Question Booklet No. :

CECH/2024

Register Number | | | | | | | | | | |

2024

Paper – I

CHEMICAL ENGINEERING

(Degree Standard)

Duration : Three Hours] **[Total Marks : 300**

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. You will be supplied with this question booklet 15 minutes prior to the commencement of the examination.
2. This question booklet contains **200** questions. Before answering the questions, you shall check whether all the questions are printed serially and ensure that there are no blank pages in the question booklet. **If any defect is noticed in the question booklet, it shall be reported to the invigilator within the first 10 minutes and get it replaced with a complete question booklet. If the defect is reported after the commencement of the examination, it will not be replaced.**
3. Answer **all** the questions. All the questions carry equal marks.
4. You must write your register number in the space provided on the top right side of this page. Do not write anything else on the question booklet.
5. An answer sheet will be supplied to you separately by the room invigilator to shade the answers. Instructions regarding filling of answers etc., which are to be followed mandatorily, are provided in the answer sheet and in the memorandum of admission (Hall Ticket).
6. You shall write and shade your question booklet number in the space provided on page one of the answer sheet with **BLACK INK BALL POINT PEN.** If you do not shade correctly or fail to shade the question booklet number, your answer sheet will be invalidated.
7. Each question comprises of five responses (answers) : i.e. (A), (B), (C), (D) and (E). You have to select ONLY ONE correct answer from (A) or (B) or (C) or (D) and shade the same in your answer sheet. If you feel that there are more than one correct answer, shade the one which you consider the best. **If you do not know the answer, you have to mandatorily shade (E).** In any case, choose ONLY ONE answer for each question. If you shade more than one answer for a question, it will be treated as a wrong answer even if one of the given answers happens to be correct.
8. You should not remove or tear off any sheet from this question booklet. You are not allowed to take this question booklet and the answer sheet out of the examination room during the time of the examination. After the examination, you must hand over your answer sheet to the invigilator. You are allowed to take the question booklet with you only after the examination is over.
9. **You should not make any marking in the question booklet except in the sheets before the last page of the question booklet, which can be used for rough work. This should be strictly adhered to.**
10. Failure to comply with any of the above instructions will render you liable for such action as the Commission may decide at their discretion.

SEAL

SPACE FOR ROUGH WORK

1. The carbon equivalent value (CE) is an index that combines the effect of Si and P upon the eutectic of iron and carbon and it is defined as ;

(A) CE = (Total %C+%P)/3 + %Si

(B) CE = Total %C + [(%Si + %P)/3]

(C) CE =[(Total %C + %Si + %P)/3]

(D) CE = (Total %C+ %Si)/3 + %P

(E) Answer not known

2. The material preferred for the storage tanks to handle 98% sulfuric acid is

(A) Stainless steel 304

(B) Stainless steel 316

(C) Lead

(D) Mild steel

(E) Answer not known

3. The most common type of continuous vacuum filter is

(A) Rotary drum filter

(B) Gravity filter

(C) Automatic belt filters

(D) Centrifugal filters

(E) Answer not known

4. The most widely used Vessel for mixing highly Viscous liquid is

(A) Propeller

(B) Turbine

(C) Anchor agitators

(D) JET mixers

(E) Answer not known

5. Rotary drum vaccum filter is fitted with a horizontal knife known as ———— blade.

(A) Nutsche

(B) Doctor

(C) Buchner

(D) Larox

(E) Answer not known

6. Rotary drum vacuum filters are designed for a slurry submerge of

(A) 10 – 15%

(B) 15 – 25%

(C) 33 – 35%

(D) 35 – 37%

(E) Answer not known

7. Calculate separation factor for a cyclone 0.3m diameter with a tangential velocity of 15 m/s near the wall?

(A) 123

(B) 153

(C) 143

(D) 103

(E) Answer not known

8. Mechanically agitated thickners are in range of ———— in diameter.

(A) 10 to 100 m
(B) 1 to 10 m
(C) 100 to 1000 m
(D) 200 to 400 m
(E) Answer not known

9. Optimum grinding conditions are obtained in Ball mills when the volume of the balls is equal to ———— that of its capacity.

(A) 30%
(B) 50%
(C) 70%
(D) 46%
(E) Answer not known

10. The terminal velocity in m/s, calculated from stokes law, for a particle diameter 0.1 mm, density 7000 kg/m^3 setting in water of density 1000 kg/m^3 and viscosity 10^{-3} Kg/m.s is (assume $g = 10 \frac{m}{52}$)

(A) 1×10^{-2} m/s
(B) 2×10^{-2} m/s
(C) 3×10^{-2} m/s
(D) 1×10^{-3} m/s
(E) Answer not known

11. Unlike an ideal crushes or grinder, an actual crusher/grinder yields

(A) smaller sized products
(B) longer sized products
(C) average sized products
(D) mixed size of products
(E) Answer not known

12. The overall heat transfer coefficient for the shell and tube heat exchanger for clean surface is $U_c = 50\ w/m^2k$. The fouling coefficient after few years of operation is found to be $h_{d0} = 200\ w/m^2k$. The overall heat transfer coefficient is determined as ;

(A) $80\ w/m^2k$

(B) $60\ w/m^2k$

(C) $40\ w/m^2k$

(D) $20\ w/m^2k$

(E) Answer not known

13. When heat is transferred from one particle of hot body to another, It is referred to as heat transfer by

(A) Conduction

(B) Convection

(C) Radiation

(D) Conduction and convection

(E) Answer not known

14. Two parallel infinite gray planes of equal emissivities are maintained at temperature T_1 and T_3. If a thin radiation shield is placed between the two planes, the steady state temperature T_2 of the shield is given by

(A) $T_2 = (T_1^4 + T_3^4)^{\frac{1}{4}}$

(B) $T_2 = 2(T_1^4 + T_3^4)^{\frac{1}{4}}$

(C) $T_2 = \frac{1}{2}(T_1^4 + T_3^4)^{\frac{1}{4}}$

(D) $T_2 = \frac{1}{4}(T_1^4 + T_3^4)^{\frac{1}{4}}$

(E) Answer not known

15. The pump which contains no check values is

(A) Centrifugal pump
(B) Plunger pump
(C) Diaphragm pump
(D) Rotary pump
(E) Answer not known

16. The ratio of all corresponding linear dimension in the model and prototype are equal, then it is said to be in

(A) conditional similarity
(B) kinematic similarity
(C) dynamic similarity
(D) geometric similarity
(E) Answer not known

17. Chemical adsorption (chemisorption) is,

(A) a reversible phenomenon
(B) an irreversible phenomenon
(C) same as Vander Waals adsorption
(D) characterised by adsorption of heat
(E) Answer not known

