MECHANICAL Engineering Interview Questions for freshers experienced :- :-

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1. What is the difference between scavenging and supercharging ?

Scavenging is process of flushing out burnt gases from engine cylinder by introducing fresh air in the cylinder before exhaust stroke ends. Supercharging is the process of supplying higher mass of air by compressing the atmospheric air.

2. What are the names given to constant temperature, constant pressure, constant volume, constant internal energy, constant enthalpy, and constant entropy processes.

Isothermal, isochroic, isobaric, free expression, throttling and adiabatic processes respectively.

3. In a Rankine cycle if maximum steam pressure is increased keeping steam temperature and condenser pressure same, what will happen to dryness fraction of steam after expansion ?

It will decrease.

4. Why entropy change for a reversible adiabatic process is zero ?

Because there is no heat transfer in this process.

5. What are two essential conditions of perfect gas ?

It satisfies equation of state and its specific heats are constant.

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MECHANICAL Engineering Interview Questions[/caption]

6. Enthalpy and entropy are functions of one single parameter. Which is that ?

Temperature.

7. Why rate of condensation is higher on a polished surface compared to rusty surface ?

Polished surface promotes drop wise condensation and does not wet the surface.

8. How much resistance is offered to heat flow by drop wise condensation ?

Nil

9. What is the relationship between COP of heating and cooling ?

COP of heating is one(unity) more than COP of cooling.

10. How much is the work done in isochoric process ?

Zero.

11. When maximum discharge is obtained in nozzle ?

At the critical pressure ratio.

12. Under what condition the work done in reciprocating compressor will be least ?

It is least when compression process approaches isothermal. For this purpose, attempts are made to cool the air during compression.

13. What is the difference between stalling and surging in rotary compressions ?

Stalling is a local phenomenon and it occurs when How breaks away from the blades. Surging causes complete breakdown of flow and as such it affects the whole machine.

14. Why the electric motor of a fan with backward curved blades is never got overloaded under any condition ?

The maximum power is consumed at about 70% of maximum flow in case'of fan with backward blades. For higher flow, power consumption gets lower.

15. Why the work per kg of air flow in axial flow compressor is less compared to centrifugal compressor for same pressure ratio ?

Isentropic efficiency of axial flow compressor is higher.

16. What is the name given to portion of thermal energy to be necessarily rejected to environment ?

Anergy.

17. What is pitting ? How it is caused ?

Non uniform corrosion over the entire metal surface, but occuring only in small pits is called pitting. It is caused by lack of uniformity in metal.

18. What is caustic embrittlement ?

It is the actual physical change in metal that makes it extremely brittle and filled with minute cracks. It occurs particularly in the seams of rivetted joints and around the rivet holes.

19. Which impurities form hard scale and which impurities soft scale ?

Sulphates and chlorides of lime and magnesium form hard scale, and carbonates of lime and magnesium form soft scale.

20. What is the difference between hard water and soft water ?

Hard water contains excess of scale forming impurities and soft water contains very little or no scale forming substances.

Acid and oxygen in feed water lead to corrosion.

22. What should be done to prevent a safety valve to stick to its seat ?

Safety valve should be blown off periodically so that no corrosion can take place on valve and valve seat.

23. Why large boilers are water tube type ?

Water tube boilers raise steam fast because of large heat transfer area and positive water circulation. Thus they respond faster to fluctuations in demand. Further single tube failure does not lead to catastrophy.

24. What type of boiler does not need a steam drum ?

Super-critical pressure boiler.

25. Why manholes in vessels are usually elliptical in shape ?

Elliptical shape has minimum area of opening and thus plate is weakened the least. Further it is very convenient to insert and take out the cover plate from elliptical opening.

26. Low water in boiler drum is unsafe because it may result in overheating of water tubes in furnace. Why it is unsafe to have high water condition in boiler drum ?

High drum level does not allow steam separation to be effective and some water can be carried over with steam which is not desirable for steam turbine.

27. Why boiler is purged everytime before starting firing of fuel ?

Purging ensures that any unburnt fuel in furnace is removed, otherwise it may lead to explosion.

28. What is the principle of mechanical refrigeration ?

Axis. A volatile liquid will boil under the proper conditions and in so doing will absorb heat from surrounding objects.

29. Why high latent heat of vaporisation is desirable in a refrigerant ?

A high latent heat of vaporisation of refrigerant results in small amount of refrigerant and thus lesser circulation system of refrigerant for same tonnage.

30. What is the critical temperature of a refrigerant ?

Critical temperature is the maximum temperature of a refrigerantrat which it can be condensed into liquid and beyond this it remains gas irrespective of pressure applied.

31. Maximum combustion temperature in gas turbines is of the order of 1100 to 10°C whereas same is around 00°C in I.C. engine ? Why ?

High temperature in I.C. engine can be tolerated because it lasts for a fraction of second but gas turbines have to face it continuously which metals can't withstand.

32. Why efficiency of gas turbines is lower compared to I.C. engines ?

In gas turbines, 70% of the output of gas turbine is consumed by compressor. I.C. engines have much lower auxiliary consumption. Further combustion temperature of I.C. engines is much higher compared to gas turbine.

33. What do you understand by timed cylinder lubrication ?

For effective lubrication, lub oil needs to be injected between two piston rings when piston is at bottom of stroke so that piston rides in oi during upward movement. This way lot of lub oil can be saved and used properly.

