Unit 3 - AMP

1. Mechanism of material removal in Laser Beam Machining is due to \_\_\_\_\_  
a) mechanical erosion due to impact of high of energy photons  
b) electro-chemical etching  
c) melting and vaporisation due to thermal effect of impingement of high energy laser beam  
d) fatigue failure  
View Answer

Answer: c  
Explanation: Laser beam machining is carried out utilizing the energy of coherent photons or laser beam, which is mostly converted into thermal energy upon interaction with most of the materials.

2. Laser Beam is produced due to \_\_\_\_\_  
a) spontaneous emission  
b) stimulated emission followed by spontaneous emission  
c) spontaneous emission followed by Spontaneous absorption  
d) spontaneous absorption leading to “population inversion” and followed by stimulated emission  
View Answer

Answer: d  
Explanation: Lasing process describes the basic operation of laser, i.e. generation of a coherent (both temporal and spatial) beam of light by “light amplification” using “stimulated emission”.

3. Which of the following processes does not use lasers?  
a) Cladding  
b) Alloying  
c) Nitriding  
d) Cutting  
View Answer

Answer: c  
Explanation: Laser Beam Machining or more broadly laser material processing deals with machining and material processing like heat treatment, alloying, cladding, sheet metal bending, etc.

4. Lasers are also used for\_\_\_\_\_  
a) riveting  
b) nitriding  
c) rapid prototyping  
d) facing  
View Answer

Answer: c  
Explanation: Nowadays, laser is also finding application in regenerative machining or rapid prototyping as in processes like stereo-lithography, selective laser sintering etc.

5. Laser stands for light amplification by stimulated emission of radiation.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: Laser stands for light amplification by stimulated emission of radiation. The underline working principle of a laser was first put forward by Albert Einstein in 1917 through the first industrial laser for experimentation was developed around the 1960s.

6. Laser beams can have power density upto \_\_\_\_\_  
a) 1 kW/mm2  
b) 10 kW/mm2  
c) 1 MW/mm2  
d) 10 MW/mm2  
View Answer

Answer: c  
Explanation: Laser beam can very easily be focused using optical lenses as their wavelength ranges from half micron to around 70 microns. Focussed laser beam as indicated earlier can have power density in excess of 1 MW/mm2.

7. Laser causes a rapid substantial rise in \_\_\_\_\_ of the material.  
a) local temperature  
b) local pressure  
c) indentation  
d) cracks  
View Answer

Answer: a  
Explanation: As laser interacts with the material, the energy of the photon is absorbed by the work material leading to rapid substantial rise in local temperature. This in turn results in melting and vaporisation of the work material and finally material removal.

8. At \_\_\_\_\_ temperature an atom is considered to be at ground level.  
a) absolute zero  
b) 0oC  
c) 100oC  
d) 100 K  
View Answer

Answer: a  
Explanation: Each of the orbital electrons is associated with unique energy levels. At absolute zero temperature an atom is considered to be at ground level when all the electrons occupy their respective lowest potential energy.

9. The electrons at ground state can be excited to a higher state of energy by \_\_\_\_\_  
a) increasing the pressure  
b) lowering the energy  
c) absorbing the energy  
d) oxidising the atom  
View Answer

Answer: c  
Explanation: The electrons at ground state can be excited to higher state of energy by absorbing energy form external sources like increase in electronic vibration at elevated temperature, through chemical reaction as well as via absorbing the energy of the photon.

10. The geometry and radii of orbital paths of electrons depend on the presence of an electromagnetic field.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: In the model of an atom, negatively charged electrons rotate around the positively charged nucleus in some specified orbital paths. The geometry and radii of such orbital paths depend on a variety of parameters like number of electrons, presence of neighbouring atoms and their electron structure, presence of an electromagnetic field, etc.

11. When coming back to normal state from excited state, electron releases \_\_\_\_\_  
a) proton  
b) anti-proton  
c) positron  
d) photon  
View Answer

Answer: d  
Explanation: On reaching the higher energy level, the electron reaches an unstable energy band. And it comes back to its ground state within a very small time by releasing a photon. This is called spontaneous emission.

12. In population inversion, no of electrons in \_\_\_\_\_ are more as compared to numbers of electrons in \_\_\_\_\_  
a) quasi-stable state, ground state  
b) meta-stable state, ground state  
c) meta-stable state, quasi-stable state  
d) mono-stable state, ground state  
View Answer

Answer: b  
Explanation: Sometimes such change of energy state puts the electrons in a meta-stable energy band. Instead of coming back to its ground state immediately (within tens of ns) it stays at the elevated energy state for micro to milliseconds. In a material, if more number of electrons can be somehow pumped to the higher meta-stable energy state as compared to the number of atoms at ground state, then it is called “population inversion”.

