

Sl. No. :101361

CHED

Register
Number

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2013
CHEMICAL ENGINEERING
(Degree Standard)

Time Allowed : 3 Hours]

[Maximum Marks : 300

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

IMPORTANT INSTRUCTIONS

1. This Booklet has a cover (this page) which should not be opened till the invigilator gives signal to open it at the commencement of the examination. As soon as the signal is received you should tear the right side of the booklet cover carefully to open the booklet. Then proceed to answer the questions.
2. This Question Booklet contains 200 questions.
3. Answer **all** questions.
4. **All** questions carry equal marks.
5. 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.
6. An Answer Sheet will be supplied to you separately by the invigilator to mark the answers. You must write your Name, Register No., Question Booklet Sl. No. and other particulars with Blue or Black ink Ball point pen on side 2 of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.
7. You will also encode your Register Number, Subject Code, Question Booklet Sl. No. etc. with Blue or Black ink Ball point pen in the space provided on the side 2 of the Answer Sheet. If you do not encode properly or fail to encode the above information, your Answer Sheet will not be evaluated.
8. Each question comprises *four* responses (A), (B), (C) and (D). You are to select **ONLY ONE** correct response and mark in your Answer Sheet. In case, you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet there are **four** brackets [A] [B] [C] and [D] against each question. To answer the questions you are to mark with Ball point pen **ONLY ONE** bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong e.g. If for any item, [B] is the correct answer, you have to mark as follows :
[A] [C] [D]
10. 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 Hall during the examination. After the examination is concluded, 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.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
12. Do not tick-mark or mark the answers in the Question booklet.
13. The last sheet of the Question Booklet can be used for Rough Work.



SEAL

1. Which of the following statements is not true ?
 - ~~(A)~~ Acetone and alcohol form a two phase system
 - (B) A system remains two-phase even if one phase is reduced to fine grains or drops
 - (C) A pair of partially miscible liquids form two-phase systems
 - (D) Emulsions are two phase systems

2. The molar specific heat of a gas
 - ~~(A)~~ increases with pressure
 - (B) decreases with pressure
 - (C) does not change with pressure
 - (D) is not related to pressure

3. A polytropic process is described by
 - (A) $PV = \text{constant}$
 - (B) $P/V = \text{constant}$
 - ~~(C)~~ $PV^n = \text{constant}$
 - (D) none of these

4. What does the zeroth law of thermodynamics refer to ?
 - (A) Efficiency of a heat engine
 - (B) Energy conservation
 - (C) Increasing entropy
 - ~~(D)~~ Thermal equilibrium

5. An ideal liquid solution in equilibrium with an ideal vapour phase obeys
 - (A) Amagat's Law
 - (B) Dalton's Law
 - ~~(C)~~ Raoult's Law
 - (D) Charle's Law

6. Latent heat of saturated steam
 - (A) increases with the increase in pressure
 - ~~(B)~~ decreases with the increase in pressure
 - (C) does not change with the pressure
 - (D) is not related to pressure

7. **Assertion (A)** : Recycling operations are commonly encountered in unit operations as well as in reactors.
Reason (R) : To avoid wastage of reactants and build up of inert.
 Select your answer according to the coding scheme given below :
 - (A) Both (A) and (R) are true, (R) is the correct explanation of (A).
 - (B) Both (A) and (R) are true. But (R) is not the correct explanation of (A).
 - ~~(C)~~ (A) is true, but (R) is false.
 - (D) (A) is false and (R) is true.

8. 1 kg/cm^2 is equal to
 - (A) 5 m water
 - (B) 1 m water
 - (C) 760 mm water
 - ~~(D)~~ 10 m water

9. Throttling (Joule-Thomson effect) process is a constant
~~(A)~~ Enthalpy process (B) Entropy process
 (C) Pressure process (D) None of these
10. What are the base units in S.I. system ?
 (A) Gram, Metre, Second, Kelvin
 (B) Gram, Centimetre, Second, Kelvin
~~(C)~~ Kilogram, Metre, Second, Kelvin, Mole, Ampere
 (D) Kilogram, Centimetre, Second, Kelvin
11. In recycling processes, what is purge ?
 (A) Ratio of quantity of reactant recycled to the quantity of reactant entering as fresh feed
 (B) Weight ratio of catalyst circulated to reactant feed in a continuous moving bed
~~(C)~~ Removal of accumulated inerts
 (D) Cleaning of catalyst
12. The variation of heat of reaction with temperature is expressed by
 (A) Classius Clapeyron equation ~~(B)~~ Kirchoff's equation
 (C) Vant Hoff isochore (D) Vant Hoff isotherm
13. A gas occupies a volume of 283 c.c. at 10 °C. If it is heated to 20 °C at constant pressure, the new volume of the gas will be _____ c.c.
 (A) 283 (B) 566 ~~(C)~~ 293 (D) 141.5
14. Compressibility factor (Z) is defined by
~~(A)~~ $\frac{PV}{RT}$ (B) $\frac{RT}{PV}$ (C) $\frac{RP}{TV}$ (D) $\frac{RV}{TP}$
15. Gross and net calorific value of a fuel will be same
 (A) if its ash content is zero (B) if its carbon content is very low
~~(C)~~ if its volatile content is zero (D) under no circumstances
16. Match List - I correctly with List - II and select your answer using the codes given below :
- | List - I | List - II |
|----------------------------------|---|
| (G) Zeroth law of thermodynamics | (1) Principle of conservation of energy |
| (H) First law of thermodynamics | (2) Thermal equilibrium between a set of bodies |
| (I) Second law of thermodynamics | (3) Absolute zero of entropy |
| (J) Third law of thermodynamics | (4) Principle of entropy increase |
- Codes :**
- | | | | | |
|----------------|-----|-----|-----|-----|
| (G) | (H) | (I) | (J) | |
| (A) | (3) | (1) | (4) | (2) |
| (B) | (2) | (1) | (4) | (3) |
| (C) | (2) | (4) | (1) | (3) |
| (D) | (4) | (3) | (1) | (2) |