34. What is IIUCR in relation to petrol engine ?

HUCR is highest useful compression ratio at which the fuel can be used in a specific test engine, under specified operating conditions, without knocking.

35. In some engines glycerine is used in place of water for cooling of engine. Why ?

Glycerine has boiling point of 90°C which increases its heat carrying capacity. Thus weight of coolant gets reduced and smaller riadiator can be used.

36. Why consumption of lubricating oil is more in two-stroke cycle petrol engine than four-stroke cycle petrol engine ?

In two-stroke engine lub oil is mixed with petrol and thus some lub oil is blown out through the exhaust valves by scavenging and charging air. There is no such wastage in four stroke petrol engine.

37. As compression ratio increases, thermal n increases. How is thermal n affected by weak and rich mixture strength ?

Thermal n is high for weak mixture and it decreases as mixture strength becomes rich.

38. How engine design needs to be changed to burn lean mixture ?

Engine to burn lean mixture uses high compression ratio and the highly turbulent move¬ment of the charge is produced by the geometry of the combustion chamber.

39. Horse power of I.C. engines can be expressed as RAC rating, SAE rating, or DIN rating. To which countries these standards belong ?

U.K., USA and Germany respectively.

40. What is the use of flash chamber in a vapour compression refrigeration cycle to improve the COP of refrigeration cycle ?

When liquid refrigerant as obtained from condenser is throttled, there are some vapours. These vapours if carried through the evaporator will not contribute to refrigerating effect. Using a flash chamber at some intermediate pressure, the flash vapour at this pressure can be bled off and fed back to the compression process. The throttling process is then carried out in stages. Similarly compression process is also done in two separate compressor stages.

41. Why pistons are usually dished at top ?

Pistons are usually hollowed at top to (i) provide greater spa'e for combustion, (ii) increase surface for flue gases to act upon, and (iii) better distribution of stresses.

42. What is the function of thermostat in cooling system of an engine ?

Thermostat ensures optimum cooling because excessive cooling decreases the overall efficiency. It allows cooling water to go to radiator beyond a predetermined temperature.

43. What are the causes of failure of boiler tubes ?

Boiler tubes, usually are made from carbon steel and are subject to (a) high rates of heat transfer,(b). bending stresses due to uneven heating, especially at expanded or welded joints into headers or drums, © external erosion from burners and flue gas, (d) possible corrosion on the boiler side, and (e) occasional manufacturing defects.

Failure may occur due to following reasons :

- High thermal ratings may lead to rapid failure if the internal fluid flow is reduced for any reason. The resultant overheating leads to a failure by creep, characterised by the bulging of the tube with the eventual development of a longitudinal split.
- Fatigue cracking due to bending stresses occur. These are associated with change of section and/or weld undercut, where tubes are expanded or welded into headers.
- Failure may arise due to overstressing of a reduced section of metal.
- Sudden failure of the boiler tube due to corrosion arises from embrittlement of the carbon steel due to interaction between atomic hydrogen from the corrosion process and the iron carbide present in the steel.

- Defects in tube manufacture, although far from being a regular occurrence, can be a cause of serious trouble. Lamination in boiler tubes or score marks arising from the cold drawing of tubes, give rise to premature failure and may promote corrosion at these regions.

44. What are the causes of failure of superheater tubes ?

Superheater tubes are subjected to the most severe combination of stress, temperature and corrosive environment. In addition to high-temperature strength, resistance to corrosion is also important. For example, low-alloy ferritic steel such as -1/% Cr, 1% Mo would not be used at metal temperatures above 580°C because of inadequate resistance to corrosion and oxidation over a full service life of 100,000/150,000 hr.

Failures in superheater tubes may arise from :

(a) Prior fabrication history (b) Faulty heat treatment

© Consequences of welding (d) Overheating of the tube metal

(e) Gas-side corrosion (f) Stress corrosion (austenitic steels).

45. Why supercritical boilers use less amount of steel compared to non-supercritical boilers ?

Supercritical boilers do not head heavy drum for separation of steam from mixture of water and steam.

46. Out of electric heater and heat pump, which is economical in operation ?

Heat pump.

47. Which furnace burns low-ash fusion coal and retains most of the coal ash in the slag?

Cyclone furnace.

48. How the thickness of thermal boundary layer and thickness of hydrodynamic boundary layer related ?

Ratio of their thickness = (Prandtl number)-1/3.

49. What is the effect of friction on flow of steam through a nozzle ?

To decrease both mass flow rate and wetness of steam.

50. Why gas turbine power plant needs efficient compressor ?

Because a large portion of turbine work is eaten away by compressor and its inefficiency will affect net power output and cost of generation.

51. Why rockets using liquid hydrogen have higher specific impulse compared to liquid hydrocarbon ?

Liquid hydrogen has higher burning velocity.

52. Why axial flow compressor is preferred for gas turbines for aeroplanes ?

Because it has low frontal area.

53. What is the effect of inter cooling in gas turbines ?

It decreases thermal efficiency but increases net output.

54. Why iso-octane is chosen as reference fuel for S.I. engines and allotted 100 value for its octane number ?

Iso-octane permits highest compression without causing knocking.

55. Why thermal efficiency of I.C. engines is more than that of gas turbine plant ?

In I.C. engine maximum temperature attained is higher than in gas turbine.

56. Which are the reference fuels for knock rating of S.I. engines ?

n-heptane and ISO-octane.