18. The property of fluid which accounts for the major losses in pipes

(A) viscosity
(B) density
(C) specific gravity
(D) compressibility
(E) Answer not known

19. Sensitivity of U-tube manometers with inclined leg depends on

(A) specific weight of fluid

(B) length of inclined of leg

(C) angle of inclination of leg

(D) atmospheric pressure

(E) Answer not known

20. A Bingham fluid of viscosity $\mu = 10$ Pa.s and yield stress $Z_0 = 10\,\text{kPa}$, is sheared between flat parallel plates separated by a distance 10^{-3}m. The top plate is moving with a velocity of 1 m/s, the shear stress on the plate is

(A) 10 kPa

(B) 20 kPa

(C) 30 kPa

(D) 40 kPa

(E) Answer not known

21. The reactant may produce a side product which deposits on and deactivates the surface is called as

(A) Parallel deactivation

(B) Series deactivation

(C) Side-by-side deactivation

(D) Independent deactivation

(E) Answer not known

22. The inverse Laplace transform for the function $\frac{1}{S(S-1)}$ is

(A) $e^t + 1$

(B) $e^t - 1$

(C) $1 - e^t$

(D) $1 + e^{-t}$

(E) Answer not known

23. Hydrostatic pressured (P) in a liquid column is calculated using

(A) $P = \frac{\rho}{gh}$

(B) $P = \frac{g}{\rho h}$

(C) $P = \rho g h$

(D) $P = \frac{gh}{\rho}$

(E) Answer not known

24. The most serious disadvantages of slurry reactors is

(A) the difficulty in retaining the catalyst

(B) less efficiency

(C) more impurities formed

(D) loss of product

(E) Answer not known

25. For a tubular reactor with space time τ and residence time θ, the following statement holds

(A) τ and θ always equal

(B) $\tau = \theta$ when the fluid density changes in the reactor

(C) $\tau = \theta$ for an isothermal tubular reactor in which the density of the fluid is constant

(D) $\tau = \theta$ for a non-isothermal reactor

(E) Answer not known

26. For a single site mechanism for the irreversible reaction $A.S \rightarrow B.S$, surface reaction is the rate controlling. The rate expression can be written as

(A) $(-r_A) = 1 + K_A P_A + K_B P_B$

(B) $(-r_A) = \dfrac{KP_A}{1 + K_A P_A + K_B P_B}$

(C) $(-r_A) = \dfrac{1 + K_A P_A + K_B P_B}{KP_A}$

(D) $(-r_A) = \dfrac{1}{1 + K_A P_A + K_B P_B}$

(E) Answer not known

27. The particles in a fluidized bed reactor are so small, that intraparticle concentration and temperature gradients are

(A) Negligible

(B) Limited

(C) Small

(D) Zero

(E) Answer not known

28. The number of reactor volumes of feed at specified conditions which can be treated in unit time is called as

(A) space velocity

(B) space time

(C) volumetric flow rate

(D) mass flow rate

(E) Answer not known

29. According to Arrhenius law, rate constant (K) is proportional to

(A) Activation Energy (E)

(B) $e^{E/RT}$

(C) $e^{RT/E}$

(D) $e^{-E/RT}$

(E) Answer not known

30. At a given temperature the number of collisions directly proportional to the number of molecules. Therefore the rate of a chemical reaction should be proportional to the

(A) concentration of reactants

(B) catalyst concentration

(C) temperature of the reaction

(D) pressure of reaction

(E) Answer not known

31. Find the eigen values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$

(A) 6, 1

(B) –6, –1

(C) 6, –1

(D) –6, 1

(E) Answer not known

32. If A is a square matrix then orthogonality property mandates

(A) $AA^T = A^{-1}$

(B) $AA^T = 0$

(C) $AA^T = A^2$

(D) $AA^T = 1$

(E) Answer not known

33. An upper triangular matrix is

(A) $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(D) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

(E) Answer not known

34. Given $f(x, y) = 2x^2 + 3y^2$, $\nabla^2 f$ is

(A) 0

(B) 5

(C) 10

(D) $4x + 6y$

(E) Answer not known

35. Solve $\frac{\partial^2 z}{\partial x^2} + z = 0$, Given that when $x = 0$, $z = e^y$ and $\frac{\partial z}{\partial x} = 1$

(A) $Z = e^y \sin x + \cos x$

(B) $Z = \sin x + \cos x$

(C) $Z = \sin x + e^y \cos x$

(D) $Z = e^y \cos x$

(E) Answer not known

36. The inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ is

(A) $\begin{bmatrix} -2 & -1 \\ -\frac{3}{2} & -\frac{1}{2} \end{bmatrix}$

(B) $\begin{bmatrix} -2 & \frac{3}{2} \\ 1 & -1 \end{bmatrix}$

(C) $\begin{bmatrix} -2 & 1 \\ \frac{3}{2} & \frac{-1}{2} \end{bmatrix}$

(D) $\begin{bmatrix} 2 & \frac{-3}{2} \\ -1 & \frac{1}{2} \end{bmatrix}$

(E) Answer not known

37. Classify the following optimization problem

Min $f(x) = x_1^{\,2} + x^2$

Subject $x_1 x_2 - 9 \leq 0$

(A) Linear programming

(B) Integral linear programming

(C) Non linear programming

(D) Mixed integer nonlinear programming

(E) Answer not known

38. The method used to find the real roots of an equation given in the form of infinite series is

(A) Convergence method

(B) Complex method

(C) Quasi method

(D) Regula Falsi method

(E) Answer not known

39. The method which is not used for curve fitting is

(A) method of moments

(B) graphical method

(C) method of least squares

(D) orthogonalization methods

(E) Answer not known

40. On curve fitting by Least square method, the sum of squares of errors is

(A) Equal to 1

(B) Equal to 100

(C) Maximum

(D) Minimum

(E) Answer not known

41. The Charismatic Leaders often

(A) Influence
(B) Lack of Skill
(C) Unable to Inspire
(D) May fail
(E) Answer not known

42. The word Reverse Discrimination Denotes

(A) Violate Equal Opportunity
(B) Violate Opportunity
(C) Equal Opportunity
(D) Partial Opportunity
(E) Answer not known

43. Identify a reason for MNCs during business in less developed countries

(A) Expensive labour
(B) Non-availability of natural resource
(C) Lower tax structures
(D) More Government restrictions
(E) Answer not known

44. Utility patient is valid for

(A) 14 years
(B) 20 years
(C) 10 years
(D) 15 years
(E) Answer not known

45. In occupational Crime the hackers means

(A) Time Bombs
(B) Horses
(C) Security
(D) Privacy
(E) Answer not known

46. Bystanders are those consumers who have ———— control over what they consume

(A) Absolute
(B) No
(C) Less control
(D) High control
(E) Answer not known

47. To achieve moral autonomy, the goal of practicing ethics provide a uniform conformity and

(A) Discrimination
(B) Prejudice
(C) Tolerance
(D) Narrow – mindedness
(E) Answer not known

48. Engineers hold the key to create a utopian society free from poverty, inefficiency, waste and the drudgery of manual labour.

