1. **Match List I with List II and select the correct answer**

List I	List II
A. Pelton wheel (single jet)	1. Medium discharge, low head
B. Francis Turbine	2. High discharge, low head
C. Kaplan Turbine	3. Medium discharge, medium head
	4. Low discharge, high head

	A	B	C
a)	4	3	2
b)	1	3	4
c)	4	1	3
d)	1	2	3

2. **Reversible adiabatic process may be expressed as $\left(T_1/T_2\right)$ equal to**

a) $(v_2/v_1)^{\gamma+1}$ b) $(v_2/v_1)^{\gamma-1/\gamma}$ c) $(p_1/p_2)^{\gamma-1/\gamma}$ d) $(p_1/p_2)^{\gamma-1}$

3. **A gas is so expanded in a cylinder that its temperature remains constant. The resulting variation of pressure vs. volume is**

a) A parabola b) A hyperbola c) A straight line through origin d) None of these

4. **According to first law of thermodynamics**

a) Mass and energy are mutually convertible
b) Heat and work are mutually convertible
c) Heat flows from hot substance to cold substance
d) Carnot engine is most efficient

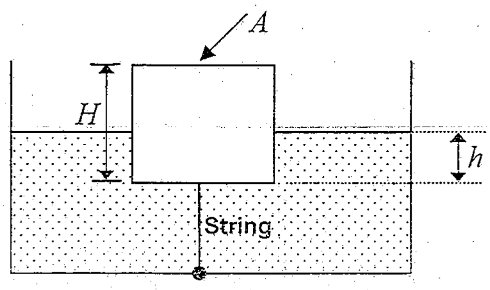
5. **Pick up the incorrect statement for centrifugal pumps**

a) Discharge α diameter
b) Head α $(\text{speed})^2$
c) Head α $(\text{diameter})^2$
d) Discharge α speed

6. **If the discharge of a centrifugal pump is throttled then its suction lift**

a) Decreases
b) First increases and then decreases
c) Remains unchanged
d) Increases

7. **A cylindrical body of cross-sectional area A height H and the density ρ_s is immersed to a depth h in a liquid of density ρ, and tied to the bottom with a string. The tension in the string is**



a) $\rho g h A$ b) $(\rho h - \rho_s H) g A$ c) $(\rho - \rho_s) g h A$ d) $(\rho_s - \rho) g h A$

8. **A manometer measures the pressure differential between two locations of a pipe carrying water. If the manometric liquid is mercury (specific gravity 13.6) and the manometer showed a level difference of 20 cm, then the pressure head difference of water between the two tapings will be**

a) 1.26 m b) 2.72 m c) 1.36 m d) 2.52 m

9. **Flow takes place at Reynolds Number of 1500 in two different pipes with relative roughness of 0.001 and 0.002. The friction factor**

a) Will be higher for the pipe with relative roughness of 0.001
b) Will be higher for the pipe having relative roughness of 0.002
c) Will be the same in both the pipes
d) In the two pipes cannot be compared on the basis of data given

10. **A liquid compressed in cylinder has a volume of 0.04 m^3 at 50 kg/cm^2 and a volume of 0.039 m^3 at 150 kg/cm^2. The bulk modulus of elasticity of liquid is**

a) 400 kg/cm^2 b) 40×10^6 kg/cm^2 c) 40×10^5 kg/cm^2 d) 4000 kg/cm^2

11. **A fluid jet is discharging from a 100 mm nozzle and the vena contracta formed has a diameter of 90 mm. If the coefficient of velocity is 0.95, then the coefficient of discharge for the nozzle is**

a) 0.7695 b) 0.81 c) 0.9025 d) 0.855

12. **A fully developed laminar viscous flow through a circular tube has the ratio of maximum velocity to average velocity as**