57. When effect of variations in specific heats is considered then how do maximum temperature and pressure vary compared to air standard cycle ?

Temperature increases and pressure decreases.

58. Quantities like pressure, temperature, density, viscosity, etc. are independent of mass. What are these called ?

Intensive properties.

59. The amount of radiation emitted per scm per sec is called .... ?

Emissive power.

60. In convection heat transfer, if heat flux intensity is doubled then temperature

difference between solid surface and fluid will ?

Get doubled.

61. How you can define coal ?

Coal is a naturally occurring hydrocarbon that consists of the fossilised remains of buried plant debris that have undergone progressive physical and chemical alteration, called coalification, in the course of geologic time.

62. Which pollutant is major greenhouse gas and what is its effect ?

CO is major greenhouse gas and it traps the radiation of heat from the sun within earth's atmosphere.

63. In order to increase efficiency and reduce CO emissions and other emissions, clear coal technologies are receiving major attention. What are these ?

Ans:

- Advanced pulverised and pressurised pulverised fuel combustion.
- Atmospheric fluidised bed combustion and pressurised fluidised bed combustion.
- Supercritical boilers.
- Integrated gasification combined cycle systems.
- Advanced integrated gasification, including fuel cell systems.
- Magneto hydrodynamic electricity generation.

64. What are the important operational performance parameters in design of fuel firing equipment ?

Fuel flexibility, electrical load following capability, reliability, availability, and maintenance ease.

65. What is the differenc between total moisture and inherent moisture in coal ?

The moisture content of the bulk as sampled is referred to as total moisture, and that of the air dried sample is called inherent moisture.

66. Proximity analysis of coal provides data for a first, general assessment of a coal's quality and type. What elements it reports ?

Moisture, volatile matter, ash and fixed carbon.

67. Ultimate analysis of coal is elementary analysis. What it is concerned with ?

Carbon, hydrogen, nitrogen, and sulphur in coal on a weight percentage basis.

68. Explain the difference between AFBC, BFBC, PFBC and PCFB in regard to fluidised bed technologies.

AFBC (Atmospheric fluidised bed combustion) process consists of forming a bed of inert materials like finely sized ash or ash mixed with sand, limestone (for sulphur removal), and solid fuel particles in a combustor and fluidising it by forcing combustion air up through the bed mixture. The gas flows thorugh bed without disturbing particles significantly but gas velocity is high enough to support the total weight of bed (fluidisation). At slightly higher

velocity excess gas passes through the bed as bubbles (fluidised bed) and gives the bed the appearance of a boiling liquid.

Bubbling fluidised bed combustion (BFBC) has a defined height of bed material and operates at or near atmospheric pressure in the furnace.

Pressurised fluidised bed combustion (PFBC) system operates the bed at elevated pressure. Exhaust gases have sufficient energy to power a gas turbine, of course, gases need to be cleaned.

In fluidised combustion, as ash is removed some unburned carbon is also removed resulting in lower efficiency. In circulating fluidised bed combustion (CFBC) system, bed is operated at higher pressure leading to high heat transfer, higher combustion efficiency, and better fuel feed. Circulating fluidised beds operate with relatively high gas velocities and fine particle sizes. The maintenance of steady state conditions in a fast fluidised bed requires the continuous recycle of particles removed by the gas stream (circulating bed). The term circulating bed is often used to include fluidised bed sys¬tems containing multiple conventional bubbling beds between which bed material is exchanged.

69. What for Schmidt plot for is used in heat transfer problems ?

Schmidt plot is a graphical method for determining the temperature at any point in a body at a specified time during the transient heating or cooling period.

70. In which reactor the coolant and moderator are the same ?

Pressurised water reactor.

71. Which reactor has no moderator ?

Fast breeder reactor.

72. What are thermal neutrons ?

Thermal neutrons are slow neutrons (having energy below 1 eV) which are in thermal equilibrium with their surroundings.

73. What is big advantage of fast breeder reactor ?

It has rapid self breeding of fissile fuel during the operation of the reactor, and thus, it offers about sixty times the output with same natural uranium resources through ordinary non-breeder nuclear reactor.

74. What is the purpose of biological shield in nuclear plants ?

Biological shield of heavy concrete prevents exposure to neutrons, beta rays and gamma rays which kill living things.

75. Which two elements have same percentage in proximate and ultimate analysis of coal?

Moisture and ash.

76. On which analysis is based the Dulong's formula for the heating value of fuel ?

On ultimate analysis.

77. Which element causes difference in higher and lower heating values of fuel ?

Hydrogen.

78. Which heating value is indicated by a calorimeter and why ?

Gross heating value because steam is condensed and heat of vapour formed is recovered.

79. State the difference between ultimate and proximate analysis of coal ?

In ultimate analysis, chemical determination of following elements is made by weight: Fixed and combined carbon, H, O, N, S, water and ash. Heating value is due to C, H and S.

In proximate analysis following constituents are mechanically determined by weight. Moisture, volatile matter, fixed carbon and ash. Heating value is due to fixed carbon and volatile matter.

80. What is fuel ratio ?

Fuel ratio is the ratio of its % age of fixed carbon to volatile matter.

81. How the analyses and calorific values of fuels can be reported ?

It may be reported as

(a) as received or fired (wet) basis

(b) dry or moisture free basis

© combustible or ash and moisture free basis

82. What is the difference between nuclear fission and fission chain reaction.

The process of splitting of nucleus into two almost equal fragments accompanied by re¬lease of heat is nuclear fission. Self sustained, continuing, sequence of fission reactions in a con¬trolled manner is fission chain reaction.