17. For a cyclic process a fixed ratio between heat and work
~~(A)~~ always exists (B) may exist
(C) never exists (D) it is difficult to predict

18. Which one of the following is correctly matched ?

List - I	List - II
(A) Irreversible process	Expansion or compression with finite pressure difference
(B) Reversible process	Process occur with finite driving force
(C) Extensive property	Temperature
(D) Intensive property	Volume

19. When a solute is dissolved in a solvent, the vapour pressure of the resultant solution is
(A) equal to that of the pure solvent
~~(B)~~ less than that of pure solvent
(C) more than that of pure solvent
(D) data insufficient, can't be predicted

20. Heat of reaction at constant volume is identified with
(A) enthalpy change ~~(B)~~ internal energy change
(C) either 'A' or 'B' (D) neither 'A' or 'B'

21. For steady incompressible flow inside a long circular pipe how does the fluid pressure inside the pipe vary ?
~~(A)~~ Decreases linearly along the full length of the pipe
(B) Decreases linearly until the flow is fully developed
(C) Increases linearly along the full length of the pipe
(D) Increases linearly until the flow is fully developed

22. In a heat transfer, what is LMTD ?
(A) Large Medial Temperature Drop ~~(B)~~ Log Mean Temperature Difference
(C) Log Mean Thermal Diffusivity (D) Low Mean Temperature Difference

23. Consider the following statements regarding flow over solid bed :
- (i) Porosity is defined as the ratio of volume of the voids to total volume.
 - (ii) A sharp transition exists between laminar and turbulent flow.
 - (iii) The friction factor f falls with increasing fluid velocity.
 - (iv) Hydraulic radius is given as the ratio of total volume of solids to the total surface area of the solids.

Which of these statements are true ?

- (A) (i) alone (B) (i) and (ii) alone
(C) (ii), (iii) and (iv) alone ~~(D)~~ (i), (iii) and (iv) alone

24. Which one of the following is correctly matched ?

List - I

List - II

- | | | |
|--|---|-------------------|
| (A) Fick's Law | - | Heat Transfer |
| (B) Newton's Law of Cooling | - | Heat conduction |
| (C) Newton's Shear Equation | - | Momentum Transfer |
| (D) Stefan-Boltzmann Law | - | Mass Transfer |

25. An exchanger in which hot and cold fluids flow over the heat transfer surface alternatively is

- | | |
|-----------------------------------|-------------------------------|
| (A) counter-flow heat exchanger | (B) cross-flow heat exchanger |
| (C) direct contact heat exchanger | (D) regenerator |

26. Which of the following methods cannot be used to prevent swirling in propeller agitators ?

- ~~(A) Increasing propeller speed~~
- (B) Installing baffles
- (C) Mounting the impeller shaft off-center in the tank
- (D) Tilting of agitator shaft

27. Radiative heat transfer varies as

- | | | | |
|-----------|-----------|---------------------------------|---------|
| (A) T^2 | (B) T^3 | (C) T^4 | (D) T |
|-----------|-----------|---------------------------------|---------|

28. Liquid metal (eg. Molten sodium) is preferred as a coolant in case of

- (A) a homogeneous reactor
- ~~(B) a graphite moderated reactor~~
- ~~(C) a fast breeder reactor~~
- (D) an enriched uranium (3% - U-235) fuelled reactor

29. In shell and tube heat exchanger, the corrosive liquid is generally passed from

- | | |
|--------------------------|-----------------------|
| (A) Tube side | (B) Shell side |
| (C) Both (A) and (B) | (D) None of the above |

30. Flow of incompressible fluid with no shear is called

- | | |
|-------------------------------|-------------------------|
| (A) Creep flow | (B) Streamline flow |
| (C) Potential flow | (D) Boundary layer flow |