(A) Guardians
(B) Saviors
(C) Social Servants
(D) Bureaucratic Servants
(E) Answer not known

49. The purpose served by code of ethics in the field of work is called as

(A) Reward
(B) Contracted regulation
(C) Hindrance
(D) Inspiration
(E) Answer not known

50. Which one of the following is not a good engineering decision?

(A) Not ensuring safety
(B) Ensuring reliability
(C) Providing user friendliness
(D) Providing environmental friendliness
(E) Answer not known

51. The dilemma faced by a new employee in accepting a New year gift offered to all the staff by a client is

(A) due to conflicting instructions
(B) due to vagueness
(C) due to conflicting Interests
(D) due to disagreement
(E) Answer not known

52. Which of the following not a moral reason for support?

(A) Respecting others
(B) Respecting the right of others
(C) Showing gratitude to other
(D) not encouraging them to work
(E) Answer not known

53. An example of a system which exhibits negative deviation from Raoult's law

(A) Acetone / Benzene
(B) Tetrahydrofuran / Carbon tetrachloride
(C) Furan / Carbon tetrachloride
(D) Ethanol / toluene
(E) Answer not known

54. For a reaction $CH_4 + H_2O \rightarrow CO + 3H_2$, assume 2 mole of CH_4, 1 mole of H_2O, 1 mole of CO, and 4 moles of H_2, the expansion for mole fraction of CH_4 in terms of reaction coordinate is

(A) $\frac{2 - \varepsilon}{8 + 2\varepsilon}$
(B) $\frac{1 - \varepsilon}{8 + 2\varepsilon}$
(C) $\frac{1 + \varepsilon}{8 + 2\varepsilon}$
(D) $\frac{4 + 3\varepsilon}{8 + 2\varepsilon}$
(E) Answer not known

55. A vapour that exists above its critical temperature is termed as a

(A) Unsaturated vapour

(B) Saturated vapour

(C) Subcooled vapour

(D) Gaseous vapour

(E) Answer not known

56. An Adiabatic Process is the one in which a system

(A) Loose the heat to surroundings

(B) Gain the heat from surroundings

(C) Neither gives heat to the surroundings Nor does it receives heat from the surroundings

(D) Either loose or gain the heat from the surroundings

(E) Answer not known

57. An Ideal gas of mass (m) and Temperature (T_1) undergoes a reversible isothermal process from an initial pressure P_1 to final pressure P_2. The heat loss during the process is Q. The entropy change Δs of the gas is

(A) $mR \ln \frac{P_1}{P_2}$

(B) $mR \ln {P_2}/{P_1}$

(C) $mR \ln {P_2}/{P_1} - \frac{Q}{T_1}$

(D) $mR \ln \frac{Q}{T_1} - \frac{P_2}{P_1}$

(E) Answer not known

58. The equation $du = Tds - Pdv$ is applicable to small changes occurring in

(A) An open system of constant composition

(B) An closed system of constant composition

(C) An open system with changes in composition

(D) A closed system with changes in composition

(E) Answer not known

59. When a solid or gas is dissolved in the liquid solvent, the heat evolved or absorbed is called

(A) Heat of dissolution
(B) Heat of mixing
(C) Specific heat
(D) Humid heat
(E) Answer not known

60. The recycling operation with chemical reactions is common in industrial process. This is mainly performed to utilize the valuable reactants to their maximum, so that the loss of the reactants is,

(A) Minimized
(B) Maximized
(C) Optimum
(D) Very high
(E) Answer not known

61. ———— is the ratio of the volume of a real gas at a set of specified temperature and pressure to the volume occupied by the gas at the same temperature and pressure.

(A) Volumetric factor
(B) Adiabatic factor
(C) Humidity factor
(D) Compressibility factor
(E) Answer not known

62. For Ideal gases,

(A) Volume percent is equal to mole percent
(B) Volume percent is equal to weight percent
(C) Volume percent is not equal to mole percent
(D) Volume percent is not equal to weight percent
(E) Answer not known

63. The working fluid used in Claude cycle of ocean thermal electric power generation is

(A) Freon
(B) Propane
(C) Water
(D) Ammonia
(E) Answer not known

64. The products of gasification process are

(A) CH_4 and CO_2
(B) H_2 and CO
(C) H_2 and N_2
(D) C_2H_5OH and CO_2
(E) Answer not known

65. Sodium Carboxycellulose is used as a detergent builder inorder to

(A) formulation of more foam
(B) builders
(C) avoid corrosion in washing machine
(D) improve soil and dirt suspension
(E) Answer not known

66. Viscose rayon is chemically

(A) Regenerated cellulose acetone
(B) Cellulose acetate
(C) Cellulose nitrate
(D) Regenerated cellulose nitrate
(E) Answer not known

67. Acid hydrolysis of glycerides followed by alkali addition is the step involved in manufacturing of ————————

(A) Fertilizer
(B) Cement
(C) Soap
(D) Glass
(E) Answer not known

68. Select the drug which is used as an anthelmintic in the treatment of infections caused by pinworms and roundworms

(A) Piperazine Citrate USP
(B) Thiamine Hydrochloride USP
(C) Phenolphthalein NE
(D) Acetaminophen USP
(E) Answer not known

69. Approximately 35% of Nitrogen is present in ————————

(A) Urea
(B) Ammonium Nitrate
(C) Calcium Ammonium Nitrate (CAN)
(D) Ammonium Sulphate
(E) Answer not known

70. Rock Phosphate used for industrial production of phosphotic acid should contain at least

(A) 5% P_2O_5
(B) 12% P_2O_5
(C) 20% P_2O_5
(D) 30% P_2O_5
(E) Answer not known

71. Sequential steps for glass manufacturing process

(A) Annealing, Melting, Shaping
(B) Annealing, Shaping, Melting
(C) Shaping, Melting, Annealing
(D) Melting, Shaping, Annealing
(E) Answer not known

72. Catalytic cracking involves

(A) Free radical chain reactions as thermal cracking
(B) Reactions involving carbo cations
(C) Reactions involving carbo anions
(D) Reactions involving natural high pressure CO_2
(E) Answer not known