83. Explain difference between fissile and fertile materials.

The materials which can give nuclear fission e.g. U 35, Pu 39, U 33 are fissile materi¬als. Fertile material itself is not fissionable, but it can be converted to a fissionable material by irradiation of neutrons in a nuclear reactor.

84. What do you understand by fuel cycle in nuclear plants ?

Fuel cycle a series of sequential steps involved in supplying fuel to a nuclear power reactor. The steps include : Mining, refining uranium, fabrication of fuel elements, their use in nuclear reactor, chemical processing to recover remaining fissionable material, re-enrichment of fuel from recovered material, refabrication of new fuel elements, waste storage etc.

85. What is heavy water and what is its use in nuclear plants ?

Water containing heavy isotopes of hydrogen (Deuterium) is known as heavy water. Heavy water is used as a moderator. Heavy water has low cross section for absorption of neutrons than ordinary water. Heavy water slows down the fast neutrons and thus moderates the chain reaction.

86. What is a converter reactor ?

A reactor plant which is designed to produce more fuel than it consumes. The breeding is obtained by converting fertile material to fissile material.

87. Explain nuclear reactor in brief.

A plant which initiates, sustains, controls and maintains nuclear fission chain reaction and provides shielding against radioactive radiation is nuclear reactor.

88. What is the difference between conversion and enrichment ?

The process of converting the non fissile U 38 to fissile U-35 is also called "Conversion". The material like U 38 which can be converted to a fissile material by the neutron flux is called "fertile material". The conversion is obtained within the nuclear reactor during the chain reaction.

Enrichment is the process by which the proportion of fissile uranium isotope (U-35) is increased above 0.7% (original % in natural uranium).

The concentration of U-35 in the uranium hexafluoride is increased from the 0.7% in natural uranium to to 4%. This is called enrichment and is accomplished in an enrichment plant.

89. Disposal of radioactive waste materials and spent fuel is a major and important technology. How the waste radioactive material is disposed off ?

Nonusable fission products are radioactive and take short/medium/long time for radioactive decay to reach safe level of radioactivity. Accordingly three methods of disposal are :

(a) Zero or low radioactivity material is dispersed or stored without elaborate shielding.

(b) Medium radioactivity material is stored for short duration of about 5 years to allow decay of radioactivity.

© High radioactive material. They are stored in water for several months to permit radioactive decay to an accepetable low level.

90. Which nuclear reactor uses water as a coolant, moderator and reflector ?

Pressurised water reactor.

91. Which reactor produces more fissionable material than it consumes ?

Breeder reactor.

92. Which reactor uses natural uranium as fuel ?

Gas cooled reacator.

93. Which reactor uses heavy water as moderator ?

CANDU.

94. Which reactor requires no moderator ?

Breeder reactor.

95. Which reactor uses primary coolant as fluoride salts of lithium, beryllium, thorium and uranium ?

Molten salt breeder reactor.

96. Why an increase in area is required to produce an increase of velocity in case of supersonic flow ?

Increase in area for increase in velocity for supersonic flow is required because the density decreases faster than velocity increases at supersonic speeds and to maintain continuity of mass, area must increase.

97. Under what circumstances would there be an increase in pressure in a diver¬gent nozzle ?

For subsonic flow at inlet section of a diffuser a lower velocity and higher pressure will exist at the exit section. For supersonic isentropic flow at the inlet section a higher velocity and lower pressure will exist at the exit but if a shock wave occurs in the diffuser then a higher pressure will exist at the exit.

98. Why water can't be used as refrigerant for small refrigerating equipment ?

The refrigerant should be such that vapour volume is low so that pumping work will be low. Water vapour volume is around 4000 times compared to R- for a given mass.

99. Which parameter remains constant in a throttling process ?

Enthalpy.

100. What is the difference between isentropic process and throttlinglprocess ?

In isentropic process, heat transfer takes place and in throttling process, enthalpy before and after the process is same.

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101. What is the difference between isotropic and anisotropic materials ?

If a material exhibits same mechanical properties regardless of loading direction, it is isotropic, e.g., homogeneous cast materials. Materials lacking this property are anisotropic.

102. What are orthotropic materials ?

It is a special class of anisotropic materials which can be described by giving their prop¬erties in three perpendicular directions e.g. wood; composites.

103. What is view factor ?

View factor is dependent upon geometry of the two surfaces exchanging radiation.

104. What properties need to be considered for applications calling for following re¬quirements :

(i) rigidity

(ii) strength for no plastic deformation under static load

(iii) strength to withstand overload without fracture.

(iv) wear resistance

(v) reliability and safety.

(i) Rigidity—Elastic modulus and yield strength

(ii) Strength (for no plastic deformation under static loading)—yield point

(iii) Strength (overload)—Toughness and impact resistance

(iv) Wear resistance—Hardness

(v) Reliability and safety—Endurance limit and yield point.

105. Explain the effects of alloying chromium and nickel in stainless steel.

Addition of nickel and chromium increases the tensile strength and increase in resistance to corrosion takes place.

106. Mention two types of dislocations.

Dislocation refers to a break in the continuity of the lattice. In edge dislocation, one plane of atoms gets squeezed out. In screw dislocation the lattice atoms move fom their regular ideal positions.

