

SLA Recruitment (ME Dept.) Written Exam, 26/11/2019

Name: _____

Exam ID No.: _____

Answer all questions on the question paper itself. Each question has the same marks. Time = 1 hour. Make suitable assumptions as needed. Your answer must be clearly marked by circling the letter for the option chosen. For example if you feel that option (b) is the correct answer for question number 123 then mark a circle around the letter "(b)" under question 123. If you change your answer later then sign next to the new option after putting a circle around it. Each question has only one possible correct answer. If more than one answer is marked, or in case of confusion about which answer has been marked, the question will not be evaluated. No negative marking.

1. A shaft with polar moment of inertia J and length L is fixed at one end. The other end is given a torque T that produces an angle of twist w . The modulus of rigidity of the shaft material is
 - (a) $TL / (Jw)$
 - (b) $Jw / (TL)$
 - (c) TLw / J
 - (d) $J / (TLw)$
2. An axial bar of length L is stretched by an axial force P producing strain energy U . If E is the Young's modulus of the material, the normal stress in the bar is
 - (a) $2UE$
 - (b) $UE / (PL)$
 - (c) $2UE / (PL)$
 - (d) UE
3. A square-shaped elastic thin plate is loaded in-plane such that the principal stresses are S and $-S$ (i.e. one is tensile and the other is compressive, respectively). Assuming a plane-stress problem, the maximum shear stress found in the plate will be
 - (a) 0
 - (b) S
 - (c) $S/2$
 - (d) $2S$
4. A thick beam has a bending moment M and a shear force V at a square cross-section with side length a . If the neutral axis is parallel to one of the sides, the ratio of the maximum shear stress and the maximum bending stress at the section will be
 - (a) $2Va / M$
 - (b) $Va / (2M)$
 - (c) Va / M
 - (d) $Va / (4M)$
5. A cantilever beam of length L and moment of inertia I is loaded by a moment M at the free end. If Young's modulus for the beam material is E , the angular deflection at the free end will be
 - (a) $2ML / (EI)$
 - (b) $ML / (EI)$
 - (c) $ML / (2EI)$
 - (d) None of these
6. Edge preparation in a welded joint is to
 - (a) Avoid sharp edges
 - (b) Increase strength of weld
 - (c) Reduce heat required
 - (d) Have uniform stresses
7. Type of fit for a bearing is decided by difference in
 - (a) Maximum shaft diameter and maximum hole size
 - (b) Minimum shaft diameter and minimum hole diameter
 - (c) Minimum shaft diameter and maximum hole diameter
 - (d) Maximum shaft diameter and minimum hole diameter

8. Variation in radius along the periphery of a cylinder at a section is called
 - (a) Cylindricity
 - (b) Circularity
 - (c) Straightness
 - (d) Profile of a line
9. Misruns and cold shuts in sand casting are caused by
 - (a) Lower pouring temperature of the melt
 - (b) Faulty moulding flask
 - (c) Lower strength of the solidified metal
 - (d) Higher pouring temperature of the melt
10. Smaller diameter rolls in rolling are used for
 - (a) Smaller reduction in cold rolling
 - (b) Smaller reduction in hot rolling
 - (c) Larger reduction in cold rolling
 - (d) For any reduction
11. Filler metal is not required in the following type of welding process
 - (a) Oxy-acetylene welding
 - (b) Electric Arc welding
 - (c) Resistance welding
 - (d) Submerged arc welding
12. In up milling, the thickness of chip is
 - (a) minimum at the beginning of the cut and maximum at the end of the cut
 - (b) maximum at the beginning of the cut and minimum at the end of the cut
 - (c) uniform throughout the cut
 - (d) none of these
13. In hot machining, tool is made of
 - (a) tungsten carbide
 - (b) brass or copper
 - (c) diamond
 - (d) stainless steel
14. In ultra-sonic machining, the metal is removed by
 - (a) using abrasive slurry between the tool and work
 - (b) direct contact of tool with the work
 - (c) maintaining an electrolyte between the work and tool in a very small gap between the two
 - (d) erosion caused by rapidly recurring spark discharges between the tool and work
15. Ceramic cutting tools are
 - (a) made by cold pressing of aluminium oxide powder
 - (b) available in the form of tips
 - (c) brittle and have low bending strength
 - (d) all of these
16. Which of the following electromagnetic wave has the highest frequency?
 - (a) Infra-Red radiation
 - (b) Red colour light
 - (c) Blue colour light
 - (d) Green colour light
17. What is the main characteristic of a surface that would make it favourable for use as a radiation shield?
 - (a) the surface must have very high absorptivity
 - (b) the surface must have very high transmissivity
 - (c) the surface must have very high reflectivity
 - (d) none of the above