a) 3.0 b) 2.0 c) 2.5 d) 1.5

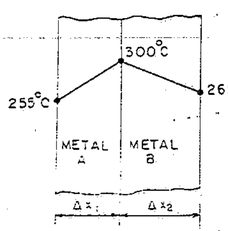
13. **If the surface tension of water-air interface is 0.073 N/m, the gauge pressure inside a rain drop of 1 mm diameter will be**

a) 0.146 N/m^2 b) 73 N/m^2 c) 146 N/m^2 d) 292 N/m^2

14. **A stream function is given by $(x^2 - y^2)$. The potential function of the flow will be**

a) $2xy + f(x)$ b) $2(x^2 - y^2)$ c) $-2xy$ + constant d) $2xy + f(y)$

15. **The temperature profile between two metal walls joined together is shown in Fig. From the figure it can be concluded that**



a) Heat flows from A to B b) Heat flows from B to A

c) Heat is generated at the interface d) A is bad conductor of heat

16. According to Fourier's law, amount of heat flow (Q) through the body in unit time is equal to

a) $KA\frac{dT}{dx}$ b) $KA\frac{dT^2}{dx^2}$ c) $K\frac{dx}{dT}$ d) $KA\frac{dx}{dT}$

17. Pitch diameter is equal to the product of

a) Circular pitch and number of teeth
b) Working depth and number of teeth
c) Clearance and number of teeth
d) Module and number of teeth

18. The tension in the cable supporting a lift moving upwards is twice the tension when the lift moves downwards. What is the acceleration of the lift?

a) g/4 b) g/3 c) g/2 d) G

19. Whirling speed of a shaft coincides with the natural frequency of its

a) Transverse vibration
b) Longitudinal vibration
c) Torsional vibration
d) Coupled bending torsional vibration

20. Oscillation of a particle is prescribed by the equation $x = 3\cos(0.25\pi t)$, where t is the time in seconds. The time taken by the particle to move from position of equilibrium to maximum displacement is

a) 2.0 sec b) 1.0 sec c) 0.5 sec d) 3.0 sec

21. If two objects are weighed in water and both of them lose the same weight, then the two objects must have identical

a)Specific gravities b) Weights in air c) Densities d) Volumes

22. 1kg of moist air of RH 70% at 21^0 C is cooled at constant pressure of 1 bar to 5^0C. The vapour pressure at 21^0C and 5^0C are 0.025 bar and 0.0087 bar. The percentage of water vapour that condenses into water, at 5^0C is

a) 66% b) 85% c) 51% d) 17%

23. Two spherical balls of same material and surface finish have their diameters in the ratio of 2:1. Both are heated to same temperature and allowed to cool by radiation. Rate of cooling of big ball as compared to smaller one will be in the ratio of

a) 1:2 b) 2:1 c) 1:1 d) 4:1

24. Ninety kilograms of ice at 0^0C are completely melted. Find the entropy change, in kJ/K, if T_2=0^0C. (Latent heat of fusion is 318.5 kJ/kg.K)

a) 0 b) 45 c) 105 d) 85

25. A solid shaft of 100mm diameter transmits 160 HP at 200rpm. The modulus of rigidity $c = 8 \times 10^5$ kg/cm^2. Then the maximum angle of twist for a length of 6 meter is

a) 5^0 b) 2.5^0 c) 3.2^0 d) 2^0

26. A perfect gas at 27^0 C is heated at constant pressure till its volume is double. The final temperature is

a) 54^0 C b) 108^0 C c) 327^0 C d) 600^0 C

27. The stagnation temperature of an isentropic flow of air (k=1.4) is 360 K. If the temperature is 200 K at a section, then the Mach number of the flow will be

a) 1.0 b) 1.5 c) 3.0 d) 2.0

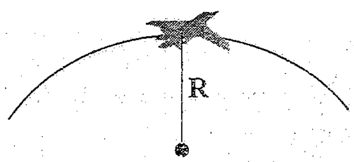
28. Air at 20^0 C blows over a plate of 50 cm X 75 cm maintained at 250^0C. If the convection heat transfer coefficient is $25W/m^{2\,0}C$, the heat transfer rate is