107. What are the principal constituents of brass?

Principal constituents of brass are copper and zinc.

108. What is Curie point ?

Curie point is the temperature at which ferromagnetic materials can no longer be magnetised by outside forces.

109. Specific strength of materials is very high when they are in fibre size but lower when they are in bar form Why ?

Crystal structure has ordered, repeating arrangement of atoms. Fibres are liable to maintain this and thus have high specific strength. As size increases, the condition of ordered and repeating arrangements can't be guaranteed because of several types of defects and dislocations and thus the specific strength gets lower.

110. What is the percentage of carbon in cast iron ?

2.5%.

111. Which element is added in steel to increase resistance to corrosion ?

Chromium.

112. Whether individual components in composite materials retain their characteristics or not?

yes.

113. An elastomer is a polymer when its percentage elongation rate is ?

Greater than 100%.

114. If percentage elongation of a material is more than 200%, it is classed as ?

Rubber.

115. Why is it that the maximum value which the residual stress can reach is the elastic limit of the material ?

A stress in excess of elastic limit, with no external force to oppose it, will relieve itself by plastic deformation until it reaches the value of the yield stress.

116. Why fatigue strength decreases as size of a part increases beyond around 10 mm?

Perfection of material conditions is possible at lower sizes and as size increases, it is not possible to attain uniform structure of the material.

117. Distinguish between creep and fatigue.

Creep is low and progressive deformation of a material with time under a constant stress at high temperature applications. Fatigue is the reduced tendency of material to offer resistance to applied stress under repeated or fluctuating loading condition.

118. While normal carburising and nitriding surface treatments increase fatigue strength, excessive treatment may decrease the fatigue strength. Why ?

.Normal carburising/nitriding treatments increase volume due to phase transformation at Surface and introduce residual compressive surface stress and thus increase the fatigue strength. By excessive treatment the high compressive stresses are introduced but these are balanced by high in¬ternal tensile stresses of equal value and the subsurface fatigue cracks may develop in the regions of high tensile stress and lead to early fatigue failure.

119. List at least two factors that promote transition from ductile to brittle fracture.

Manner of loading, and the rate of loading promote transition from ductile to brittle frac¬ture. A machine member may have ductile failure under static loading but may fail in brittle fashion when the load is fluctuating. Similarly a material may evidence ductile failure under tensile loading at ordinary testing speed but if load is applied at a high velocity then failure may be brittle.

120. Which theories of failure are used for (a) ductile materials, and (B) brittle materials ?

For ductile materials, theories of failure used are maximum shear stress theory, and maximum energy of distortion theory; while for brittle materials, theory of maximum principal stress, and maximum strain are used.

121. What does thermal diffusivity of metals signify.

Thermal diffusivity is associated with the speed of propagation of heat into solids during changes in temperature with time.

122. For conduction of heat, the instantaneous rate of heat flow is product of three factors. What are these ?

1. Area of the section of the heat flow path, perpendicular to the direction of heat flow.
2. temperature gradient, i.e. change of temperature w.r.t. length of path.
3. Thermal conductivity of material.

123. How convective heat transfer is effected and on what factors it depends ?

Convective heat transfer is effected between a solid and fluid by a combination of molecular conduction within the fluid in combination with energy transport resulting from the motion of

fluid particles. It depends on boundary layer configuration, fluid properties and temperature difference.

124. Which is the common element between brass and bronze ?

Copper.

125. What does following alloy designation indicate FG 250 ?

Grey cast iron with tensile strength of 250 MPa.

126. How is ceramic defined ?

It is a solid formed by combination of metallic and non-metallic elements.

127. Give one example of metal classified as per structure as BCC, FCC, HCP and CCP.

BCC (body centred cubic) structure—Molybdenum

FCC (face centred cubic) structure—Aluminium

HCP (hexagonal closed packed) structure—Zinc

CCP (cubic dosed packed) structure-Copper.

128. What is the name of solid solution of carbon in alpha iron and delta iron ?

Ferrite and austenite respectively.

129. Explain the difference between pearlite and cementile ?

Pearlite is eutectoid mixture of ferrite and cementile. Cementite is chemical compound of iron and carbon.

130. Give one example each of the following proportion of materials dimensional, physical, technological and mechanical.

Roughness, enthalpy, toughness, and hardness respectively.

131. For which parts the Wahl factor and Lewis form factor used ?

For springs and gears respectively.

132. How oxygen can be removed from steel during melting? What are fully killed steels ?

Oxygen can be removed by adding elements such as manganese, silicon or aluminium which, because of their high affinity for oxygen, react with it to form non-metallic oxides which rise into the slag. Steels which have had most of their dissolved oxygen removed are called "fully killed steels".

133. Hydrogen cannot be removed easily from molten steel. What harm hydrogen has on property of steel ?

Execessive hydrogen results in the formation of small fissures often described as hairline cracks or flakes in the steel. Large forgings in alloy steel are particularly sensitive to this phenom¬enon.

134. What is allotrope ? In what forms of cubic pattern, iron exists ?

Some elements exist in more than one crystalline form. Each form is known as "allotrope". Iron exists in two forms of cubic pattern, namely body centered cubic (bcc) and face-centered cubic (fee).

135. What is the difference between alpha iron, delta iron and gamma iron ?

The bcc form of iron exists between room temperature and 910°C, and between 1400°C and the melting point at 1539°C. The lower temperature form is known as "alpha"-iron and the higher temperature form as "delta"-iron. The face-centered cubic form existing between 910°C and 1400°C is referred to as "gamma-iron".