31. The simplest mass transfer theory used for the design of absorption equipment is

- | | |
|----------------------------|----------------------------|
| (A) Penetration theory | (B) Surface renewal theory |
| (C) Film theory | (D) None of the above |

32. Which of the following is used for very accurate measurement of flow of gas at low velocity ?

- | | |
|-------------------|------------------------------------|
| (A) Pitot tube | (B) Rotameter |
| (C) Orifice meter | (D) Hot wire anemometer |

33. The dimensionless group in mass transfer similar to Prandtl number in heat transfer is
 (A) Sherwood number (B) Schmidt number
 (C) Lewis number (D) Reynold's number
34. Grashof number represents the process of
 (A) Forced convection (B) Natural convection
 (C) Radiation (D) Conduction
35. Bernoulli's equation describes
 (A) mechanical energy balance in potential flow
 (B) kinetic energy balance in laminar flow
 (C) mechanical energy balance in turbulent flow
 (D) mechanical energy balance in boundary layer
36. Taylor-Prandtl analogy for heat and mass transfer considers the transfer through
 (A) turbulent layer (B) transition and laminar layer
 (C) laminar and turbulent layer (D) laminar, transition and turbulent layer
37. In case of liquid-liquid binary diffusion, diffusivity of one constituent into another depends on
 (A) temperature and pressure (B) Concentration
 (C) Nature of the constituents (D) All the above
38. Operating velocity in a packed tower is usually
 (A) equal to the flooding velocity (B) half the flooding velocity
 (C) twice the flooding velocity (D) none of the above
39. The porosity of a compressible cake is
 (A) minimum at the filter medium (B) minimum at the upstream face
 (C) maximum at the filter medium (D) same throughout the thickness of cake
40. Diffusivity in concentrated solutions differs from that in dilute solutions because of changes in
 (A) viscosity with concentration (B) degree of ideality of the solution
 (C) both (A) and (B) (D) None of these
41. The ratio of the area of openings in one screen (Taylor series) to that of the openings in the next smaller screen is
 (A) 1.5 (B) 1 (C) $\sqrt{2}$ (D) none of these
42. Ultrafine grinders operate principally by
 (A) slow compression (B) impact
 (C) attrition (D) cutting

43. Fluid-energy mill is an example of
 (A) crusher (B) grinder ~~(C) ultrafine grinder~~ (D) cutting machine
44. Solar cells convert the sunlight into
~~(A) Electrical energy~~ (B) Mechanical energy
 (C) Heat energy (D) Chemical energy
45. Wind energy, transferred to the large sea surface, is stored in waves as
 (A) Chemical energy (B) Thermal energy
 (C) Electrical energy ~~(D) Mechanical energy~~
46. Due to compression size reduction occurs in
 (A) Jaw crushers (B) Gyratory crushers
 (C) Smooth roll crushers ~~(D) All (A), (B) and (C)~~
47. Cobar gas is generated by
~~(A) Fermentation of cowdung~~ (B) Oxidation of cowdung
 (C) Hydrogenation of cowdung (D) None of these
48. Energy from the sun is mainly from
~~(A) Fission reactions~~ (B) Fusion reactions
 (C) Combustion reactions (D) None of these
49. The operating speed of a ball mill should be
 (A) More than the critical speed (B) Equal to the critical speed
 (C) Two times the critical speed ~~(D) Less than the critical speed~~
50. A propeller agitator
~~(A) produces mainly axial flow~~
 (B) produces mainly radial and tangential currents
 (C) is used for mixing highly viscous pastes
 (D) all the above
51. Magnetic Hydro Dynamic (MHD) power generation is based on the principle of
~~(A) Faraday's Law~~ (B) Fourier's Law
 (C) Stefan-Boltzmann's Law (D) Newton's Law
52. Mass (m) can be converted in the form of energy (E) by the relationship, $E = mc^2$, this is invented by
 (A) Arrhenius (B) Newton ~~(C) Einstein~~ (D) Wein
53. Cyclone separators are used to separate
 (A) two immiscible liquids ~~(B) solids from fluids~~
 (C) two immiscible solids (D) solids from solids

