressure angle.
- B) Using fewer teeth.
- C) Using stub teeth or undercutting.
- D) Increasing the module.

Answer: C) Using stub teeth or undercutting.

Explanation: Interference occurs when the tip of a tooth on one gear digs into the root of the mating tooth. Modifying the tooth profile can prevent this.

73. The function of a flywheel is to:

- A) Regulate the mean speed of an engine.
- B) Reduce the fluctuations of speed during a cycle.
- C) Transmit power.
- D) Store energy for long periods.

Answer: B) Reduce the fluctuations of speed during a cycle.

Explanation: It stores energy during the power stroke and releases it during other strokes, thus keeping the speed variations within permissible limits.

74. The mode of heat transfer that does not require a medium is:

- A) Conduction

- B) Convection
- C) Radiation
- D) Advection

Answer: C) Radiation

Explanation: Thermal radiation is the transfer of energy via electromagnetic waves and can occur through a vacuum, which is how the sun's energy reaches Earth.

75. Fourier's law of heat conduction relates the heat transfer rate to the:

- A) Temperature difference and thermal conductivity.
- B) Temperature gradient and thermal conductivity.
- C) Convection coefficient and surface area.
- D) Emissivity of the surface.

Answer: B) The temperature gradient and thermal conductivity.

Explanation: The law states that the rate of heat flux is directly proportional to the temperature gradient (change in temperature per unit length).

76. In a heat exchanger, if the hot and cold fluids flow in the same direction, it is called a:

- A) Parallel-flow heat exchanger.
- B) Counter-flow heat exchanger.
- C) Cross-flow heat exchanger.
- D) Regenerative heat exchanger.

Answer: A) Parallel-flow heat exchanger.

Explanation: In this configuration, both fluids enter at one end and flow in the same direction to the other end.

77. The unit of thermal conductivity is:

- A) $\text{W/m}^2\text{K}$
- B) W/mK
- C) W/K
- D) J/kgK

Answer: B) W/mK

Explanation: Thermal conductivity (k) is a material property that indicates its ability to conduct heat.

78. The working fluid in a vapor compression refrigeration system is called a:

- A) Coolant
- B) Lubricant
- C) Refrigerant
- D) Absorbent

Answer: C) Refrigerant

Explanation: Refrigerants (like R-134a or ammonia) are fluids that undergo a phase change from liquid to gas (and back) to move heat from one location to another.

79. The component of a refrigeration system where the refrigerant rejects heat is the:

- A) Evaporator
- B) Compressor
- C) Condenser
- D) Expansion valve

Answer: C) Condenser

Explanation: In the condenser, the high-pressure, high-temperature refrigerant vapor from the compressor is cooled and condensed back into a liquid, releasing heat to the surroundings.

80. Relative humidity is defined as the ratio of:

- A) The mass of water vapor to the mass of dry air.
- B) The actual mass of water vapor to the mass of water vapor in saturated air.
- C) The volume of water vapor to the volume of dry air.
- D) The partial pressure of dry air to the total pressure.

Answer: B) The actual mass of water vapor to the mass of water vapor in saturated air.

Explanation: It is a measure of the amount of moisture in the air compared to the maximum amount it could hold at that same temperature.

81. Which of the following is an example of a single-point cutting tool?

- A) Milling cutter
- B) Grinding wheel
- C) Lathe tool

D) Drill bit

Answer: C) Lathe tool

Explanation: A lathe tool uses a single cutting edge to remove material during operations like turning and facing.

82. The process of joining metal parts by heating them to a suitable temperature and using a filler metal with a melting point above 450°C but below the melting point of the base metal is called:

A) Welding

B) Soldering

C) Brazing

D) Riveting

Answer: C) Brazing

Explanation: Brazing creates a strong, permanent joint without melting the base metals. The filler metal is drawn into the joint by capillary action.

83. The operation of producing a flat surface on a workpiece by using a multi-point rotating cutter is called:

A) Turning

B) Drilling

C) Milling

D) Grinding

Answer: C) Milling

Explanation: Milling is a versatile machining process used to create flat surfaces, slots, pockets, and complex contours.

84. In arc welding, the electric arc is produced between the workpiece and the:

A) Welding torch

B) Electrode

C) Filler rod

D) Shielding gas nozzle

Answer: B) Electrode

Explanation: The intense heat of the electric arc melts the workpiece and the electrode (if it is a consumable type), forming a molten pool that solidifies to create the weld.

85. The process of enlarging an existing hole is called:

- A) Drilling
- B) Reaming
- C) Boring
- D) Tapping

Answer: C) Boring

Explanation: Boring is performed to increase the diameter of a previously drilled hole to a precise dimension and improve its surface finish.

86. A pattern in sand casting is a replica of the object to be cast, with some modifications. One of these modifications is the addition of:

- A) Risers
- B) Runners
- C) Shrinkage allowance
- D) Gates

Answer: C) Shrinkage allowance

Explanation: The pattern is made slightly larger than the final desired part to compensate for the contraction or shrinkage of the metal as it cools and solidifies.