136. Metals, in general are of low strength and do not possess required physio-chemical and technological properties for a definite purpose. Alloys are therefore more than metals alone. Discuss the arrangement of atoms and structures of alloys.

Alloys are produced by melting or sintering two ore more metals, or metals and a non-metal, together. Alloys possess typical properties inherent in the metallic state. The chemical elements that make up an alloy are called its components. An alloy can consist of two or more components. The phase and structures of alloys describe the constitution, transformations and properties of metals and alloys. A combination of phases in a state of equilibrium is called a system. A phase is a homogeneous portion of a system having the same composition and the same state of aggregation throughout its volume, and separated from the other portions of the system by interfaces. For instance, a homogeneous pure metal or alloy is a single-phase system. A state in which a liquid alloy (or metal) coexists with its crystals is a two-phase system. Structure refers to the shape, size or the mutual arrangement of the corresponding phases in metals or alloys. The structural components of an alloy are its individual portions, each having a single structure with its characteristic features.

137. What is the difference between isotropic material and homogeneous material ?

In homogeneous material the composition is same throughout and in isotropic material the elastic constants are same in all directions.

138. Explain the difference between the points of inflexion and contraflexure.

At points of inflexion in a loaded beam the bending moment is zero and at points of contraflexure in loaded beam the bending moment changes sign from increasing to decreasing.

139. What is the difference between proof resilience and modulus of resilience ?

Proof resilience is the maximum strain energy that can be stored in a material without permanent deformation. Modulus of resilience is the maximum strain energy stored in a material per unit volume.

140. What is the difference between column and strut ?

Both column and strut carry compressive load. Column is always vertical but strut as member of structure could carry axial compressive load in any direction.

141. Explain the difference between ferrite, austenite and graphite ?

Ferrite is the solid solution of carbon and other constituents in alpha-iron. It is soft, ductile and relatively weak.

Austenite is the solid solution of carbon and other constituents in gamma-iron. It exists in ordinary steels at elevated temperatures, but it is also found at ordinary temperatures in some stainless steels.

Graphite has a hexagonal layer lattice.

142. Explain the terms solid solution, eutectic, eutectoid and peritectic.

Solid Solution. When a homogeneous mixture of two (or more) atomic forms exists in solid state, it is known as solid solution.

Eutectic. A mixture of two (or more) phases which solidify simultaneously from the liquid al¬loy is called an eutectic. Alloys in which the components solidify simultaneously at a constant tem¬perature the lowest for the given system, are called eutectic alloys.

Eutectoid. Eutectoid alloys are the alloys for which two solid phases which are completely soluble become completely insoluble on cooling before a certain temperature called eutectoid tem¬perature.

Peritectic. A peritectic transformation involves a reaction between a solid and liquid that form a different and new solid phase. This three phase transformation occurs at a point called peritectic point.

143. What do you understand by critical points in iron, iron-carbide diagram ?

The temperatures at which the phase changes occur are called critical points (or tem¬peratures).

145. Why PERT is preferred over CPM for evaluation of project ?

PERT is based on the approach of multiple time estimates for each activity.

146. What is the percentage of chromium in 18 : 4 : 1 IISS ?

4%.

147. What is stellite ?

It is a non-ferrous cast alloy containing cobalt, chromium and tungsten.

148. Which rays are produced by cobalt-60 in industrial radiography ?

Gamma rays.

149. What are killed steels and what for these are used ?

Killed steels are deoxidised in the ladle with silicon and aluminium. On solidification no gas evolution occurs in these steels because they are free from oxygen.

150. What is critical temperature in metals ?

It is the temperature at which the phase change occurs in metals.

MECHANICAL Engineering Interview Questions and Answers pdf for freshers :-

151. Car tyres are usually made of ?

Styrene-butadine rubber.

152. What is the structure of pure iron and whether it is soft or hard ?

Ferrite and it is soft.

153. Which elements increase the corrosion resistance of steel ?

Chromium and nickel.

154. What causes hardness in steel ? How heat treatment alters properties of steel ?

The shape and distribution of the carbides in the iron determines the hardness of the steel. Carbides can be dissolved in austenite is the basis of the heat treatment of steel. If steel is heated above the A critical temperature to dissolve all the carbides, and then cooled, suitable cooling through the cooling range will produce the desired size and distribution of carbides in the ferrite, imparting different properties.

155. Explain the formation of micro structures of pearlite, bainite and martensite in steel.

If austenite containing about 0.80 percent carbon is slowly cooled through the critical temperature, ferrite and cementite are rejected simultaneously, forming alternate plates or lamellae. This microstructure is called pearlite. At temperatures just belot the A1, the transformation from austenite.to pearlite may take an appreciable time to initiate and complete, but the product will be lameller pearlite. As the transformation temperature is lowered, the time to initiate transformation shortens but the product is pearlite of increasing fineness, and at temperatures approaching 550°C it cannot be resolved into its lamellar

constituents. Further deerease in transformation temperature causes a lengthening of the ncubation period and a change in structure of the product to a form known as "bainite".

If the temperature is lowered sufficiently, the diffusion controlled nucleation and growth modes of transformation are suppressed completely and the austenite transforms by a diffusionless process in which the crystal lattice effectively shears to a new crystallographic configuration known as "martensite". This phase has a tetragonal crystal structure and contains carbon in supersaturated solid solution.