54. Producer gas contains mostly
 (A) H_2 and CO_2 (B) C_2H_2 , CO_2 and H_2
 (C) CO , H_2 and O_2 (D) CO , CO_2 , N_2 , H_2
55. The filter medium resistance is controlled by
 (A) the pressure drop alone (B) the flow rate alone
 (C) both pressure drop and flow rate (D) the cake thickness
56. What are the factors that influence flotation?
 (i) Material density (ii) Particle shape
 (iii) Particle size (iv) Selective aeration
 (A) (i), (ii), (iii) and (iv) (B) (i), (ii) and (iv)
 (C) (ii), (iii) and (iv) (D) (iii) and (iv)
57. What is the role of pine oil in flotation?
 (A) Activator (B) Collector (C) Depressor (D) Frother
58. Greenhouses utilize which form of renewable energy?
 (A) Bio-energy (B) Geothermal energy
 (C) Hydro-electric energy (D) Solar energy
59. Which of the following are characteristic of impeller mixers?
 (i) Turbulence is an essential requirement for mixing.
 (ii) Mixing action is mainly restricted to the near vicinity of the impeller.
 (iii) Not applicable to high viscosity fluids.
 (iv) Large forces are generated and machinery must be ruggedly built.
 (A) (i) and (ii) only (B) (ii) and (iv) only
 (C) (i) and (iii) only (D) (ii), (iii) and (iv) only
60. The optimum temperature for anaerobic digestion of municipal, agricultural and industrial wastes containing high water content organic material is around
 (A) 10 to 20 °C (B) 60 to 80 °C
 (C) 35 to 55 °C (D) upto 10 °C
61. Rotary kilns in cement industry are lined with
 (A) fire clay
 (B) silica
 (C) lead
 (D) high alumina and high magnesia bricks
62. Copper vessels are most suitable for the storage of
 (A) HNO_3 (B) HPO_4 (C) Dry chlorine (D) All the above

63. Hydrofluoric acid is stored in
 (A) Stainless steel or glass-lined vessel
~~(B) Teflon coated HDP containers~~
 (C) Wrought iron containers
 (D) Karbate vessel
64. Balls in a ball mill are usually made of
 (A) Cast iron
 (B) Wrought iron
 (C) Stainless steel
~~(D) Steel~~
65. Atmospheric corrosion of metals takes place by
 (A) Rapid oxidation
~~(B) Slow oxidation~~
 (C) Rapid hydration
 (D) None of the above
66. Liquid ammonia is shipped in
~~(A) Steel containers~~
 (B) Aluminium containers
 (C) Glass containers
 (D) Lead lined vessels
67. Name the occupational health disease due to chemical industries.
 (A) Primary complex
 (B) Hepatitis
~~(C) Dermatitis~~
 (D) Peritonitis
68. Which organisation is working for the safety in industries ?
 (A) Employees State Insurance (ESI)
~~(B) National Institute of Health (NIH)~~
 (C) Human Resource Development (HRD)
 (D) Small Industries Services Institute (SISI)
69. The process of protection of iron by coating with zinc is called
 (A) Tempering
~~(B) Galvanizing~~
 (C) Nitriding
 (D) Smelting
70. Silicon rubber is not resistant to the corrosive action of
 (A) Sulphuric acid (10%)
 (B) Sulphuric acid (95%)
 (C) Ether
~~(D) Both (B) and (C)~~
71. Alkaline corrosion can be prevented using
 (A) Aluminium (B) Nickel (C) Durion ~~(D) Karbate~~
72. The most commonly used resin for making reinforced plastic is
~~(A) Unsaturated polyester~~
 (B) Polypropylene
 (C) Polyurethane
 (D) Nylon-6

73. In SO_2 absorber packing material used is
 (A) Cast iron ~~(B) Chemical stoneware~~
 (C) Karbate (D) Mild Steel
74. Corrosion resistance of steel is increased by the addition of
 (A) Phosphorous and tungsten ~~(B) Nickel and chromium~~
 (C) Lead and vanadium (D) Molybdenum and tungsten
75. Presence of cobalt in steel improves its
~~(A) Cutting ability~~ (B) Corrosion resistance
 (C) Tensile strength (D) None of these
76. An example of a first degree hazard is
~~(A) The presence of heat~~ (B) Falling
 (C) Collision (D) Stumbling
77. Slow and progressive deformation of a material with time under constant stress is called
~~(A) Creep~~ (B) Erosion (C) Resilience (D) None of these
78. Acid proof stoneware
 (A) has very low strength
 (B) cannot be heated
 (C) can be broken by small temperature changes
~~(D) All (A), (B) and (C)~~
79. Purpose of sizing agent used in the manufacturing of paper is
 (A) it increases the strength of the fibers
 (B) it gives the correct size of the paper, some metals
~~(C) it imparts resistance to penetration by liquids, resin oil~~
 (D) none of the above
80. Citric acid is manufactured by
~~(A) Fermentation~~ (B) Solvay process
 (C) Mecker process (D) Spray pond process
81. Carborundum consists mainly of
 (A) Bauxite ~~(B) Silicon carbide~~
 (C) Boron carbide (D) Calcium carbide
82. Diaphragm electrolytic cell produces
 (A) 70% NaOH solution (B) 60% NaOH solution
 (C) 98.5% NaOH solution ~~(D) 10-12% NaOH solution~~