a) 2.156 kW b) 2156 kW c) 215.6 kW d) 21.56 kW

29. A small plastic boat loaded with pieces of steel rods is floating in a bath tub. If the cargo is dumped into the water allowing the boat to float empty, the water level in the tub will

a) Rise b) Remains same c) Fall d) Cannot be estimated from the information

30. When a jet plane flying at 300 m/s is at the very top of its trajectory, the apparent weight of a passenger is one half of her actual weight. Find the radius of curvature R of the flight path at this point. Use g= 10 m/s^2



a) 22 km b) 18 km c) 30 km d) 16 km

31. Two cars are moving in the same direction with a speed of 45 km/hr and a distance of 10 km separates them. If a car coming from the opposite direction meets these two cars at an interval of 6 minutes, its speed would be

a) 45 km/hr b) 55 km/hr c) 65 km/hr d) 75 km/hr

32. If the rotating mass of a rim type flywheel is distributed on another rim type flywheel whose mean radius is half the mean radius of the former, then energy stored in the later at the same speed will be

a) Four times the first one b) Same as the first one
c) One and a half times the first one d) One fourth of the first one

33. **Tungsten in High Speed Steel provides**

a) Hot hardness b) Toughness c) Wear resistance d) Sharp cutting edge

34. **Which of the following regions of the electromagnetic spectrum would be used to determine the structure of crystalline solids?**

a) Microwave b) Infrared c) X- ray d) Visible

35. **Fluidity in casting (CI) operation is greatly influenced by**

a) Melting temperature of molten metal
b) Pouring temperature of molten metal
c) Finish of the mould
d) Carbon content of molten metal

36. **Robert Hooke discovered experimentally that within elastic limit**

a) Stress = strain
b) Stress/strain = a constant
c) Stress x strain = 1
d) None of these

37. **Two heavy rotating masses are connected by shafts of lengths l_1, l_2 and l_3 and the corresponding diameters are d_1, d_2 and d_3. this system is reduced to a torsionally equivalent length of the shafts is**

a) $l_1 + l_2\left(\frac{d_1}{d_2}\right)^4 + l_3\left(\frac{d_1}{d_3}\right)^4$
b) $l_1 + l_2\left(\frac{d_1}{d_2}\right)^3 + l_3\left(\frac{d_1}{d_3}\right)^3$
c) $\frac{l_1 + l_2 + l_3}{3}$
d) $l_1 + l_2 + l_3$

38. Precipitation hardening is applicable for

a) Pure aluminuim
b) Low carbon steel
c) Non-metal
d) Aluminium – Copper alloy

39. Match the lists I and II using code given below

A. Car dash board — 1. Polyvinylchloride (PVC)
B. Aircraft windows — 2. TEFLON
C. Conduit pipes — 3. Polyacrylonitrile
D. Bearings and gears — 4. Polymethylmethacrylate

	A	B	C	D
a)	1	2	3	4
b)	3	4	1	2
c)	4	3	2	1
d)	2	3	4	1

40. The mass moment of inertia of a cube with edges of length b, about an axis passing through an edge

a) $\frac{mb^2}{2}$ b) $\frac{mb^2}{6}$ c) $\frac{3mb^2}{2}$ d) $\frac{2mb^2}{3}$

41. A thin cylinder contains fluid at a pressure of 30 kg/cm^2 .The inside diameter of the shell is 60 cm and the tensile stress in the material is to be limited to 900 kg/cm^2. The shell must have minimum wall thickness of