156. How with alloying of steel it is possible to a achieve properties which can not be achieved with heat treatment ?

A prerequisite to the hardening of steels is that martensite should be formed on cooling, but this can only be achieved if the rate of cooling is great enough to suppress the formation of pearlite or bainite and in plain carbon steels this can be achieved by quenching relatively small specimens

157. What are the major effects of alloying elements?

Ans:

1. To alter the transformation temperatures and times
2. To modify the room temperature and elevated temperature strengths of given structures by (a) stiffening the crystals and (B) introducing complex precipitates which tend to harden the steel.
3. To modify the type of oxide film formed on the surface of the steel and thereby affect its corrosion resistance.

158. What is the difference between austenite stabilisers and ferrite stabilisers ?

Austenite stabilisers have the effect of extending the temperature range overwhich austenite is formed. Such elements are carbon, manganese, nickel, copper and cobalt.

Ferrite stabilisers have the effect of extending the temperature range over which alpha and delta ferrite are formed, which consequently reduces temperature range over which austenite is formed. Such elements are silicon, chromium, molybdenum, tungsten, titanium and niobium.

159. What are the effects of carbon on the properties of steel.

In general, an increase in carbon content produces higher ultimate strength and hardness but lowers ductility and toughness of steel alloys. Carbon also increases air-hardening tendencies and weld hardness, especially in the presence of chromium. In low-alloy steel for high-temperature applications, the carbon content is usually restricted to a maximum of about 0.15% in order to assure optimum ductility for welding, expanding, and bending operations. To minimize intergranular corro¬sion caused by carbide precipitation, the carbon content of austenitic (18-8 type) alloys is limited in commercial specifications to a maximum of 0.08%, or even less, i.e. 0.03% in the extremely low-carbon grades used in certain corrosion-resistant applications.

In plain carbon steels in the normalised condition, the resistance to creep at temperatures below 440°C appears to increase with carbon content up to 0.4% carbon, at higher temperatures there is

but little variation of creep properties with carbon content.

An increase in carbon content lessens the thermal and electrical conductivities of steel and increases its hardness on quenching.

160. What is the role of silicon as alloying element in steels ?

Silicon contributes greatly to the production of sound steel because of its deoxidizing and degasifying properties. When added in amounts up to 2.5%, the ultimate strength of the steel is increased without loss in ductility. Silicon in excess of 2.5% causes brittleness, and amounts higher than 5% make the steel non-malleable.

Resistance to oxidation and surface stability of steel are increased by the addition of silicon. These desirable effects partially compensate for the tendency of silicon to lower the creep properties of steel. Silicon increases the electrical resistivity of steel and decreases hysteresis losses.

161. Discuss the role of manganese in alloying steels.

Manganese is an excellent deoxidizer and sulfur neutralizer, and improves the mechanical properties of steel, notably the ratio of yield strength to tensile strength at normal temperatures. As an alloying element, manganese serves as an inexpensive means of preventing "hot shortness". It improves rolling properties, hardenability, and resistance to wear. However manganese increases the crack sensitivity of weldments, particularly with steels of higher carbon content.

162. Define buckling factor.

It is the ratio of the equivalent length of column to the minimum radius of gyration.

163. What do you understand by catenary cable ?

A cable attached to the supports and carrying its own weight.

164. What is coaxing ?

It is the process of improving fatigue properties by first under-stressing and then increasing the stress in small increments.

165. What is difference between conjugate beam and continuous beam ?

A conjugate beam is an imaginary beam of same size as original beam and carrying a distributed load in accordance with the bending moment diagram.

A continuous beam is one which is resting on more than two supports.

166. What is isotropic material ?

It is a material having same elastic constants in all directions.

167. Explain difference between modulus of resilience and modulus of rigidity ?

Modulus of resilience is the maximum strain energy stored in a material per unit volume and modulus of rigidity is the ratio of shearing stress to the shearing strain within the elastic limit.

168. What is the difference between basic hole and basic shaft ?

A basic hole is one whose lower deviation is zero and in case of basic shaft the upper deviation is zero.

169. What for pyranometer is used ?

It is used to measure the total hemispherical solar radiation.

170. Describe transfer machines in brief.

It is an automatic machine in which workpiece alongwith fixture is transferred from one station to other automatically and several operation on workpiece are performed at each station.

171. What is burnt-out point ?

It corresponds to maximum heat flux at which transition occurs from nucleate boiling to film boiling.

172. What do you understand by eutectic ?

It is mechanical mixture of two or more phases which solidify simultaneously from the liquid alloy.

173. Explain the difference between grey iron and white iron. What is mottled iron ?

The carbon in cast iron could exist at room temperature as either iron carbide, or as graphite which is the more stable form. Irons containing carbon as graphite are soft, easily machinable and are called "grey irons". Irons with carbon present as iron carbide are extremely hard, difficult to machine and are called "white" irons. Irons with fairly equal proportions of graphite and iron carbide have intermediate hardness and are called "mottled" irons.

173. The graphite in grey irons exists in the form of flakes which act as stress-raisers under tensile loading and consequently grey irons have relatively low tensile strength and ductility. Still grey iron is extensively used in engineering. Why ?

Grey iron is extensively used in engineering because of following characteristics.

(a) Cheapness.

(B) Low melting point and high fluidity making it suitable for castings of intricate shape.

© Relatively good erosion and corrosion resistance.