18. If the rate of evaporation of water is found to be zero, what can be said about the value of the relative humidity of the air near it:
- (a) 0%
 - (b) 100%
 - (c) 50%
 - (d) none of the above
19. The process in which no heat transfer takes place through boundaries is defined as:
- (a) isothermal process
 - (b) isochoric process
 - (c) isobaric process
 - (d) adiabatic process
20. If the speed of light in vacuum is denoted by X , then what is the speed of light in a medium having refractive index $7/2$?
- (a) X
 - (b) $2X$
 - (c) $7X/2$
 - (d) $2X/7$
21. Water boils at a lower temperature on the hills because
- (a) It is cold on the hills
 - (b) There is less carbon dioxide on the hills
 - (c) There is a decrease in air pressure on the hills
 - (d) There is less oxygen
22. The process of chamfering the entrance of a drilled hole is known as _____
- (a) counter-boring
 - (c) counter-sinking
 - (d) counter-fillet
 - (d) trepanning
23. The function of taper turning process is to _____
- (a) reduce the diameter of a workpiece along its length
 - (b) reduce the diameter by removing material about an axis offset from the axis of workpiece
 - (c) remove the material from end surface of a workpiece
 - (d) all of the above
24. The process of joining similar or dissimilar materials by heating them below 450°C using non-ferrous filler material is called as _____
- (a) Brazing
 - (b) Soldering
 - (c) Welding
 - (d) All of the above
25. A flat surface can be produced by a lathe machine, if the cutting tool moves _____
- (a) parallel to the axis of rotation of workpiece
 - (b) perpendicular to the axis of rotation of workpiece
 - (c) at an angle of 45°
 - (d) none of the above

26. For Newtonian fluids shear stress is linearly proportional to
(a) shear strain
(b) rate of shear strain
(c) vorticity
(d) deformation
27. Which one has highest thermal conductivity?
(a) water
(b) copper
(c) plastic
(d) oxygen
28. Which one represents conservation of energy?
(a) Bernoulli's equation
(b) Navier Stokes equation
(c) continuity equation
(d) Newton's law of viscosity
29. At what value, temperature will be same in Fahrenheit and Celsius scale?
(a) -32
(b) 50
(c) -40
(d) 20
30. Which one of these can't be used for measuring pressure?
(a) Barometer
(b) Manometer
(c) Bourdon gauge
(d) Anemometer
31. RTD measures temperature difference based on change in
(a) Current
(b) Flow rate
(c) Potential difference
(d) Resistance
32. A gas is contained in a cylinder by a freely moving piston. In a process, the gas expands from a volume of 200 cm^3 to 1000 cm^3 while the pressure of the gas is maintained constant at 5 bar. The gas rejects 100 J of energy in this process. The change in internal energy of the gas during this process is:
(a) -400 J
(b) -500 J
(c) 400 J
(d) 500 J
33. Reynolds number of flow of water in a circular is calculated to be 5000. If the duct has a diameter of 10 cm and dynamic viscosity of water is 0.0009 Pas, what is the velocity of water in the duct?
(a) 4.5 cm /s
(b) 1.5 m/s
(c) 1.5 cm/s
(d) 4.5 m/s
34. A solid metal sphere of diameter 20 cm at a temperature of 100°C is contained inside a hollow metallic cube. Each side of the cube is 30 cm at a temperature of 30°C . Now all air inside the cube and sphere system is insulated from environment. What is the mode of heat transfer between sphere and cube? Assume that cube is touching the bottom surface of cube at one point.
(a) No heat transfer is possible
(b) Free convection and conduction
(c) conduction and radiation
(d) Only radiation

