

## Instructions:

1. Ensure that all pages are printed.
2. Use Black ball pen only
3. Change in option is not allowed
4. There is no negative marking
5. Use of non-programmable scientific calculator is allowed

1. Head developed by a centrifugal pump depends on its \_\_\_\_\_.  
A Diameter B Speed  
C Both A and B D None of these
2. The unit of heat transfer co-efficient in SI unit is \_\_\_\_\_.  
A  $W/m^2.K$  B  $W/m.K$   
C  $J/m^2.K$  D  $J/m.K$
3. Segmental baffles in a 2-4 shell and tube heat exchanger  
A change the flow pattern of the tube side fluid and increase the overall heat transfer coefficient. B increase the heat transfer coefficient in the shell side and support the tubes.  
C help to reduce the thermal expansion of the tubes and increase the heat transfer coefficient in the tube side. D increase the number of passes in the shell side and increase the heat transfer coefficient in the tube side.
4. The Reynolds number is defined as the ratio of the  
A inertial to viscous forces. B buoyancy to viscous forces.  
C buoyancy to inertial forces. D buoyancy to surface tension forces.
5. In a shell and tube heat exchanger, which is the best tube arrangement if the fluids are clean and non-fouling?  
A Triangular B Square  
C Rotated square D Rectangular
6. If air (a non-condensing gas) is present in a condensing vapor stream, it will \_\_\_\_\_ the condensation rate of vapor.  
A increase B increase the condensing film co-efficient as well as  
C not affect D decrease
7. Which characteristic of a fluid is not important in deciding its route in a shell and tube heat exchanger?  
A Corrosiveness B Fouling characteristic  
C Viscosity D None of these
8. Two tubes of diameters, 1 and 2 cms are filled with mercury to a height of 50 cm. Pressure at the bottom of the mercury column will be \_\_\_\_\_.  
A Higher for the tube of diameter 1 cm B Higher for the tube of diameter 2 cm  
C Same for both the tubes D Can't say. Data insufficient.
9. Minimum fluidisation velocity for a specific system depends upon the \_\_\_\_\_.  
A particle size B fluid viscosity  
C density of both the particle & the fluid D All A, B and C

10. Permanent pressure loss in a well designed venturi meter is about \_\_\_\_\_ percent of the venturi differential.  
 A 10 B 70  
 C 50 D 1
11. Potential flow is characterised by the \_\_\_\_\_.  
 A irrotational and frictional flow. B irrotational and frictionless flow.  
 C one in which dissipation of mechanical energy into heat occurs. D formation of eddies within the stream.
12. Assuming flow to be laminar, if the diameter of the pipe is halved, then the pressure drop will  
 A increase B decrease  
 C remain same D be quadrupled
13. With increase in the ratio of orifice diameter to pipe diameter, the fraction of the orifice pressure differential that is permanently lost  
 A increases B decreases  
 C remains unchanged D increases exponentially
14. The terminal velocity of a small sphere settling in a viscous fluid varies as the  
 A first power of its diameter. B inverse of the fluid viscosity.  
 C inverse square of the diameter. D square of the difference in specific weights of solid & fluid.
15. Maximum work that could be secured by expanding the gas over a given pressure range is the \_\_\_\_\_ work.  
 A isothermal B adiabatic  
 C isentropic D none of these
16. Work done is a \_\_\_\_\_.  
 A property of the system B path function  
 C state function D state description of a system
17. Extensive properties of a thermodynamic system depend upon the \_\_\_\_\_ of the system.  
 A specific volume B temperature  
 C mass D pressure
18.  $PV^\gamma = \text{Constant}$  (where,  $\gamma = C_p/C_v$ ) is valid for a/an \_\_\_\_\_ process.  
 A isothermal B isentropic  
 C isobaric D adiabatic
19. For an azeotropic mixture, the value of relative volatility will be  
 A 0 B 1  
 C Between 0 and 1 D  $>1$
20. Peclet number in heat transfer is  
 A Product of Reynolds and Prandtl number B Product of Reynolds and Nusselt number  
 C Product of Prandtl and Nusselt number D Product of Grashoff and Prandtl number
21. In a forced convection, the heat transfer depends on  
 A Re, Pr B Re, Gr  
 C Mainly Gr D Re only
22. With increase in porosity, the thermal conductivity of a solid substance  
 A increase B decrease  
 C remains unchanged D may increase or decrease; depends on the solids
23. The DCDA (Double Contact Double Adsorption) process is used for the manufacture of  
 A Urea B Sulphuric Acid.  
 C Nitric Acid D Ammonia