(d) High damping capacity, with respect to vibration.

(e) Relatively good mechanical properties under compressive loading.

174. Under what condition a convergent divergent nozzle required ?

When pressure ratio is greater than critical pressure ratio.

175. What is endurance limit and what is its value for steel ?

Endurance limit is the maximum level of fluctuating stress which can be tolerated indefinitely. In most steels this stress is approximately 50% of the ultimate tensile strength and it is defined as the stress which can be endured for ten million reversals of stress.

176. How the net work to drive a compressor and its volumetric efficiency behave with increase in clearance volume ?

Work remains unaltered and volumetric efficiency decreases.

177. What do you understand by sulphur print ?

Sulphides, when attached with dilute acid, evolve hydrogen sulphide gas which stains bromide paper and therefore can be readily detected in ordinary steels and cast irons. While sulphur is not always as harmful as is sometimes supposed, a sulphur print is a ready guide to the distribution of segregated impurities in general.

178. What is the different between brass and bronze ?

Brass is an alloy of copper with zinc; and bronze is alloy of copper with tin.

179. What is the effect of addition of zinc in copper? What is the use of 70/30 brass ?

By addition of zinc in copper, both tensile strength and elongation increases. The 70/30 brass has excellent deep drawing property and is used for making radiator fins.

180. What for admirality brass used ?

Admirality brass with 29% zinc and 1% tin has good corrosion resistance and is used for condenser and feed heater tubes. Aluminium is also added to brass to improve corrosion resistance.

181. What is the maximum use of magnesium ?

Magnesium is used to alloy with aluminium and as an additive for making SG (Spheroidal Graphite) iron.

182. What for zinc finds applications ?

Galvanizing consumes the largest proportion of zinc. Zinc is resistant to corrosion but is attacked by acids and alkalies. Zinc alloy.s are suited for making die casting since the melting point is reasonably low.

183. Which factors influence the type of fracture in failure of a material ?

Seven factors influencing type of failure are :

1. Type of material (inherent structure properties),
2. Manner of loading (Static versus dynamic),
3. Range of imposed stress,
4. Strain rate (static, dynamic, impact),
5. Stress distribution (discontinuity in material/shape),
6. temperature, and
7. surface treatment.

184. What is the name given to ratio of actual cycle efficiency and ideal cycle efficiency.

Efficiency ratio.

185. List two effects of manganese in plain carbon steels.

Manganese increases tensile strength and hardness. It decreases weldability.

186. Name the strongest and weakest type of atomic bonds.

Metallic bond is strongest and molecular bond also known as Vander Waals bond is weakest.

187. In which process internal energy remains constant ?

Isothermal process.

188. What is temper embrittlement in alloy steels and what are its effects ?

Embrittlement attack is usually intergranular in metals, i.e. cracks progress between the grains of the polycrystalline material. It imparts a tendency to fail under a static load after a given period of time in those alloy steels which are susceptible to embrittlement.

189. What are whiskers ?

Whiskers are very small crystals which are virtually free from imperfections and dislocations.

190. What is Bauschinger effect ?

According to Bauschinger, the limit of proportionality of material does not remain constant but varies according to the direction of stress under cyclic stresses.

191. What is the difference between heat capacity and specific heat of a material ?

The heat capacity of a material is the amount of heat transformed to raise unit mass of a material 1 degree in temperature.

The specific heat of a material is the ratio of the amount of heat transferred to raise unit mass of a material 1 degree in temperature to that required to raise unit mass of water 1 degree of temperature at some specified temperature.

For most engineering purposes, heat capacities may be assumed numerically equal to;specific heats.

192. Explain the rule to find specific heat of aqueous solutions.

For aqueous solutions of salts, the specific heat can be estimated by assuming the specific heat of the solution equal to that of the water alone. Thus, for a 15% by weight solution of sodium chloride in water, the specific heat would be approximately 0.85.

193. What do you understand by latent heat ? Give four examples of latent heats.

For pure substances, the heat effects accompanying changes in state at constant pressure (no temperature change being evident) are known as latent heats. Examples of latent heats are : heat of fusion, vaporisation, sublimation, and change in crystal form.

194. Define the terms free energy and free enthalpy. What is their significance and importance ?

Free energy (or Helmholtz function) is defined as/= u -Ts.

It is equal to the work during a constant-volume isothermal reversible nonflow process.

Free enthalpy (or Gibbs function) is defined as g = h - Ts

(where u = internal energy, h = enthalpy, T = temperature, s = entropy)

Gibbs function is of particular importance in processes where chemical changes occur. For reversible isothermal steady-flow processes or for reversible constant-pressure isothermal nonflow processes, change in free energy is equal to net work.

195.Which parameter remains constant in isochoric process ?

Volume.

196. What is polytropic process ? Under what conditions it approaches isobaric, isothermal, and isometric process ? In which reversible process no work is done ?

A polytropic process is one that follows the equation pun = constant (index n may have values from - oc to + oo. This process approaches isobaric when n = 0, isothermal when n = 1, and isometric when n = <x>. No work is done in isometric process.

197. Whether superheated steam can be treated like ideal gas ?

Yes.

198. Out of constant pressure and constant volume lines on TS diagram which line has higher slope ? And whether slope is constant or variable ?

Constant volume line. Slope is variable.

199. Whether entropy is intensive property or extensive property ?

Entropy is extensive property.

200. In which process fluid expands but does no work ?

Throttling process.