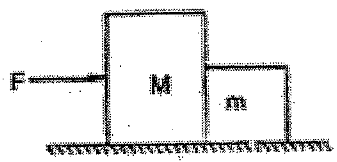
a) 1mm b) 2.7mm c) 10mm d) 9mm

42. When a shaft is subjected to combined twisting moment *(T)* and bending moment *(M)*, the equivalent twisting moment is equal to

a) $\frac{1}{2}\left[M+\sqrt{M^2+T^2}\right]$ b) $\sqrt{M^2+4T^2}$

c) $\sqrt{4M^2+T^2}$ d) $\sqrt{M^2+T^2}$

43. Two blocks with masses M and m are in contact with each other and are resting on a horizontal frictionless floor. When horizontal force F is applied to the heavier, the blocks accelerate to the right. The force between the two blocks are



a) $mF/(M+m)$ b) MF/m c) mF/M d) $(M+m)F/m$

44. A machine mounted on a single coil spring has a period of free vibration of T. If the spring is cut into four equal parts and placed in parallel and the machine is mounted on them, then the period of free vibration of the new system will be

a) 16 T b) T/4 c) 4 T d) T/16

45. Dislocations in materials are

a) Point defect b) Surface defect c) Planer defect d) Line defect

46. Which of the following thermocouple is capable of measuring highest temperature?

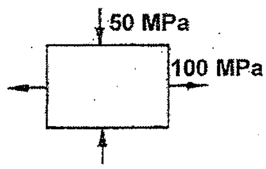
a) Chromel – alumel b) Platinum – rhodium

c) Iridium – rhodium d) Iron – constantan

47. **A circular rod of 100mm diameter and 500mm length is subjected to a tensile force of 1000kN. Determine the modulus of rigidity (G) if E=2x10^5 N/mm^2 and Poisson's=0.3**

a) 0.335x10^5 N/mm^2 b) 0.521x10^5 N/mm^2
c) 0.7692x10^5 N/mm^2 d) 0.2256x10^5 N/mm^{2}0

48. **For the state of stress shown in the above figure, normal stress acting on the plane of maximum shear stress is**



a) 25 MPa tension b) 75 MPa compression
c) 25 MPa compression d) 75 MPa tension

49. **The effective diameter of an external or internal screw thread, is known as**

a) Minor diameter b) Major diameter c) Pitch diameter d) None of these

50. **Consider the following statements:**
If at section away from the ends of the beam, M represents the bending moment, V the shear force, w the intensity of loading and y represents the deflection of the beam at the section, then

1. $dM/dx = V$ **2.** $dV/dx = w$ **3.** $dw/dx = y$

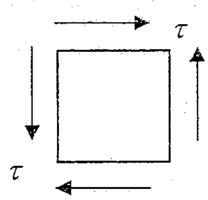
Of these statements

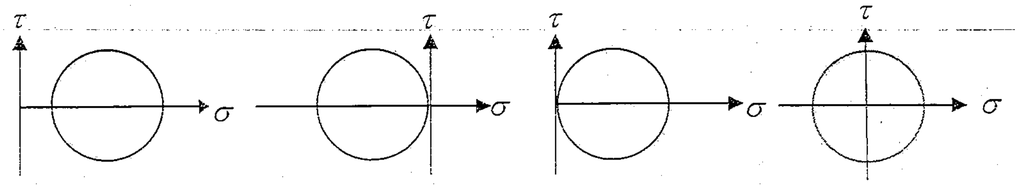
a) 1 and 2 are correct b) 1 and 3 are correct
c) 2 and 3 are correct d) 1,2 and 3 are correct

51. For a column of length L is fixed at both ends, corresponding Euler's critical load is

a) $\pi^2 EI/L^2$ b) $2\pi^2 EI/L^2$ c) $3\pi^2 EI/L^2$ d) $4\pi^2 EI/L^2$

52. Which one of the following figures is the correct sketch of Mohr's circle of the given state of stress





(a) (b) (c) (d)

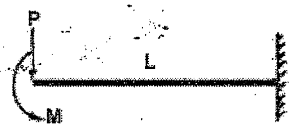
53. With a punch for which the maximum crushing stress is 4 times the maximum shearing stress of the plate, the biggest hole that can be punched in the plate would be of diameter equal to

a) $\frac{1}{4}\times$ Thickness of plate
b) $\frac{1}{2}\times$ Thickness of plate
c) Plate thickness
d) $2\times$Plate thickness