83. Portland cement is a finely ground
 (A) calcium aluminates and silicates of varying combinations
 (B) calcium aluminates and sodium silicates of varying combinations
 (C) calcium aluminates and caustic soda
 (D) calcium silicates and gypsum of fixed composition
84. Blood poisoning chemicals are
 (A) Carbon Monoxide (B) Lead
 (C) Benzene (D) All (A), (B) and (C)
85. Synthetic glycerine is produced from
 (A) Toluene (B) Phenol (C) Propylene (D) Naphthalene
86. Promoter used in Ammonia synthesis is
 (A) V_2O_5 (B) K_2O (C) SiO_2 (D) U_2O_3
87. Nylon-66 is manufactured from
 (A) Hexamethylene diamine and adipic acid
 (B) Hexamethylene diamine and maleic anhydride
 (C) Caprolactum
 (D) Dimethylene terephthalate and ethylene glycol
88. Which one is not a thermoplastic ?
 (A) Bakelite (B) Terylene (C) Polystyrene (D) Polythene
89. Polyurethane is
 (A) a polyester (B) a Nylon-6 (C) an elastomer (D) None of the above
90. Penetration test and softening point tests are important for
 (A) Bitumen (B) Gasoline (C) Kerosene (D) Light gas oil
91. Commercial name of polytetrafluoro ethylene is
 (A) Dacron (B) Nylons (C) Teflon (D) Bakelite
92. Indigo dye gives
 (A) black colour (B) blue colour (C) green colour (D) red colour
93. Catalyst used in the hydrogenation of vegetable oils is
 (A) Copper (B) Silver (C) Nickel (D) Platinum
94. What kind of rubber is used in making sound insulation devices ?
 (A) Foam rubber (B) Polyurethane rubber
 (C) Sponge rubber (D) Thiokols

95. Isoprene is a monomer of
 (A) Natural rubber (B) PVC (C) Starch (D) Synthetic rubber
96. Which of the following ceramics possesses good strength, translucency and very low porosity?
 (A) Earthenware (B) Stoneware (C) Tile (D) White ware
97. What is triple superphosphate?
 (A) $3\text{CaH}_4(\text{PO}_4)_2 \cdot 7\text{CaSO}_4$ (B) $\text{Na}(\text{PO}_3)_6$
 (C) $(\text{NH}_4)_2\text{HPO}_4$ (D) $\text{CaH}_4(\text{PO}_4)_2$
98. Vinylite resins are used in
 (A) electrical insulators (B) floor coverings
 (C) ropes (D) tyres
99. Soaps remove dirt by
 (A) decreasing wettability (B) supplying hydrophilic group
 (C) increasing the surface tension (D) none of the above
100. Which of the following has the highest octane rating?
 (A) Aromatics (B) Iso-paraffins
 (C) Naphthalenes (D) Straight-chain paraffins
101. A strain gauge can be used as a transducer for
 (A) pH (B) temperature
 (C) pressure (D) density
102. When damping coefficient is unity, the system is
 (A) Over damped (B) Critically damped
 (C) Under damped (D) Highly fluctuating
103. Phase margin is equal to
 (A) 180 phase lag (B) phase lag - 180
 (C) phase lag + 180 (D) phase lag + 90
104. The qualitative and quantitative estimation of mixture of gaseous hydrocarbon can be carried out using
 (A) Orsat gas analyser (B) Polarimeter
 (C) Gas chromatography (D) Fourier transform infra red spectroscopy
105. The basic principle involved in the measurement of temperature by thermocouple is
 (A) Seebeck effect (B) Thomson and Peltier effect
 (C) Peltier and Seebeck effect (D) Hall effect and Joule heating effect

106. Any time delay between an initiating action and desired effects is called
 (A) Processing error (B) Time constant
~~(C) Transportation lag~~ (D) None of the above
107. On-off controllers are commonly used in
 (A) Hygrometry ~~(B) Thermostats~~
 (C) Viscometers (D) Hydrometry
108. Cascade control contains
 (A) one feed back and feed forward (B) two feed forward
~~(C) ratio control~~ ~~(D) two feed back~~
109. Which of the following controllers eliminates offset and oscillations?
 (A) P (B) PI (C) PD ~~(D) PID~~
110. Which of the following is a first-order instrument?
 (A) U-tube type mercury manometer
~~(B) Bimetallic thermometer with covering~~
~~(C) Mercury thermometer without any covering~~
 (D) Mercury thermometer with covering
111. According to bode stability criterion, a system is unstable if the open loop frequency response exhibits an amplitude ratio exceeding unity at frequency for which phase lag is
 (A) 0° (B) 45° (C) 90° ~~(D) 180°~~
112. Which of the following is a dynamic characteristic of instrument?
~~(A) Time lag~~ (B) Drift (C) Reproducibility (D) Span
113. The transfer function of a first order system is
~~(A) $\frac{1}{TS+1}$~~ (B) $\frac{1}{TS}$ (C) $\frac{S}{TS+1}$ (D) None of the above
114. The proportional band
 (A) is always more than 100% ~~(B) may be more than 100%~~
 (C) is always less than 10% (D) is always zero
115. Consider the following statements :
 I. Response of a system to a sinusoidal input is called frequency response.
 II. Mercury in glass thermometer kept in boiling water is example for first order system
 III. The ratio of output amplitude to input amplitude for a sinusoidal forcing function in a first order system is unity.
 IV. When the damping coefficient is unity, the system is highly fluctuating.
 Now select your answer
 (A) I alone is correct ~~(B) I and II are correct~~
 (C) II and III are correct (D) IV is not correct