73. From among the following, choose one that is not an exothermic process

(A) Methanol synthesis
(B) Catalyic cracking
(C) Ammonia synthesis
(D) Oxidation of Sulphur
(E) Answer not known

74. Fermentation is adversely affected by the

(A) High concentration of Sugar
(B) Absence of air
(C) Presence of air
(D) Presence of Ammonium Salts
(E) Answer not known

75. This technique is most favorable for extraction of small amounts of large, relatively non volatile and expensive solutes

(A) Solvent Extraction
(B) Reactive Extraction
(C) Supercritical Fluid Extraction
(D) Azeotropic Extraction
(E) Answer not known

76. For high conversion in a highly exothermic solid catalysed reaction, _____ reactor is used.

(A) Fixed
(B) Fluidised bed reactor followed by a fixed
(C) Fixed bed reactor followed by a fluidised
(D) Fluidised
(E) Answer not known

77. Pervaporation using n-heptane at 1 atmosphere and 95°C, the flux was inversely proportional to the

(A) The thickness of the dense polymer film
(B) The concentration difference
(C) Infinity dilution
(D) Pressure gradient
(E) Answer not known

78. If temperature is increased the solubility of $MnSO_4 \cdot H_2O$

(A) Decreases
(B) Increases
(C) Insoluble
(D) Unchange
(E) Answer not known

79. Microfiltration is generally used for particles in the size range of

(A) 0.5 to 10 μm
(B) 0.1 to 0.4 μm
(C) 10 to 15 μm
(D) 5 to 10 μm
(E) Answer not known

80. In absorption process, operating line and equilibrium line are straight and parallel. Which one of the following relation is correct? Where NTU – Number of Transfer Unit , NTP – Number of Theoretical Plates.

(A) NTU > NTP
(B) NTU = NTP
(C) NTP > NTU
(D) NTU = 2 (NTP)
(E) Answer not known

81. In a distillation column, rate of reflux return can be controlled by

(A) Ball valve
(B) Reflux diverter
(C) Reflux splitter
(D) Needle valve
(E) Answer not known

82. The moisture content of cellular materials at which the cell walls are completely saturated while the cavities are liquid free. It is termed as

(A) Bound moisture
(B) Unbound moisture
(C) Free moisture
(D) Fibre saturation point
(E) Answer not known

83. The non-dimensional parameter called Schmidt number comprising density ρ, viscosity μ and mass diffusivity is given by

(A) $\frac{D\rho}{\mu}$

(B) $\frac{\mu}{\rho D}$

(C) $\frac{\mu D}{\rho}$

(D) $\frac{\mu\rho}{D^2}$

(E) Answer not known

84. Range of diffusivity of gases at atmospheric pressure in cm²/second.

(A) > 10

(B) > 1

(C) < 1

(D) < 10

(E) Answer not known

85. When gas diffuse in a very small pore of a solid and if the pore size is much smaller than normal mean free path, then the process is

(A) Integral collision

(B) Knudsen diffusion

(C) Molecular diffusion

(D) Lennard – Jones force

(E) Answer not known

86. Cascade control is used when there are

(A) One measurement and one manipulate variable

(B) More than one measurement and one manipulated variable

(C) One measurement and more than one manipulated variable

(D) More than one measurement and more than one manipulated variable

(E) Answer not known

87. The Laplace transform equation for a Ramp function is

(A) $1/s$
(B) $A/s+\alpha$
(C) $H/s\left(1-e^{-st}\right)$
(D) A/s^2
(E) Answer not known

88. Point out the transfer function of first order system with transportation lag (or) dead time (FOSDT)

(A) $\dfrac{e^{\tau_d s}}{\tau s+1}$
(B) $\dfrac{1}{(\tau s+1)(\tau_d s+1)}$
(C) $e^{-\tau_d s}$
(D) $\dfrac{e^{-\tau_d s}}{\tau s+1}$
(E) Answer not known

89. Find the initial value $x(0)$ of the function that has the following transform

$$x(s)=\frac{s^4-6s^2+9s-8}{s(s-2)(s^3+2s^2-s-2)}$$

(A) 1
(B) 2
(C) 3
(D) 0
(E) Answer not known

90. A thermometer having time constant 7 sec and showing 90°F is immersed in a hot bath at 100°F. What is the temperature reading after 7 seconds?

(A) 99°F
(B) 96.32°F
(C) 98.32°F
(D) 93.19°F
(E) Answer not known

91. Brooks deflection potentiometer is used, when the unknown voltage is,

(A) varying in a slow rate
(B) constant
(C) varying very rapidly
(D) varying moderately
(E) Answer not known

92. Minimum input required to calculate the 'Blank Diameter' for a Torispherical Head is

(A) Crown radius
(B) Crown radius, Knuckle radius and Length of straight flange
(C) Knuckle radius and Length of straight flange
(D) Crown radius and Knuckle radius
(E) Answer not known

93. For the problem optimization, different constraints are used, the tool which is preferably used to solve the equation using Microsoft Office Excel is

(A) Goal seek function
(B) Regression Analysis
(C) Solver function
(D) What if function
(E) Answer not known

94. The geometric figure formed by a set of (n+1) points in an n-dimensional space is defined as

(A) Simplex
(B) Jacobian
(C) Lagragian
(D) Regular
(E) Answer not known

95. Choose the correct characteristics of linear programming problem.

(A) The objective function is of minimization type
(B) All the decision variables are negative
(C) All the constraints are non-equality type
(D) The matrix form is maximise $f(x) = X$
(E) Answer not known

96. The final steps in the health and safety management control cycle are ———— and performance review.

(A) Energy Auditing
(B) Permit-to-work
(C) Safety Auditing
(D) Safety promotion
(E) Answer not known

97. The main functions of the safety officer are

I. To make representations to the employer on matters arising from the investigation of hazards, causes of accidents and ill health.
II. To undertake workplace inspections.
III. To investigate hazards and causes of accidents.

(A) I only
(B) II only
(C) I and II only
(D) I, II and III
(E) Answer not known

98. The type of fire extinguisher must not be used in case of electrical base fire is

(A) Halon extinguisher
(B) Carbon chloride extinguisher
(C) Foam extinguisher
(D) Dry powder extinguisher
(E) Answer not known

99. Select the portable fire extinguishers used to extinguish class D fires.

(A) Carbon dioxide extinguishers
(B) Water extinguishers
(C) Foam type of extinguishers
(D) Special dry powder extinguishers
(E) Answer not known

100. A fire broke out in the nuclear reactor due to reactive sodium metal. Identify the type of fire that takes place in the above mentioned scenario.