54. A simply supported beam with width 'b' and depth 'd' carries a central load W and undergoes deflection δ at the centre. If the width and depth are interchanged, the deflection at the centre of the beam would attain the value:

a) $\frac{d}{b}\delta$
b) $\left(\frac{d}{b}\right)^2\delta$
c) $\left(\frac{d}{b}\right)^3\delta$
d) $\left(\frac{d}{b}\right)^{3/2}\delta$

55. The given figure shows a cantilever of span 'L' subjected to a concentrated load 'P' and a moment 'M' at the free end. Deflection at the free end is given by



a) $\frac{PL^2}{2EI}+\frac{ML^2}{3EI}$
b) $\frac{ML^2}{2EI}+\frac{PL^3}{48EI}$
c) $\frac{ML^2}{3EI}+\frac{PL^3}{2EI}$
d) $\frac{ML^2}{2EI}+\frac{PL^3}{3EI}$

56. In arc welding, penetration is minimum for

a) DCSP
b) DCRP
c) AC
d) DCEN

57. Match list –I (welding effects) with list –II (causes) and select the correct answer using the codes given below the lists :

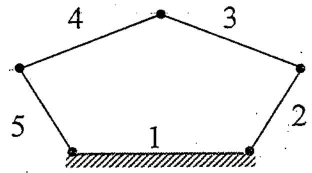
List – I (Welding defects)	List – II (Causes)
A. Spatter	1. Damp electrodes
B. Distortion	2. Arc blow
C. Slag inclusion	3. Improper cleaning in multipass Welding
D. Porosity	4. Poor joint selection

	A	B	C	D
a)	2	4	3	1
b)	4	2	1	3
c)	2	4	1	3
d)	4	2	3	1

58. Two beams of equal cross sectional area are subjected to equal bending moment. If one beam has square section and the other has circular section then,

a) Both the beams will be equally strong
b) Square section beam will be stronger
c) Circular section beam will be stronger
d) Depends on loading condition

59. **The number of degree of freedom of a five link plane mechanism with five revolute pairs as shown in the figure is**



a) 3 b) 4 c) 1 d) 2

60. **To ensure self locking in a screw jack, it is essential that helix angle is**

a) Larger than friction angle
b) None of these
c) Equal to friction angle
d) Smaller than friction angle

61. **A cutting tool having tool signature as 10, 9, 6, 6, 8, 8, 2 will have side rake angle**

a) 10° b) 9° c) 8° d) 2°

62. **In radiographic test, type of defect not detectable by X-Ray is**

a) Delamination in cladded sheet
b) Porosity in castings
c) Tungsten inclusion in TIG weld
d) Under cut in metal arc welding

63. **In CAM, " Part programming" refers to**

a) Generation of cutter location data
b) On-line Inspection
c) Machine Selection
d) Tool Selection

64. **A 50mm diameter steel rod was turned at 284 rpm and tool failure occurred in 10 minutes. The speed was changed to 232 rpm and the tool failed in 60 minutes. Assuming straight line relationship between cutting speed and tool life, the value of Taylorian Exponent is**

a) 0.21 b) 0.13 c) 0.11 d) 0.23

65. **Which of the following screw thread is adapted for power transmission in one direction**

a) Acme threads
b) Buttress threads
c) Square threads
d) Multiple threads

66. **CLA value and RMS values are used for measurement of**

a) Metal hardness
b) Sharpness of tool edge
c) Surface dimensions
d) Surface roughness

67. **A sine bar is specified by**

a) Its total length
b) The size of the rollers
c) The centre distance between the two rollers
d) The distance between rollers and upper surface

68. **A shaft and hole pair is designated as 50H7d8. This assembly constitutes**

a) Interference fit
b) Transition fit
c) Clearance fit
d) None of the above

69. **A milling machine has the following two index plates supplied along with the indexing head:**

Plate I : 15, 16,17,18,19, 20, hole circles
Plate 2: 21,23,27,29,31,33, hole circles