116. McLeod gauge is used to measure
 (A) Pressure (B) Vacuum (C) Flow rate (D) None of the above
117. The second order system with the transfer function $\frac{4}{s^2 + 2s + 4}$ has a damping ratio of
 (A) 2.0 (B) 0.5 (C) 1.0 (D) 4.0
118. Which one of the following statement is correct ?
 (A) Stability of a control system containing transportation lag can be best analysed by Routh test.
 (B) Optical pyrometer is the most suitable instrument for measuring the temperature of a red hot furnace
 (C) Radiation pyrometer is the instrument which indicates the reverse direction of temperature change.
 (D) Thermo couple is suitable for measuring liquid temperature only.
119. Which of the following controllers has maximum offset ?
 (A) P-controller (B) P-I controller
 (C) P-D controller (D) P-I-D controller
120. Stability of a control system containing a transportation lag can be best analysed by
 (A) Routh test (B) Root locus method
 (C) Frequency response method (D) None of these
121. What is the frequency range in which acoustic energy is normally audible ?
 (A) 2 - 10 Hz (B) 20 - 20,000 Hz
 (C) 30,000 - 50,000 Hz (D) 60,000 - 70,000 Hz
122. An investment of ₹ 1,000 is earning interest at the rate of 10% and when compounded annually, it amounts in 2 years to
 (A) ₹ 1,210 (B) ₹ 1,200 (C) ₹ 1,190 (D) ₹ 1,220
123. Moist climate is the most favourable factor in the site selection for a
 (A) Steel plant (B) Textile factory
 (C) Petroleum refinery (D) Coke oven battery
124. A property has an initial value of ₹ 10,000, service life of 10 years and final salvage value of ₹ 2,000. What is the annual depreciation cost if straight line depreciation is used ?
 (A) ₹ 1,000 (B) ₹ 1,200 (C) ₹ 200 (D) ₹ 800
125. If S represents the amount available after n interest periods for an initial principal P with the discrete compound interest rate i, the present worth can be determined by
 (A) Present worth = $\frac{S}{(1+i)^n}$ (B) Present worth = $\frac{S}{e^{in}}$
 (C) Present worth = $\frac{S}{(1+in)^n}$ (D) Present worth = $\frac{S}{(1+n)^n}$

126. Bubble caps are located on trays with a pitch of
 (A) (2.0 - 2.5) O.D. (B) (1.5 - 2.2) O.D.
~~(C) (1.3 - 2.0) O.D.~~ (D) 1.5 O.D.
127. The peripheral speed of shell in a rotary dryer is commonly
 (A) 10 - 20 m/min ~~(B) 20 - 25 m/min~~
 (C) 30 - 35 m/min (D) 50 - 60 m/min
128. Installation costs for equipment is equal to
 (A) 20 - 25% of the purchased equipment cost.
~~(B) 35 - 45% of the purchased equipment cost.~~
 (C) 50 - 60% of the purchased equipment cost.
 (D) 60 - 75% of the purchased equipment cost.
129. Eco-system refers to
 (A) a group of individuals of any one kind of organism
 (B) all of the population occupying a given area
~~(C) the community and non-living environment working together~~
 (D) a portion of earth where living objects can be found
130. The safe level of noise intensity to human in decibels is
 (A) 180 (B) 100 ~~(C) 80~~ (D) 20
131. Maximum permissible limit of sulphur dioxide in atmospheric air as per WHO specification is
 (A) $10 \mu\text{g}/\text{m}^3$ (B) $30 \mu\text{g}/\text{m}^3$ ~~(C) $60 \mu\text{g}/\text{m}^3$~~ (D) $100 \mu\text{g}/\text{m}^3$
132. Presence of soluble organic pollutants in polluted water causes
 (A) undesirable plants growth ~~(B) depletion of oxygen~~
 (C) improves dissolved oxygen (D) none of these
133. Which of the following is a gaseous pollutant?
 (A) Mist ~~(B) Hydrocarbons~~
 (C) Smoke (D) Fumes
134. What is the advantage of using fabric filtration device for controlling air pollution?
 (A) Not affected by relative humidity
 (B) Independent to filtering velocity
 (C) Can handle gases above 500°C
~~(D) Dry collection possible~~
135. Cost of a storage tank of capacity 50 lt. costs ₹ 10,000 when the cost index was 200. What will be the cost of a similar tank of same capacity when the cost index is 300?
~~(A) ₹ 15,000~~ (B) ₹ 20,000 (C) ₹ 18,000 ~~(D) ₹ 17,000~~