24. Critical Speed of a ball mill depends on  
 A the radius of the mill(shell) and the radius of the particles  
 B the radius of the mill(shell) and the density of the particles  
 C the radius of the balls and the radius of the particles  
 D the radius of the balls and the radius of the mill(shell)
25. Polyvinyl Chloride is produced by  
 A Co-polymerisation  
 B addition- type kinetics  
 C reacting chlorine with polyethylene  
 D reacting hydrochloric acid with polyethylene
26. Absorptivity of a perfect black body is equal to  
 A 0  
 B 1  
 C 0.5  
 D infinite
27. In constant pressure filtration, the rate of filtration follows the relation ( $V$  = filtrate volume,  $t$  = time,  $k$  and  $C$  = constants).  
 A  $\frac{dV}{dt} = kV + C$   
 B  $\frac{dV}{dt} = \frac{1}{kV + C}$   
 C  $\frac{dV}{dt} = kV$   
 D  $\frac{dV}{dt} = kV^2$
28. For a particle settling in water at its terminal settling velocity, which of the following is true?  
 A Buoyancy = Weight + Drag  
 B Weight = Buoyancy + Drag  
 C Drag = Buoyancy + Weight  
 D Drag = Weight
29. According to the penetration theory of mass transfer, the mass transfer coefficient ( $k$ ) varies with diffusion coefficient ( $D$ ) of the diffusing species as  
 A  $D$   
 B  $D^{-1/2}$   
 C  $D^{1/2}$   
 D  $D^{3/2}$
30. The Grashoff Number is  
 A Thermal diffusivity/Mass diffusivity  
 B Inertial force/Surface tension force  
 C Sensible heat/Latent heat  
 D Buoyancy force/Viscous force
31. An aqueous solution of 2.45% by weight  $H_2SO_4$  has a specific gravity of 1.011. The composition expressed in normality is  
 A 0.2500  
 B 0.2528  
 C 0.5000  
 D 0.5055
32. The number of degrees of freedom for an azeotropic mixture of ethanol and water in vapour-liquid equilibrium is  
 A 3  
 B 1  
 C 2  
 D 0
33. The molar composition of a gas is 10%  $H_2$ , 10%  $O_2$ , 30%  $CO_2$  and balance  $H_2O$ . If 50%  $H_2O$  condenses, the final mole percent of  $H_2$  in the gas on a dry basis will be:  
 A 10%  
 B 5%  
 C 18.18%  
 D 20%
34. The feed to a binary distillation column has 40 mol% vapour and 60 mol% liquid. Then, the slope of the  $q$ -line in the McCabe-Thiele plot is  
 A -1.5  
 B -0.6  
 C 0.6  
 D 1.5
35. In the sulphite process for paper manufacturing, the 'cooking liquor' is  
 A magnesium bisulphite and sulphur dioxide in acid medium  
 B magnesium sulphite and magnesium dicarbonate  
 C sodium sulphite and magnesium sulphite  
 D sodium sulphite and sodium bisulphite and sulphur dioxide