(A) Class A fire
(B) Class B fire
(C) Class C fire
(D) Class D fire
(E) Answer not known

101. In Motor Vehicles Act 1988 for packaging, labelling and transportation of the wastes, any accidents during handling and transportation are to be reported to the

(A) State Pollution Control Boards
(B) Police Department
(C) Collectorate
(D) Inspector of Factories
(E) Answer not known

102. Match the pollution control equipments with the pollutants removed

(a)	Electro static precipitators	1.	Coarse particles
(b)	Cyclone separator	2.	Fine dust
(c)	Adsorption	3.	Silica gel
(d)	Absorber	4.	Sulfur dioxide

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

(E) Answer not known

103. Montreal protocol was signed for controlling the production and consumption of

(A) Carbon dioxide
(B) Ozone depleting substances
(C) Sulphur
(D) Ammonia
(E) Answer not known

104. The unit Decibel (dB) is used to measure

(A) Sound
(B) Wind
(C) Tidal
(D) Wave
(E) Answer not known

105. An example of non-degradable pollutants is

(A) Domestic sewage
(B) Discarded vegetables
(C) Rotten fruits waste
(D) Mercury
(E) Answer not known

106. The creation of highly protective coating, thin film by the oxide coating on the surface of the metal that offers resistance to corrosion is known as

(A) Pickling
(B) Electropolishing
(C) Plating
(D) Passivation
(E) Answer not known

107. In SO_3 absorber (contact process), packing material used is of

(A) Cast iron
(B) Chemical stoneware
(C) Karbate
(D) Mild steel
(E) Answer not known

108. Shellac is a resin of animal origin, which is composed of

(A) Two free acid, three ester linkage, five hydroxyl group and four aldehydic group
(B) 1-free acid, 5-ester linkage, 3-hydroxyl group and free aldehydic group
(C) 1-free acid, 3-ester linkage, 5-hydroxyl group and free aldehydic group
(D) 2-free acid, 3-ester linkage, 4-hydroxyl and 4-aldehydic group
(E) Answer not known

109. ———— type of metals are used for electroplating to protect against corrosion.

(A) Noble metals
(B) Heavy metals
(C) Metalloids
(D) Light metals
(E) Answer not known

110. Match the correct relation :

List-I		List-II
(a) Power Number	1.	$\frac{q}{nD_a^3}$
(b) Froude Number	2.	$\frac{n^2 D_a}{g}$
(c) Flow Number	3.	$\frac{nD_a^2\rho}{\mu}$
(d) Reynolds Number	4.	$\frac{p}{n^3 D_a^5 \rho}$

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

(E) Answer not known

111. In a mixing tank operating at very high Reynolds number, if the diameter of the impeller is doubled (other conditions remaining constant), the power required increases by a factor of

(A) 4 (B) 16

(C) 32 (D) 64

(E) Answer not known

112. When granular solids are piled up on a flat surface, the sides of the pile are at a definite reproducible angle with the horizontal. The angle is called

(A) Angle of repose
(B) Angle of inclination
(C) Angle of regeneration
(D) Angle of response
(E) Answer not known

113. Match the crushing action involved in the operation of various size reduction equipments.

(a)	Jaw crusher	1.	Inter particle attrition
(b)	Ball mill	2.	Compression
(c)	Fluid energy mill	3.	Both attrition and impact
(d)	Hammer mill	4.	Impact

	(a)	(b)	(c)	(d)
(A)	3	2	1	4
(B)	1	3	2	4
(C)	4	1	2	3
(D)	2	4	1	3
(E)	Answer not known			

114. Match the Solid - Liquid separations with their corresponding process.

(a)	Pre treatment	1.	Clarification
(b)	Solid concentration	2.	Coagulation
(c)	Solid separation	3.	Drying
(d)	Post treatment	4.	Thickening

	(a)	(b)	(c)	(d)
(A)	1	2	3	4
(B)	4	2	3	1
(C)	2	4	1	3
(D)	1	4	2	3
(E)	Answer not known			

115. Effectiveness of a heat exchanger is

(A) Actual heat transfer/Heat content of hot Fluid

(B) Actual heat transfer/Heat content of cold fluid

(C) Actual heat transfer/Heat content of higher heat capacity fluid

(D) Actual heat transfer/Heat transfer when minimum heat capacity fluid goes through the max. ΔT in exchanger

(E) Answer not known

116. The battle pitch should not be less than ———— the diameter of shell.

(A) $\frac{1}{4}$

(B) $\frac{1}{3}$

(C) $\frac{1}{2}$

(D) $\frac{1}{5}$

(E) Answer not known

117. The steam consumption of evaporator is calculated by

(A) Capacity × Economy

(B) $\frac{\text{Economy}}{\text{Capacity}}$

(C) $\frac{\text{Capacity}}{\text{Economy}}$

(D) $\frac{1}{\text{Capacity} \times \text{Economy}}$

(E) Answer not known

118. Among the substance having low thermal conductivity is

(A) Mineral wool
(B) Fire clay brick
(C) Air
(D) Asbestos
(E) Answer not known

119. Find the critical radius of insulation of a steam pipe having outer diameter of 11 cm, covering with an insulating substance (k = 1 w/mk) and heat transfer coefficient of 8 w/m^2k is

where
cm = centimeter
m = meter
mm = milimeter

(A) 12.5 cm
(B) 12.5 m
(C) 12.5 mm
(D) 1.25 m
(E) Answer not known

120. Abbreviation of NPSH in liquid pumping device

(A) Net Positive Suction Head
(B) Non Positive Suction Head
(C) Non Positive Suction Handle
(D) Net Positive Suction Handle
(E) Answer not known

121. If NPSH is equal to ————aviation will occur. Thus, NPSH must be greater than ————.

(A) Zero, Two
(B) Two, Zero
(C) One, Zero
(D) Zero, Zero
(E) Answer not known

122. Invariant velocity distribution of the fluid flow along the tube length is defined as

(A) Fully developed flow

(B) Laminar flow

(C) Transition flow

(D) Turbulent flow

(E) Answer not known

123. Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (Gauge) and with mean velocity of 20 m/s. Find the total head or total energy per unit weight of the water at a cross-section, which is 5m above the datum line

(A) 520.7 cm

(B) 35.0 m

(C) 30.2 m

(D) 35.2 m

(E) Answer not known

124. Flour dough is an example of

(A) Pseudo plastic fluid

(B) Visco elastic fluid

(C) Thixotropic fluid

(D) Rheopectic fluid

(E) Answer not known

125. Choose the wrong one for desirable characteristic of manometer fluid

(A) it should have high viscosity

(B) it should be non-corrosive

(C) it should be free from capillary effects

(D) it should have negligible surface tension

(E) Answer not known

126. Which process depends upon Temperature difference as well as on the mechanical energy imparted to the fluid involved in a system.