35. Which of the following expressions has the units m^2/s ? Here k is the thermal conductivity, ρ is the density, c_p is the specific heat at constant temperature and l is a length scale.

- (a) $\frac{l\rho c_p}{k}$
- (b) $\frac{k}{\rho c_p}$
- (c) $\frac{k}{\rho l c_p}$
- (d) $\frac{l^2 \rho c_p}{k}$

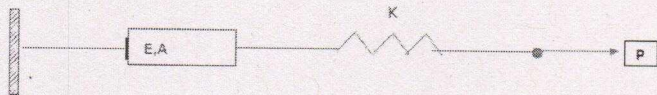
36. Let's consider that an initial displacement of x is applied to a spring mass system. For which values of stiffness (k) and mass (m), the system is going to have highest velocity at the mean position?

- (a) $K=1, M=1$
- (b) $K=1, M=2$
- (c) $K=2, M=1$
- (d) $K=2, M=2$

37. Let's say a ball 'A' of mass 1 Kg is moving with a velocity of 10m/sec, and hits a stationary ball 'B' of mass 1Kg. What is going to be the velocity of ball B after the impact?

- (a) 5m/sec
- (b) 10m/sec
- (c) 0m/sec
- (d) $10/\sqrt{2}$ m/sec

38. What is the equivalent stiffness of the following system? Here, E , A and L are elastic modulus, area and length of the bar respectively.



- (a) $\frac{EA}{L} + K$
- (b) $\frac{1}{\frac{1}{K} + \frac{EA}{L}}$
- (c) $\frac{1}{\frac{1}{K} + \frac{L}{EA}}$
- (d) $\frac{L}{EA} + K$

39. Which is not an assumption in the Euler-Bernoulli beam theory?

- (a) The cross section of the beam remain plane after the deformation.
- (b) Beam is prismatic, means cross section is identical throughout the length.
- (c) Shear stress is varying linearly along the cross section.
- (d) Beam is homogeneous, means material properties are identical throughout the beam.

40. What are the eigenvalues of the matrix $A =$

$$\begin{bmatrix} 4 & 0 & 0 \\ 1 & 3 & 2 \\ 2 & 2 & 3 \end{bmatrix}$$

- (a) 5, 1, 4
- (b) 3, 1, 4
- (c) 3, 2, 4
- (d) 4, 0, 3

41. The property of a material by virtue of which it can be beaten or rolled into plates is called

- (a) malleability
- (b) ductility
- (c) plasticity
- (d) reliability.

42. The percentage reduction in area of a cast iron specimen during tensile test would be of the order of

- (a) more than 50%
- (b) 25—50%
- (c) 10—25%
- (d) negligible.

43. Poisson's ratio is defined as the ratio of
- (a) longitudinal stress and longitudinal strain
 - (b) longitudinal stress and lateral stress
 - (c) lateral stress and longitudinal stress
 - (d) none of the above.
44. Induction heating process is based on which of the following principles?
- (a) Thermal ion release principle
 - (b) Nucleate heating principle
 - (c) Resistance heating principle
 - (d) Electro-magnetic induction principle
45. The best shape for sprue in sand casting is
- (a) Straight cylindrical
 - (b) Tapered
 - (c) Either straight cylindrical or tapered
 - (d) Shape does not matter

---- Good Luck ----