36. In Tyler series, the ratio of the aperture size of a screen to that of the next smaller screen is  
 A  $1/\sqrt{2}$  B  $\sqrt{2}$   
 C 1.5 D 2
37. 1 Kcal/kg°C is equivalent to \_\_\_\_\_ BTU/lb.°F.  
 A 1 B 2.42  
 C 4.97 D None of these
38. Rate of adsorption increases as the  
 A Temperature increases. B Temperature decreases.  
 C Pressure decreases. D None of these
39. Increase in reflux ratio always increases the \_\_\_\_\_ cost of the distillation column  
 A Operating cost B Fixed cost  
 C Both (A) and (B) D None of these
40. Fenske equation determines the  
 A maximum number of ideal plates. B height of the distillation column.  
 C minimum number of theoretical plates. D optimum reflux ratio.
41. Nitrile rubber is produced by the polymerisation of  
 A acrylonitrile & butadiene B acrylonitrile & styrene  
 C isobutylene & isoprene D none of these
42. In a fluidized bed reactor  
 A Temperature gradients are very high B Temperature is more or less uniform  
 C Hot spots formed D Segregation of solids occurs
43. Bollman extractor  
 A is a static bed leaching equipment B is used for extraction of oil from oilseed  
 C is a centrifugal extractor D employs only counter-current extraction
44. Prilling tower is found in the flow sheet for the manufacturing of  
 A Ammonia B Urea  
 C Superphosphate D Triple Superphosphate
45. An isothermal liquid phase zero order reaction  $A \rightarrow B$  ( $k = 0.5 \text{ mol/m}^3 \text{ s}$ ) is carried out in a batch reactor. The initial concentration of A is  $2 \text{ mol/m}^3$ . At 3 seconds from the start of the reaction, the concentration of A in  $\text{mol/m}^3$  is \_\_\_\_\_.  
 A 0.5 B 1  
 C 0.1 D 5
46. In order to achieve the same conversion under identical reaction conditions and feed flow rate for a non-autocatalytic reaction of positive order, the volume of an ideal CSTR is  
 A always greater than that of an ideal PFR B always smaller than that of an ideal PFR  
 C same as that of an ideal PFR D smaller than that of an ideal PFR only for first order reaction
47. Catalytic cracking is  
 A a hydrogen addition process B a carbon rejection process  
 C An exothermic process D A coking process
48. Reid vapour pressure of gasoline is the measure of its  
 A Pour point B Cloud point  
 C vapour locking tendency D Carbon residue

49. For an exothermic reversible reaction, which of the following correctly describes the dependence of the equilibrium constant(K) with temperature(T) and pressure(P)?  
 A K is independent of T and P      B K increases with an increase in T and P  
 C K increases with T and decreases with P      D K decreases with an increase T and is Independent of P
50. The exit age distribution of a fluid leaving a vessel is used to know the  
 A Activation energies of a reaction      B Reaction mechanism  
 C Extent of non-ideal flow in the vessels      D None of these
51. Response of a linear control system for a change in set point is called  
 A Frequency response      B Transient response  
 C Servo problem      D Regulator problem
52. For an input forcing function,  $X(t) = 2t^2$ , the laplace transform of this function is  
 A  $2/s^2$       B  $4/s^2$   
 C  $2/s^3$       D  $4/s^3$
53. In second order underdamped system  
 A Decay ratio = overshoot      B Decay ratio =  $(\text{overshoot})^2$   
 C Overshoot increases for increasing damping co-efficient.      D Large damping co-efficient means smaller damping.
54. Which is the most undesirable component in kerosene ?  
 A Aromatics      B i-paraffins  
 C n-paraffins      D Naphthenes
55. High Aniline point of Diesel indicates that, it  
 A Is highly aromatic      B Has a large ignition delay  
 C Is highly paraffinic      D Has a lower diesel index
56. Which is almost absent in crude petroleum?  
 A Olefins      B Mercaptans  
 C Naphthenes      D Cycloparaffins
57. Octane number of gasoline is a measure of its  
 A knocking tendency      B ignition delay  
 C ignition temperature      D smoke point
58. Half life of \_\_\_\_\_ order reaction does not depend upon concentration  
 A 0      B 2  
 C 1      D 3
59. Utilities cost in the operation of chemical process plant comes under the  
 A plant overhead cost      B Fixed charges  
 C Direct production cost      D General expenses
60. Which of the following relationship is not correct is case of a chemical process plant?  
 A Manufacturing cost = direct product cost + fixed charges + plant overhead costs      B General expenses = administrative expenses + distribution & marketing expenses  
 C Total product cost = manufacturing cost + general expenses      D Total product cost = direct production cost + plant overhead cost.
61. In a manufacturing industry, break even point occurs, when the