136. The most efficient equipment for removal of submicron dust particles from blast furnace gas is
 (A) Venturi scrubber (B) Gravity setting chamber
~~(C) Electrostatic precipitator~~ (D) Cyclone separator
137. The biochemical treatment of sewage effluents is essentially a process of
 (A) Reduction ~~(B) Oxidation~~ (C) Dehydration (D) Alkalinization
138. Which of the following factors is the most important in site selection for a nuclear power plant?
~~(A) Absence of earthquake prone zone in the nearby areas~~
 (B) Abundant availability of water
 (C) Remotely located from residential area
 (D) Proximity to fuel source
139. Scheduling provides information regarding
 (A) the proper utilization of machines
 (B) means to minimise idle time of machines
 (C) time of completion of a job
~~(D) the time of starting job and also about how much work should be completed during a particular period~~
140. A device for damping vibrations or rapid movement in one direction but only slower motion in the opposite direction is called
 (A) Volume control (B) Set point (C) Capacitor ~~(D) Dashpot~~
141. The unit of diffusivity is same as that of
 (A) Density (B) Molal concentration
~~(C) Kinematic viscosity~~ (D) Velocity head
142. Rate of adsorption increases as the
 (A) temperature increases ~~(B) temperature decreases~~
 (C) not affected by temperature (D) none of these
143. Can a cooling tower cool water below the wet bulb temperature of inlet air?
 (A) Yes
~~(B) No~~
 (C) Yes, but height of cooling tower should be very high
 (D) Yes, but the air flow rate should be very high
144. At minimum reflux ratio for a given separation,
 (A) Number of plates is zero ~~(B) Number of plates is infinity~~
 (C) Separation is most efficient (D) None of these

145. The diameter of a packed absorption tower depends on the

- (A) quantities of gas and liquid handled
- (B) properties of fluids
- (C) the ratio of one stream to the other
- ~~(D)~~ All (A), (B) and (C)

146. The Chilton-Colburn analogy for mass transfer states that

- (A) $N_{St} N_{Sc}^{\frac{1}{3}} = \frac{f}{8}$
- ~~(B)~~ $N_{St} N_{Sc}^{\frac{2}{3}} = \frac{f}{2}$
- (C) $N_{St} N_{Sc}^{\frac{3}{2}} = \frac{f}{2}$
- (D) $N_{St} N_{Sc}^{\frac{2}{3}} = \frac{f}{8}$

where f = fanning friction factor

147. Select unit operation which always operates in unsteady state condition :

- (A) Absorption
- (B) Distillation
- ~~(C)~~ Adsorption
- (D) Drying

148. Solvent used in extractive distillation

- (A) alters the relative volatility of the original components
- (B) is of low volatility
- (C) must form no azeotropes with the original substances
- ~~(D)~~ all (A), (B) and (C)

149. The operating line for an absorber is curved when plotted in terms of

- ~~(A)~~ mole fractions
- (B) mole ratios
- (C) partial pressure
- (D) mass fractions

150. Ion exchange process is similar to

- (A) Absorption
- ~~(B)~~ Adsorption
- (C) Extraction
- (D) Leaching

151. Relative volatility α for a binary system

- ~~(A)~~ decreases with increase in pressure
- (B) increases with increase in pressure
- (C) increases with increase in temperature at constant pressure
- (D) has no significance in distillation operation

152. The flash distillation process is suitable for separating components which

- (A) boil at very close temperatures
- ~~(B)~~ boil at widely different temperatures
- (C) form minimum-boiling azeotrope
- (D) form maximum-boiling azeotrope

153. Flooding velocities for regular packings
~~(A)~~ will be considerably greater than for random packing.
 (B) will be considerably smaller than for random packing.
 (C) will be equal to that for random packing.
 (D) decreases linearly with increase in gas flow rate.
154. For all useful liquid-liquid extraction operations the selectivity of solvent must be
 (A) more than zero (> 0) ~~(B)~~ more than one (> 1)
 (C) less than one (< 1) (D) less than or equal to 1 (≤ 1)
155. The diffusivity, D_{AB} (for component A diffusing in B) is equal to the diffusivity D_{BA} (for component B diffusing in A) for a binary mixture of
~~(A)~~ Newtonian liquids (B) Non-Newtonian liquids
~~(C)~~ Ideal gases (D) Real gases
156. Desorption of the adsorbed solute by solvent is called
 (A) Reverse osmosis (B) Dialysis
 (C) Sublimation ~~(D)~~ Elution
157. The principle of physical adsorption is
~~(A)~~ due to Vander Waal's forces
 (B) accompanied by a chemical reaction
 (C) accompanied by adsorption of heat
 (D) none of the above
158. For obtaining a given separation in a distribution column, the minimum number of theoretical stages is obtained when the column is operated at
~~(A)~~ minimum reflux ratio (B) optimum reflux ratio
~~(C)~~ total reflux (D) zero reflux ratio
159. Sugar is leached from sugar beats with
 (A) Cold water ~~(B)~~ Hot water (C) Sulphuric acid (D) Nitric acid
160. In an agitated liquid-liquid extraction column, it is better to admit the brighter phase
 (A) by spray from the top ~~(B)~~ distribution from the bottom
 (C) admission from the side (D) all of the above
161. A catalyst is said to be negative catalyst, if it
~~(A)~~ reduces the value of equilibrium constant
~~(B)~~ retards the rate of reaction
 (C) does not initiate the reaction
 (D) all of the above