(A) Convection
(B) Radiation
(C) Diffusion
(D) Conduction
(E) Answer not known

127. Molecularity of a reaction is equal to the number of

(A) Products formed in the elementary reaction
(B) Reactants involved in the elementary reaction
(C) Reactants and products in the elementary reaction
(D) Reactants and products in the non-elementary reaction
(E) Answer not known

128. Find the poles of the system $G(S) = \dfrac{S+1}{(S+2)(S+3)}$

(A) 2, 3
(B) –2, 3
(C) 2, –3
(D) –2, –3
(E) Answer not known

129. Thiele modulus is defined as below ;

(A) $\left(\dfrac{L\sqrt{R}}{D}\right)^{0.1}$
(B) $(D/K)^{0.1}$
(C) $L\sqrt{\dfrac{K}{D}}$
(D) $\left(\dfrac{LD}{K}\right)$
(E) Answer not known

130. The dispersion model and tank-in-series model apply in

Statement 1 : Laminar flow in long pipe

Statement 2 : Flow in packed bed

Statement 3 : Laminar flow in short pipe

(A) Statement 1 only is true

(B) Statement 2 only is true

(C) Statement 3 only is true

(D) Statement 1 and 2 are true

(E) Answer not known

131. The fluid elements of a single flowing stream can be mix with each other either early or late in the vessel is called as

(A) micro fluids

(B) macro fluids

(C) earliness of mixing

(D) state of aggregation

(E) Answer not known

132. For low value of thick modulus (mL < 0.4), the effectiveness factor tends to

(A) 0

(B) 1

(C) 2

(D) –1

(E) Answer not known

133. A reaction $A \rightarrow B$ is to be conducted in two CSTRs in series. The steady state conversion desired is x_f. The reaction rate as a function of conversion is given by $r = \frac{-1}{1+x}$. If the feed contains NOB, then the conversion in the first reactor that minimizes the total volume of the two reactor is

(A) $1 - x_f$

(B) $0.2 x_f$

(C) $0.5 x_f$

(D) $0.5(1 - x_f)$

(E) Answer not known

134. For a reaction $2A + B \xrightarrow{k} C$, the order of the reaction will be,

(A) one

(B) two

(C) three

(D) four

(E) Answer not known

135. Milk is pasteurized if it is heated to 63°C for 30 min, but if it is heated to 74°C it only needs 15S for the same result. Find the activation energy equation in J/mol

(A) $\ln \frac{0.25}{30} = \frac{E}{8.314}\left(\frac{1}{336} - \frac{1}{347}\right)$

(B) $\ln\left(\frac{30}{0.25}\right) = \frac{E}{8.314}\left(\frac{1}{336} - \frac{1}{347}\right)$

(C) $\ln\left(\frac{0.25}{30}\right) = \frac{E}{831.4}\left(\frac{1}{336} - \frac{1}{347}\right)$

(D) $\ln\left(\frac{30}{0.25}\right) = \frac{E}{831.4}\left(\frac{1}{336} - \frac{1}{347}\right)$

(E) Answer not known

136. The general solution of the differential equation

$$\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 9x = 0$$

is

(A) $t = (c_1 + c_2x)\,e^{-3x}$

(B) $x = (c_1 + c_2t)\,e^{-3t}$

(C) $x = c_1 + c_2t + c_3e^{-3t}$

(D) $t = c_1 + c_2x + c_3e^{-3x}$

(E) Answer not known

137. The solution of ODE involves introduction of ———— and solution of PDE involves introduction of

whereas,

ODE – Ordinary Differential Equation

PDE – Partial Differential Equation

(A) arbitrary functions, arbitrary constants

(B) arbitrary constants, arbitrary functions

(C) arbitrary constants, arbitrary constants

(D) arbitrary functions, arbitrary functions

(E) Answer not known

138. For any square matrix A, its transpose A' will have

(A) Same eigen value

(B) Zero

(C) Unity

(D) Two times eigen value

(E) Answer not known

139. Finite difference method, the derivatives in differential equation $\frac{dy}{dx}$ at node i written as forward difference approximation as

(A) $\left.\frac{dy}{dx}\right|_i = \frac{y_{i+1} - y_i}{\Delta_n} + o(\Delta n)$

(B) $\left.\frac{dy}{dx}\right|_i = \frac{y_i - y_{i-1}}{\Delta x} + o(\Delta x)$

(C) $\left.\frac{dy}{dx}\right|_i = \frac{y_i - y_{i-1}}{2\Delta x} + o(\Delta x)^2$

(D) $\left.\frac{dy}{dx}\right|_i = \frac{y_i - y_{i-1}}{2\Delta x} + o(\Delta x)$

(E) Answer not known

140. A root of the equation $x^4 - 3x + 1 = 0$ needs to be found using the Newton-Raphson method. If the initial guess is $x_0 = 0$. Then the new estimate x_1 after first iteration is

(A) $\frac{1}{3}$

(B) $-\frac{1}{3}$

(C) 3

(D) -3

(E) Answer not known

141. Estimate the natural logarithm of 2 using Linear Interpolation, given that $\ln(1) = 0$ and $\ln(4) = 1.38$

(A) 0.345

(B) 0.690

(C) 0.693

(D) 0.460

(E) Answer not known

142. The Trapezoidal Rule is

(A) Divergent

(B) Convergent

(C) Depends on the Function

(D) None of the above

(E) Answer not known

143. The quadratic equation $x^2 - 6x + 10 = 0$ has

(A) Two Reat and Different Roots

(B) Two Complex roots

(C) Two Reat and Equal roots

(D) No Solution

(E) Answer not known

144. Find the roots of the equation $x^3 - 7x^2 + 36 = 0$, Given that one root is double of others

(A) 6, –1, 2

(B) 3, 6, –2

(C) 6, 1, 2

(D) 6, +2, 2

(E) Answer not known

145. If $3 + i\sqrt{2}$ is one root of the equation $x^4 + x^3 - 25x^2 + 41x + 66 = 0$, Identify one of the other roots from following list.