- A total annual rate of production equals the assigned value      B total annual product cost equals the total annual sales.  
 C annual profit equals the expected value.      D annual sales equals the fixed cost.
62. \_\_\_\_\_ taxes are based on gross earnings.  
 A Property      B Exice  
 C income      D Capital gain
63. Cost incurred towards \_\_\_\_\_ in a chemical plant is a component of the utilities cost.  
 A water supply      B running a control laboratory  
 C property protection      D Medical services
64. Catalytic action in a catalytic chemical reaction follows from the ability of catalyst to change the  
 A activation energy      B equilibrium constant  
 C heat of reaction      D None of these
65. An amplitude ratio of 0.1 corresponds to \_\_\_\_\_ decibels.  
 A 20      B -20  
 C 10      D -10
66. Presence of sulphur in gasoline  
 A leads to corrosion.      B increases lead susceptibility  
 C decreases gum formation.      D helps during stabilisation
67. Operating principle of cyclone separator is based on the action of \_\_\_\_\_ dust particles.  
 A diffusion of      B centrifugal force on  
 C gravitational force on      D electrostatic force on
68. Reinglemann chart is used for the measurement of the  
 A combustibles present in automobile exhaust      B smoke density from a chimney.  
 C exhaust gas density.      D flue gas temperature.
69. Threshold Limit Value (TLV) is the maximum allowable concentration (i.e. safe limit) of pollutants in air. Safe limit for SO<sub>2</sub> in air is \_\_\_\_\_ ppm  
 A 5      B 500  
 C 1000      D 2000
70. Gel point in Condensation polymerisation is used to express  
 A End of reaction      B Control of reaction rate  
 C Start of crosslinking      D Start of degradation
71. Examples for inorganic polymers are  
 A Silicone rubber and Polyphosphate      B Polygermane and Lignin  
 C Cellulose and Polypeptide      D Silicone rubber and Polypyrrole
72. Which type of white pigment is largely accepted in polymer industry?  
 A CaO      B CaCO<sub>3</sub>  
 C TiO<sub>2</sub>      D MgO
73. Nylon-6 is manufactured from

- A caprolactum. B adipic acid and hexamethylenediamine.  
C maleic anhydride and hexamethylenediamine. D sebacic acid and hexamethylenediamine
74. Buna-S is also known as  
A Teflon B PTFE  
C SBR D Polyacrylates
75. Which of the following is not a biopolymer?  
A protein B polysaccharide  
C polyurethane D RNA
76. Ziegler-Natta Catalyst is used to produce  
A Stereoregular Polymers B Branched Polymers  
C Copolymers D Amorphous Polymers
77. Which of the following polymers are condensation polymers?  
A Bakelite B Teflon  
C Butyl rubber D Amino resin
78. Function of baffles in a shell and tube heat exchanger \_\_\_\_\_.  
A To direct shell side fluid B To support tube bundle  
C To increase shell side heat transfer coefficient D All of the above
79. In general, strongest polymer group is \_\_\_\_\_.  
A Thermoplasts B Thermosets  
C Elastomers D All polymers
80. Expandable Polystyrene beads are produced by  
A Bulk Polymerisation B Interfacial Polymerisation  
C Plasma Polymerisation D Suspension Polymerisation
81. Improper integral  $\int_0^{\infty} \frac{dx}{x^2 + 1}$  is

A  $\frac{\pi}{2}$

B  $\frac{\pi}{3}$

C  $\frac{\pi}{4}$

D None of these.

82. Determine the saddle point of  $f(x, y) = x^2 - y^2 - 2x + 4y + 6$ .

A (1, 1)

B (-1, 1)

C  $(1, -1)$

D  $(1, 2)$

83. Find the derivative of the function  $f(x, y) = 2xy - 3y^2$  at  $P(5, 5)$  in the direction of

$$\vec{u} = 4\hat{i} + 3\hat{j}.$$

A  $-3$

B  $-4$

C  $3$

D  $4$

84. Evaluate  $\int_C x \, ds$  where  $C$  is the straight line segment  $x = t, y = t/2$ , from  $(0, 0)$

to  $(4, 2)$ .

A  $4$

B  $2$

C  $4\sqrt{5}$

D None of these

85. Determine the counterclockwise circulation of  $\vec{F} = (x - y)\hat{i} + (y - x)\hat{j}$  where  $C$  is

the square bounded by  $x = 0, x = 1, y = 0, y = 1$ .