87. Go and No-Go gauges are examples of:

- A) Measuring instruments
- B) Limit gauges
- C) Templates
- D) Working gauges

Answer: B) Limit gauges

Explanation: They do not measure the actual size but check whether a part is within its specified upper and lower dimensional limits.

88. The process of cutting metal by forcing it through a die is known as:

- A) Forging
- B) Rolling

C) Extrusion

D) Drawing

Answer: C) Extrusion

Explanation: Extrusion is used to produce long, straight parts with a constant cross-section, such as aluminum window frames and pipes.

89. A sine bar is used to measure:

A) Length

B) Angles

C) Flatness

D) Roundness

Answer: B) Angles

Explanation: It is used in conjunction with slip gauges to set up and measure angles with very high precision.

90. The Unilateral System of tolerance is one in which the tolerance is allowed on:

A) Both sides of the basic size.

B) One side of the basic size.

C) The upper limit only.

D) The lower limit only.

Answer: B) One side of the basic size.

Explanation: In this system, one of the limits coincides with the basic size, and the tolerance zone lies entirely on one side of it.

91. The process of improving the surface finish and dimensional accuracy of a workpiece by removing a very small amount of material using abrasive particles is called:

A) Knurling

B) Lapping

C) Facing

D) Parting

Answer: B) Lapping

Explanation: Lapping is a finishing operation that produces very smooth, flat, and accurate surfaces.

92. Computer Numerical Control (CNC) refers to the automation of machine tools by means of:

- A) Mechanical cams and linkages.
- B) A computer executing a pre-programmed sequence of commands.
- C) Hydraulic tracer systems.
- D) Manual handwheels and levers.

Answer: B) A computer executing a pre-programmed sequence of commands.

Explanation: CNC technology allows for high precision, repeatability, and the manufacturing of complex shapes with minimal human intervention.

93. The function of a differential in an automobile is to:

- A) Allow the front wheels to turn at different speeds.
- B) Transmit power from the engine to the gearbox.
- C) Allow the driving wheels to rotate at different speeds when cornering.
- D) Act as a suspension component.

Answer: C) Allow the driving wheels to rotate at different speeds when cornering.

Explanation: When a car turns, the outer wheel must travel a longer distance than the inner wheel. The differential enables this difference in speed while still transmitting torque to both wheels.

94. The component that connects the gearbox to the differential is the:

- A) Clutch
- B) Axle
- C) Propeller shaft
- D) Piston rod

Answer: C) Propeller shaft

Explanation: The propeller shaft (or driveshaft) transmits the rotational power from the transmission to the rear differential in a rear-wheel-drive vehicle.

95. A disc brake works by squeezing brake pads against a:

- A) Rotating drum
- B) Rotating disc or rotor
- C) Stationary drum

D) Wheel rim

Answer: B) Rotating disc or rotor

Explanation: The friction between the pads and the disc converts the kinetic energy of the vehicle into heat, thus slowing it down.

96. The purpose of the suspension system in a vehicle is to:

A) Transmit engine power.

B) Absorb shocks and vibrations from the road surface.

C) Steer the vehicle.

D) Cool the engine.

Answer: B) Absorb shocks and vibrations from the road surface.

Explanation: The suspension system maximizes the friction between the tires and the road surface, providing steering stability with good handling and ensuring passenger comfort.

97. The octane rating of gasoline is a measure of its:

A) Ignition quality

B) Viscosity

C) Volatility

D) Resistance to knocking or detonation

Answer: D) Resistance to knocking or detonation

Explanation: A higher octane rating indicates greater resistance to auto-ignition, which allows for higher compression ratios and improved engine efficiency.

98. The critical path in a project network (PERT/CPM) is the sequence of activities that:

A) Has the maximum duration.

B) Has the minimum duration.

C) Has zero slack.

D) Involves the most resources.

Answer: A) Has the maximum duration.

Explanation: The critical path determines the shortest possible time to complete the entire project. Any delay in an activity on the critical path directly delays the project completion. It also has zero slack.

99. The economic order quantity (EOQ) is the order quantity that:

- A) Maximizes the total inventory cost.
- B) Minimizes the ordering cost.
- C) Minimizes the carrying cost.
- D) Minimizes the total inventory holding and ordering costs.

Answer: D) Minimizes the total inventory holding and ordering costs.

Explanation: EOQ is a model used in inventory management to find the optimal order size that balances the cost of holding inventory against the cost of ordering it.

100. Work study is a management technique that involves:

- A) Financial auditing and accounting.
- B) Method study and work measurement.
- C) Marketing and sales analysis.
- D) Product design and development.

Answer: B) Method study and work measurement.

Explanation: Method study is used to improve methods of production, and work measurement is used to assess human effectiveness and set standard times for tasks.