(A) $2 + i\sqrt{3}$

(B) $3 - i\sqrt{2}$

(C) $2 - i\sqrt{3}$

(D) 0

(E) Answer not known

146. The chemical responsible for yellowish tinge on Tajmahal's surface is

(A) Carbon Dioxide

(B) Nitrogen Dioxide

(C) Silicon Dioxide

(D) Sulphur Dioxide and Suspended particulate matter

(E) Answer not known

147. In the professional ethics, the degree of Safety proposed to be attained varies with

(A) Design, duration and product

(B) Cost of risk, design and utility

(C) Cost of risk, perception and utility

(D) Product, perception and cost to risk involved

(E) Answer not known

148. Match the following

(a)	Domestic crimes	–	1. Price fixing
(b)	Lawful employment crimes	–	2. Kidnapping
(c)	Unlawful employment crimes	–	3. Inflated insurance claim
(d)	Victimless crimes	–	4. Sibling feuds

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

(E) Answer not known

149. Which of the following are not true to met and ensure a safe design?

(i) Design must comply with applicable laws

(ii) Acceptable design must meet the standards

(iii) Alternative designs that are safe must not to explores

(iv) Prototype and final product must be tested for safety

(A) (iii) only

(B) (i) only

(C) (iii) and (iv) only

(D) (iv) only

(E) Answer not known

150. What is the individual factor that can effect the process of decision making in an organisation?

(A) Personal value
(B) Economic condition
(C) Organizational politics
(D) Organizational policies
(E) Answer not known

151. Factual inquiries are used to

(A) To identify and justify the morally desirable norms and standard
(B) To clarifying the meaning of concepts, principles and issue of ethics
(C) To protect public safety extend in a given situation
(D) To uncover information bearing upon value issues
(E) Answer not known

152. Divine Command ethics maintain to say

(A) An act is right means is commanded by Community
(B) An act is right means is commanded by People
(C) An act is right means is commanded by God
(D) An act is right means is commanded by Group of organisation
(E) Answer not known

153. Which of the following is not in senses of engineering ethics?

(A) Activity and area of enquiry
(B) Resolving moral issues
(C) Codes of conduct
(D) Justifying personal issues
(E) Answer not known

154. The temperature at which the first bubble of vapour is formed from the liquid solution at constant pressure is called

(A) Bubble point temperature
(B) Critical temperature
(C) Dew point
(D) Boiling temperature
(E) Answer not known

155. The partial pressure of the species in the vapour phase is directly proportional to its liquid – phase mole fraction known as

(A) Newton's law
(B) Gibbs rule
(C) Henry's law
(D) Kick's law
(E) Answer not known

156. Choose the right answer from the following

(i) Entropy is a state function
(ii) Entropy changes of the reversible process and irreversible process are identical
(iii) Entropy is a path function

(A) (i) only
(B) (i) and (ii)
(C) (i) and (iii)
(D) (ii) and (iii)
(E) Answer not known

157. Which of the following is true for ideal solution?

(i) Partial Gibbs free energy is zero
(ii) Activity coefficient is one
(iii) Activity coefficient is zero
(iv) Partial Gibbs free energy is one

(A) (i) and (ii)
(B) (i) and (iii)
(C) (i) and (iv)
(D) only (i)
(E) Answer not known

158. How much heat must be added in order to raise the temperature of a 20% (mass) caustic soda solution from 260 K to 360 K? The mean specific heat capacity of caustic soda solution is 3.5 kJ/Kg K.

(A) 100 kJ
(B) 200 kJ
(C) 350 kJ
(D) 450 kJ
(E) Answer not known

159. The Maxwell's reaction for Gibbs free energy $dG = -sdT + Vdp$ is

(A) $\left(\frac{\partial T}{\partial v}\right)_S = -\left(\frac{\partial p}{\partial s}\right)_V$

(B) $\left(\frac{\partial P}{\partial T}\right)_V = \left(\frac{\partial s}{\partial v}\right)_T$

(C) $\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial s}{\partial p}\right)_T$

(D) $\left(\frac{\partial T}{\partial p}\right)_S = \left(\frac{\partial V}{\partial s}\right)_P$

(E) Answer not known

160. Evaporator used to produce 25% by mass of solid from 4% weak liquor. Calculate the evaporation of water per 100 kg feed in Evaporator.

(A) 84 kg
(B) 64 kg
(C) 60 kg
(D) 80 kg
(E) Answer not known

161. The ratio of the actual moles of the desired product to the moles which would have been resulted if the reactant was converted entirely to form the desired products is called

(A) Yield
(B) Selectivity
(C) Reaction Coordinate
(D) Extent of Reaction
(E) Answer not known

162. For the Isentropic expansion of an ideal gas from the initial conditions P_1, T_1 to the final conditions P_2, T_2. Which one of the following relations is valid? $(\nu = C_P/C_V)$

(A) $(P_1/P_2) = (T_1/T_2)^{\nu}$

(B) $(P_1/P_2) = (T_1/T_2)^{\nu/\nu-1}$

(C) $(P_1/P_2) = (T_1/T_2)$

(D) $(P_1/P_2) = (T_1/T_2)^{\nu-1/\nu}$

(E) Answer not known

163. The pitzer ascentric factor is a material parameter that determines

(A) Crystallinity of material

(B) Polarity and shape of molecule

(C) Size of particle

(D) Non polarity and free ions in molecule

(E) Answer not known

164. Fuel cell is a device which converts

(A) Chemical energy into Electrical energy

(B) Electrical energy into Chemical energy

(C) Thermal energy into Chemical energy

(D) Mechanical energy into Electrical energy

(E) Answer not known

165. Photo electric effect was explained by

(A) Einstein

(B) Faraday

(C) Plank

(D) Hertz

(E) Answer not known

166. The rubber is separated by a process known as

(A) Coagulation

(B) Sterlization

(C) Condensation

(D) Purification

(E) Answer not known

167. The Saponification of a fat or oil is done using ———— solution for hot process.

(A) NaOH

(B) KOH

(C) HCL

(D) NaCL

(E) Answer not known

168. Match the following

(a) Cellulose	1. Emulsion Polymerization
(b) Polyester	2. Addition Polymerization
(c) Polypropylene	3. Natural Polymer
(d) Very High Molecular weight polymer	4. Condensation Polymerization

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

(E) Answer not known

169. Match correctly the petroleum related products

(a) Heavy distillate	1. Diesel oils
(b) Intermediate distillate	2. Asphalt
(c) Light distillate	3. Waxes
(d) Residue	4. Kerosene

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

(E) Answer not known

170. Pair the following reactors with the products :

(P) ARC Furnace	1. Citric Acid
(Q) Fermenter	2. Calcium Carbide
(R) Hydrogenator	3. Saturated Fats
	4. Alum

	(P)	(Q)	(R)
(A)	4	1	3
(B)	2	1	3
(C)	4	3	1
(D)	2	3	1

(E) Answer not known

171. The major constituents of Portland Cement are

I. $2CaO.SiO_2$

II. $Ca(OH)_2$

III. $4\ CaO.\ Al_2O_3.\ Fe_2O_3$

IV. $3\ CaO.Al_2O_3$

(A) I and IV (B) II and III

(C) I and III (D) II and IV

(E) Answer not known

172. The decrease in ionization of a weak electrolyte by the addition of a strong electrolyte having an ion common with weak electrolyte is