13. In laser beam machine, one end of the glass is\_\_\_\_\_  
a) open  
b) blocked with a 10% reflective mirror  
c) blocked with a 75% reflective mirror  
d) blocked with a 100% reflective mirror  
View Answer

Answer: d  
Explanation: The gas, called lasing medium is enclosed in a cylindrical glass vessel. One end of the glass is blocked with a 100% reflective mirror and the other end is having a partially reflective mirror.

14. In laser beam machining, electrons are excited by \_\_\_\_\_  
a) high temperature steam  
b) flash lamps  
c) flash torch  
d) cathode ray tube  
View Answer

Answer: b  
Explanation: Population inversion can be carried out by exciting the gas atoms or molecules by pumping it with flash lamps. Then stimulated emission would initiate lasing action. Stimulated emission of photons could be in all directions.

15. The photons emitted in the \_\_\_\_\_ direction form a laser beam.  
a) vertical  
b) horizontal  
c) longitudinal  
d) lateral  
View Answer

Answer: c  
Explanation: Most of the stimulated photons, not along the longitudinal direction would be lost and generate waste heat. The photons in the longitudinal direction would form coherent, highly directional, intense laser beam.

16. How many types of lasers are there?  
a) 2  
b) 3  
c) 4  
d) 5  
View Answer

Answer: a  
Explanation: Many materials can be used as the heart of the laser. Depending on the lasing medium lasers are classified as:  
• Solid-state laser  
• Gas laser.

17. How many types of solid state lasers are there?  
a) 2  
b) 3  
c) 4  
d) 5  
View Answer

Answer: b  
Explanation: Solid-state lasers are commonly of the following type:  
• Ruby which is a chromium – alumina alloy having a wavelength of 0.7 μm  
• Nd-glass lasers having a wavelength of 1.64 μm  
• Nd-YAG laser having a wavelength of 1.06 μm  
These solid-state lasers are generally used in material processing.

18. Lasers can be operated in \_\_\_\_\_ modes  
a) 2  
b) 7  
c) 8  
d) only one  
View Answer

Answer: a  
Explanation: Lasers can be operated in  
• continuous mode, or  
• pulsed mode  
Typically CO2 gas laser is operated in continuous mode and Nd – YAG laser is operated in pulsed mode.

19. Helium-Neon is a gas laser.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: The generally used gas lasers are:  
• Helium – Neon  
• Argon  
• CO2 etc.

20. Flash tubes used for Nd-YAG laser can be helical or flat.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: Nd-YAG laser is pumped using a flash tube. Flash tubes can be helical, or they can be flat. Typically the lasing material is at the focal plane of the flash tube. Though helical flash tubes provide better pumping, they are difficult to maintain.

21. The flash tube is operated in \_\_\_\_\_ mode.  
a) pulsed  
b) continuous  
c) reversed  
d) synchronous  
View Answer

Answer: a  
Explanation: The flash tube is operated in pulsed mode by charging and discharging of the capacitor. Thus the pulse on time is decided by the resistance on the flash tube side and pulse off time is decided by the charging resistance. There is also a high voltage switching supply for initiation of pulses.

22. How many types of flows are possible in gas lasers?  
a) 2  
b) 3  
c) 4  
d) 5  
View Answer

Answer: b  
Explanation: Gas lasers can be:  
• Axial flow  
• Transverse flow  
• Folded flow.

23. The power of CO2 laser is around\_\_\_\_\_\_  
a) 15 Watt per meter of tube length  
b) 55 Watt per meter of tube length  
c) 100 Watt per meter of tube length  
d) 1 MW per meter of tube length  
View Answer

Answer: c  
Explanation: The power of a CO2 laser is typically around 100 Watt per metre of tube length. Thus to make a high power laser, a rather long tube is required which is quite inconvenient. For optimal use of floor space, high-powered CO2 lasers are made of folded design.

24. In a CO2 laser, a mixture of \_\_\_\_\_ is circulated through the gas tube.  
a) CO2, N2 and He  
b) CO2, N2 and Ar  
c) CO2, H2 and N2  
d) CO2, I2 and O2  
View Answer

Answer: a  
Explanation: In a CO2 laser, a mixture of CO2, N2 and He continuously circulate through the gas tube. Such continuous recirculation of gas is done to minimize consumption of gases.

25. In CO2 laser, ‘He’ gas is used for cooling purpose.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: CO2 acts as the main lasing medium whereas nitrogen helps in sustaining the gas plasma. Helium on the other hand helps in cooling the gases. High voltage is applied at the two ends of the tube leading to discharge and formation of gas plasma.

26. CO2 lasers are folded to achieve \_\_\_\_\_\_\_\_\_\_\_\_\_  
a) high power  
b) high depth of cuts  
c) high material removal rate  
d) avoid over heating  
View Answer

Answer: a  
Explanation: CO2 lasers are folded to achieve high power. In folded laser, there would be a few 100% reflective turning mirrors for manoeuvring the laser beam from the gas supply as well as a high voltage supply.