A  $2$

B  $1$

C  $3$

D  $0$



86. General solution of  $12y'' - 5y' - 2y = 0$  is

A  $y = c_1 e^{2x/3} + c_2 e^{-x/4}$

B  $y = c_1 e^{2x/3} + c_2 e^{x/4}$

C  $y = c_1 e^{-2x/3} + c_2 e^{-x/4}$

D None of these

87. Determine the particular integral of  $y'' - 10y' + 25y = 30x + 3$

A  $y_p = \frac{6}{5}x - \frac{3}{5}$

B  $y_p = \frac{6}{5}x + 3$

C  $y_p = \frac{6}{5}x + \frac{3}{5}$

D None of these

88. Find the solution of  $x \frac{dy}{dx} + (3x + 1)y = e^{-3x}$ .

A  $y = e^{-3x} + c x^{-2} e^{-3x}$

B  $y = e^{3x} + c x^{-1} e^{-3x}$

C  $y = e^{-3x} + c x^{-1} e^{-3x}$

D None of these

89. The particular integral of  $y'' + y = \sec x$

A  $y_p = x \cos x \ln |\cos x|$

B  $y_p = \cos x \ln |\cos x|$

C  $y_p = \sin x \ln |\cos x|$

D None of these

90. The solution of  $x^2 y'' - 3xy' - 2y = 0$  is

A  $y = c_1 x^{(2-\sqrt{6})} + c_2 x^{(2+\sqrt{6})}$

B  $y = c_1 x^{(1-\sqrt{6})} + c_2 x^{(1+\sqrt{6})}$

C  $y = c_1 x^{(3-\sqrt{6})} + c_2 x^{(3+\sqrt{6})}$

D None of these

91. Let  $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$  then  $A^n =$

A  $\begin{bmatrix} 1 & 2n \\ 0 & n \end{bmatrix}$

B  $\begin{bmatrix} n & 2n \\ 0 & n \end{bmatrix}$

C  $\begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix}$

D  $\begin{bmatrix} 1 & 2n \\ 0 & 1 \end{bmatrix}$

92. Find the eigen values of  $A = \begin{bmatrix} 2 & -1 \\ -2 & 3 \end{bmatrix}$ .

A  $2, -3$

B  $1, 4$

C  $-1, 4$

D None of these

93. Solve  $2x + 3y = 1, \quad 5x + 7y = 3$ .

A  $(x, y) = (-2, -1)$

B  $(x, y) = (2, 1)$

C  $(x, y) = (2, -1)$

D None of these

94. The function  $f(z) = \frac{z}{z+i}$  is not analytic at

A  $z = 0$

B  $z = -i$

C  $z = i$

D None of these

95. Evaluate  $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$  where  $C$  is the circle  $|z| = 3$ .

A  $2\pi i$

B  $4\pi i$

C  $-2\pi i$

D None of these

96. Choose correct option for the series of  $\csc z$ .

A  $\frac{1}{z} + \frac{z}{6} + \frac{7z^3}{360} + \dots$

B  $z + \frac{z^2}{6} + \frac{7z^3}{360} + \dots$

C  $\frac{1}{z} + \frac{z}{36} + \frac{7z^3}{360} + \dots$

D None of these

97. Find the probability that a single toss of a die will result in a number less than 4 if no other information is given.

A  $\frac{1}{6}$

B  $\frac{1}{3}$

C  $\frac{1}{4}$

D  $\frac{1}{2}$

98. Find the probability that in five tosses of a fair die, a 3 will at most once.

A  $\frac{625}{3625}$

B  $\frac{625}{3600}$

C  $\frac{3125}{3888}$

D  $\frac{315}{3625}$

99. Determine the interval where root lies for the function  $f(x) = x^3 - 2x^2 - 5$ .

A  $(-1, 0)$

B  $(2, 3)$

C  $(0, 1)$

D  $(1, 2)$

100. Choose appropriate formula of Simpson's Three - Eights rule for  $\int_{x_0}^{x_3} f(x) dx$ .

A  $\frac{3h}{8}[f(x_0) + 3f(x_1) + 3f(x_2) + f(x_3)]$       B  $\frac{3h}{8}[f(x_0) + 2f(x_1) + 2f(x_2) + f(x_3)]$

C  $\frac{3h}{2}[f(x_0) + 3f(x_1) + 3f(x_2) + f(x_3)]$       D  $\frac{h}{3}[f(x_0) + 3f(x_1) + 3f(x_2) + f(x_3)]$