(A) Buffer solution
(B) Common –ion effect
(C) Solubility product
(D) Dilution effect
(E) Answer not known

173. The relationship between relative super saturation 's' and super saturation ratio "S" is ;

(A) $s = S - 1$
(B) $s = S + 1$
(C) $s = \frac{1}{S}$
(D) $s = \frac{S}{S+1}$
(E) Answer not known

174. In a membrane separation, part of the feed that passes through the membrane is

(A) Retentate
(B) Barier
(C) Permeate
(D) Non-Porous
(E) Answer not known

175. In Industrial Crystallization the two-phase mixture of mother liquor and crystals of all sizes, which occupies the crystallizer are withdrawn as product, technically it is called as

(A) Magma
(B) Slurry
(C) Invariant crystals
(D) Embryo
(E) Answer not known

176. Crystallization process happens in

(A) Saturated solution
(B) Undersaturated solution
(C) Supersaturated solution
(D) Dilute solution
(E) Answer not known

177. Distillation under minimum reflux conditions the number of theoretical stages would be

(A) One
(B) Minimum
(C) Maximum
(D) Infinite
(E) Answer not known

178. A wet solid is to be dried from 90% moisture to 5% moisture. If 100 KG wet solid is to be dried, the amount of moisture evaporated is

(A) 0.85 Kg
(B) 5 Kg
(C) 8.5 Kg
(D) 85 Kg
(E) Answer not known

179. j_D is

(A) $St_H \, Pr^{2/3}$
(B) $St_D \, Sc^{2/3}$
(C) $Sc \, Pr^{2/3}$
(D) $S \, L \, Sc^{2/3}$
(E) Answer not known

180. The unit of molar flux is

(A) $\frac{mol}{m^2 s}$
(B) $\frac{m^2}{s}$
(C) $\frac{mol}{m^3}$
(D) mol
(E) Answer not known

181. The frequency at which the magnitude of the system becomes zero db is

(A) Resonant frequency
(B) Cut-off frequency
(C) Gain crossover frequency
(D) Phase crossover frequency
(E) Answer not known

182. In frequency response analysis, the Laplace transform operation (s) is replaced by

(A) $\omega\tau$
(B) 2ω
(C) $\tau^2\omega^2$
(D) $j\omega$
(E) Answer not known

183. The τ_I value for PID controller according to Ziegler–Nichols controller settings

(A) $\frac{Pu}{2}$
(B) $\frac{Pu}{4}$
(C) $\frac{Pu}{6}$
(D) $\frac{Pu}{8}$
(E) Answer not known

184. The primary controller is a cascade control system must be tuned always

(A) using the Ziegler–Nichols method
(B) faster than the secondary
(C) with the same parameter as the master
(D) after the secondary is tuned
(E) Answer not known

185. In a second order underdamped system

(A) Decay Ratio = Overshoot
(B) Decay Ratio = (Overshoot)^2
(C) Overshoot increases for increasing damping coefficient
(D) Large damping co-efficient means smaller damping
(E) Answer not known

186. Find the general solution of $Y'' + 8Y' + 12Y = 0$

(A) $Y = c_1\ e^{-2x} + c_2\ e^{-6x}$ (B) $Y = c_1\ e^{-2x}$

(C) $Y = c_1 e^{-6x}$ (D) $Y = c_1 e^{2x} \pm c_2 e^{6x}$

(E) Answer not known

187. A stuffing box is used for

(A) Absorbing the contraction/expansion of pipeline due to temperature changes

(B) Prevention of fluid leakage around moving parts

(C) Facilitating smooth opening and closing of a valve

(D) Reducing the resistance of fluid flow

(E) Answer not known

188. Identify the temperature sensor which utilizes the principle of Seebeck effect is

(A) Bimetallic thermometer

(B) Anemo meter

(C) Resistance temperature detector

(D) Thermo couple

(E) Answer not known

189. The relation between Capital rate of Return Ratio (CRR), Net Present Value (NPV) and Maximum Cumulative Expenditure (MCE) is

(A) CRR = NPV / MCE (B) CRR = MCE / NPV

(C) CRR = NPV × MCE (D) CRR = MCE / (NPV+MCE)

(E) Answer not known

190. In a Heat Exchanger network, the plot between heat flow through process vs Temperature is known as

(A) Composite curve (B) Optimization curve

(C) Parabolic curve (D) Diffusion curve

(E) Answer not known

191. In chemical oxidation, the effectiveness of Chlorine is influenced greatly by the

(A) physical and chemical characteristics
(B) temperature of the solution
(C) more impurities formed
(D) production of foam
(E) Answer not known

192. The qualitative tools for hazard analysis is done by

(A) FMEA (Failure Mode and Effect Analysis)
(B) Fire and Explosion Index
(C) Chemical Exposure Index
(D) Fault Tree Analysis
(E) Answer not known

193. The hazard identification methods do not include

(A) Hazard Surveys
(B) Hazards and operability (Hazop) studies
(C) Process hazards checklists
(D) Risk Assessment
(E) Answer not known

194. Select the reactive wastes from the options given.

I. Paint thinners
II. Nitro glycerine
III. Hypodermic needles
IV. Gun powder

(A) II and IV only
(B) I and II only
(C) I, II and III only
(D) I and IV only
(E) Answer not known

195. This hazard identification technique employs a formal procedure to identify hazards in a chemical process facility. The procedure involved is effective and well accepted in chemical industries.

(A) HAZAN
(B) HAZOP
(C) Hazard surveys
(D) Safety Review
(E) Answer not known

196. A measure of human injury, environmental damage on economic loss in terms of both the incident likelihood and magnitude of loss or injury is defined as

(A) Hazard
(B) Likelihood
(C) Consequence
(D) Risk
(E) Answer not known

197. The most commonly used chemical coagulant in Industrial waste water treatment is

(A) Ferrous Sulphate
(B) Alum
(C) Lime
(D) Hydrazine
(E) Answer not known

198. _____ remove particulate matter from gas streams by capturing them in liquid droplets.

(A) Hydrocyclone
(B) Wet scrubbers
(C) Aerators
(D) Clarifier
(E) Answer not known

199. Aerosol consisting of water droplets is called

(A) Plume
(B) Fume
(C) Fog
(D) Smog
(E) Answer not known

200. Which of the following is a secondary air pollutant?

(A) Pan
(B) Ozone
(C) Carbon monoxide
(D) Nitrogen dioxide
(E) Answer not known

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