27. Nd-YAG laser can be used for drilling holes in the range of \_\_\_\_\_ diameter.  
a) 0.25 mm – 1.5 mm  
b) 1 mm – 1.5 mm  
c) 1.5 mm – 2 mm  
d) 2 mm – 2.5 mm  
View Answer

Answer: a  
Explanation: For drilling holes as small as 0.25mm and as large as 1.5mm diameter, following lasers are used;  
• Nd-YAG,  
• Nd-glass, and  
• Ruby.

28. For which of the following materials CO2 laser is not used?  
a) Plastics  
b) Metals  
c) Organic materials  
d) Ceramics  
View Answer

Answer: b  
Explanation: For,  
• Plastics— CO2 laser is used  
• Metals—Nd-YAG, Ruby, Nd-glass lasers are used  
• Organic materials and non-metals—Pulsed CO2 laser is used  
• Ceramics—Pulsed CO2, Nd-YAG lasers are used.

29. Which of the following does not hold true about laser beam machining?  
a) High initial cost  
b) High running cost  
c) No heat affected zone  
d) It is not suitable for heat sensitive materials  
View Answer

Answer: c  
Explanation: Following are the limitations of laser beam machining;  
• High initial capital cost  
• High maintenance cost  
• Not very efficient process  
• Presence of Heat Affected Zone – specially in gas assist CO2 laser cutting  
• Thermal process – not suitable for heat sensitive materials like aluminium glass fibre laminate.

30. Using lasers, large aspect ratio in drilling can be achieved.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: Following are the advantages of laser beam machining:  
• In laser machining, there is no physical tool. Thus no machining force or wear of the tool takes place.  
• Large aspect ratio in laser drilling can be achieved along with acceptable accuracy or dimension, form or location  
• Micro-holes can be drilled in difficult – to – machine materials  
• Though laser processing is a thermal processing but heat affected zone especially in pulse laser processing is not very significant due to the shorter pulse duration.

31. Which of the following is un-conventional machining process?  
a) Grinding  
b) Milling  
c) Turning  
d) Electro chemical machining  
View Answer

Answer: d  
Explanation: Electro chemical machining is an un-conventional machining process used for large material removal from the surface using electricity generated due to chemical reactions.

32. Which of the following is conventional machining process?  
a) Electro chemical machining  
b) Milling  
c) Electron discharge machining  
d) None of the mentioned  
View Answer

Answer: b  
Explanation: Milling is a conventional machining process used for material removal from the surface.

33. In ECM, heavy electrical sparks are created.  
a) True  
b) False  
View Answer

Answer: b  
Explanation: Sparks are generated in EDM, by using high voltage current, for proper erosion of material.

34. In ECM, tool does not touch the work piece.  
a) True  
b) False  
View Answer

Answer: a  
Explanation: Tool is very near to work piece but does not touch it in ECM.

35. Which of the following is correct about ECM?  
a) Erosion of metal takes place as a reverse process of electroplating  
b) Thermal stresses are induced  
c) Mechanical stresses are induced  
d) None of the mentioned  
View Answer

Answer: a  
Explanation: In ECM, erosion of metal takes place as reverse process of electroplating.

36. Which of the following material cannot be machined using electro chemical machining?  
a) Iron  
b) Aluminum  
c) Copper  
d) Wood  
View Answer

Answer: d  
Explanation: Wood is a bad conductor of electricity and hence cannot be machined using electro chemical machining.

37. Which of the following material can be machined using electro chemical machining?  
a) Iron  
b) Rubber  
c) Plastic  
d) Wood  
View Answer

Answer: a  
Explanation: Iron is a good conductor of electricity and hence can be machined using electro chemical machining.

38. Electrode gap in electro chemical machining is generally ranged from  
a) 0.5 mm to 0.9 mm  
b) 1.1 mm to 1.2 mm  
c) 0.1 mm to 0.2 mm  
d) 3.1 mm to 4.2 mm  
View Answer

Answer: c  
Explanation: Electrode gap in electro chemical machining is generally ranged from 0.1 mm to 0.2 mm.

39. Electrolytes used in ECM must posses  
a) Low electrical conductivity  
b) Low chemical stability  
c) High electrical conductivity  
d) None of the mentioned  
View Answer

Answer: c  
Explanation: Electrolytes used in ECM must have high electrical conductivity.

40. Which of the following is not a function of electrolyte in ECM?  
a) It completes the circuit  
b) It helps in electrochemical reaction  
c) It carries away heat and waste product  
d) It provide non reactive environment  
View Answer

Answer: d  
Explanation: Electrolyte provides reactive environment for chemical reactions to takes place.