It is proposed to mill a spur gear of 28 teeth using simple indexing method. Which one of the following combinations of index plate and number of revolutions is correct?

a) Plate I : 1 revolution and 9 holes in 18 hole circles
b) Plate 2 : 1 revolution and 9 holes in 21 hole circles
c) Plate 2: 1 revolution and 9 holes in 33 hole circles
d) Plate 1 : 1 revolution and 9 holes in 15 hole circles

70. **The initial blank diameter required to form a cylindrical cup of outside diameter 'd' and total height 'h' having a corner radius 'r' is obtained using the formula**

a) Do= $\sqrt{d^2 + 4dh} - 0.5r$
b) Do = $d + 2h + 2r$
c) Do = $d^2 + 2h^2 + 2r$
d) Do = $\sqrt{d^2 + 4dh - 0.5r}$

71. **The equation of the tangent to the curve $y(x-2)(x-3) - x + 7 = 0$, at the point where it cuts the x-axis is**

a) $-x + 20y = 7$
b) $x + 20y = 7$
c) $x - 20y = 7$
d) $-x - 20y = 7$

72. **If the imaginary part of $\frac{2z+1}{iz+1}$ is -2, then the locus of the point z in the complex plane is**

a) $x + 2y - 2 = 0$
b) $2x + y - 2 = 0$
c) $x - 2y - 2 = 0$
d) $x + 2y + 2 = 0$

73. **General solution of the differential equation $(D^2 - 2D + 1)y = e^x$ is**

a) $Ae^x + Be^{-x} + \frac{x^2}{2}e^x$
b) $e^x(A + Bx) - \frac{x^2}{2}e^x$
c) $Ae^x + Be^{-x} - \frac{x^2}{2}e^x$
d) $e^x(A + Bx) + \frac{x^2}{2}e^x$

74. In a simple micrometer with screw pitch 0.5 mm and divisions on thimble 50, the reading corresponding to 5 divisions on barrel and 12 divisions on thimble is

a) 2.620 mm b) 2.512 mm c) 5.120 mm d) 5.012 mm

75. The value of $\begin{vmatrix} a & b & c \\ b+c & c+a & a+b \\ a^2 & b^2 & c^2 \end{vmatrix}$ is

a) 0 b) $-(a-b)(b-c)(c-a)(a+b+c)$

c) $(a-b)(b-c)(c-a)(a+b+c)$ d) 1

76. If $\upsilon=(x^2+y^2+z^2)^{-1/2}$, then $\frac{\partial^2\upsilon}{\partial x^2}+\frac{\partial^2\upsilon}{\partial y^2}+\frac{\partial^2\upsilon}{\partial z^2}$ is

a) $-\frac{1}{2}$ b) -1 c) 0 d) 1

77. The image of the point (1,2,3) in the plane $2x+y+z=13$ is

a) (5,4,5) b) (5,5,4) c) (3,3,4) d) (4,5,5)

78. The value of curl of the vector $\vec{v}=(xyz)\hat{i}+(3x^2y)\hat{j}+(xz^2-y^2z)\hat{k}$ at the point (2, -1, 1) is

a) $2\hat{i}+3\hat{j}+14\hat{k}$ b) $2\hat{i}-3\hat{j}+14\hat{k}$

c) $2\hat{i}+3\hat{j}-14\hat{k}$ d) $2\hat{i}-3\hat{j}-14\hat{k}$

79. An open tank contains water to a depth of 2 m and oil over it to a depth of 1 m. If the specific gravity of oil is 0.8, then the pressure intensity at the interface of the two fluid layers will be

a) 9750 N/m^2 b) 8720 N/m^2 c) 9347 N/m^2 d) 7848 N/m^2

80. A box contains 6 black and 5 red balls. Two balls are drawn one after another from the box without replacement. The probability for both balls to be red is

a) $\frac{3}{11}$ b) $\frac{2}{11}$ c) $\frac{5}{11}$ d) $\frac{25}{121}$