162. BET apparatus is used to determine the
~~(A)~~ specific surface of a porous catalyst
 (B) pore size distribution
 (C) pore diameter
 (D) porosity of the catalyst bed
163. If n = overall order of a chemical reaction, a = initial concentration of reactant, t = time required to complete a definite fraction of the reaction, then the correct relationship is
 (A) $t \propto \frac{1}{a^n}$ ~~(B)~~ $t \propto \frac{1}{a^{n-1}}$ (C) $t \propto \frac{1}{a^{n-1}}$ (D) $t \propto a^{n-1}$
164. A reaction which proceeds with absorption of heat is termed as
 (A) exothermic reaction ~~(B)~~ endothermic reaction
 (C) thermo-chemical reaction (D) photochemical reaction
165. In a continuous flow stirred tank reactor, the composition of the exit stream
 (A) depends upon the flow rate of inlet stream
 (B) is different from that in the reactor
~~(C)~~ is same as that in the reactor
 (D) none of these
166. The equilibrium constant for the reversible reaction $A \xrightleftharpoons[K_2]{K_1} P$ is affected by the
~~(A)~~ Temperature of the system
 (B) Presence or absence of inerts
 (C) Pressure of the system
 (D) Kinetics of the reaction
167. Sum of the exponents of the concentration terms in the rate equation is called as
 (A) Molecularity of the reaction
~~(B)~~ Overall order of the reaction
 (C) Rate of the reaction
 (D) None of the above
168. If 'n' is the order of reaction, then unit of rate constant is
~~(A)~~ $\frac{1}{(\text{time})(\text{concentration})^{n-1}}$ (B) $(\text{time})^{-1}(\text{concentration})^{n-1}$
 (C) $(\text{time})^{n-1}(\text{concentration})$ (D) $(\text{time})^{1-n}(\text{concentration})^{1-n}$
169. Which is the most suitable reactor for very high pressure gas-phase reaction?
 (A) Batch reactor ~~(B)~~ Tubular flow reactor
 (C) Stirred tank reactor (D) Fluidized bed reactor

170. In autocatalytic reactions
- (A) One of the reactants acts as a catalyst
 - ~~(B) One of the products acts as a catalyst~~
 - (C) Catalysts have very high selectivity
 - (D) No catalyst is used
171. In an ideal mixed reactor (at steady state), the
- (A) space time is equivalent to holding time for constant density system
 - (B) composition throughout the reactor remains same
 - (C) exit stream has the same composition as the fluid within the reactor
 - ~~(D) all (A), (B) and (C)~~
172. Which of the following factors control the design of a fluid solid reactor ?
- (A) The reaction kinetics for single particle
 - (B) The size distribution of solids being treated
 - (C) Flow patterns of solids and fluids in the reactor
 - ~~(D) All (A), (B) and (C)~~
173. For nearly isothermal operation involving large reaction time in a liquid phase reaction, the most suitable reactor is
- (A) tubular flow reactor
 - (B) batch reactor
 - (C) fixed bed reactor
 - ~~(D) stirred tank reactor~~
174. A plug-flow reactor is characterised by
- ~~(A) high capacity~~
 - (B) presence of axial mixing
 - (C) presence of lateral mixing
 - (D) constant composition and temperature of reaction mixture
175. A first order reaction required two unequal sized CSTR. Which of the following gives higher yield ?
- (A) Large reactor followed by smaller one
 - (B) Smaller reactor followed by large one
 - ~~(C) Either of the arrangement (A) or (B) will give the same yield~~
 - (D) Both connected in parallel
176. Rate of a chemical reaction is defined as
- (A) moles formed / (volume of fluid) (time)
 - (B) moles formed / (surface) (time)
 - (C) moles formed / (volume of reactor) (time)
 - ~~(D) each of the above~~

177. The rate of the chemical reaction $A \rightarrow B$ doubles as the concentration of A i.e., C_A is doubled. If rate of reaction is proportional to C_A^n then what is the value of n for this reaction ?
 (A) 0.5 ~~(B) 1~~ (C) 0 (D) 2
178. An expression for the time (t) at which a first order reaction $A \xrightarrow{k}$ product is 90% complete is
 (A) $t = 0.693/k$ ~~(B) $t = 2.303/k$~~ (C) $t = 0.90/k$ (D) $t = 1.1/k$
179. Due to the presence of a catalyst, the equilibrium constant
 (A) increases
 (B) ~~decreases~~
 (C) unaffected
 (D) can't predict, data insufficient
180. A first order reaction is to be treated in a series of two mixed reactors. The total volume of the two reactors is
 (A) minimum when the reactors are of different sizes.
 (B) maximum when the reactors are of equal in size.
~~(C) minimum when the reactors are of equal size.~~
 (D) either (B) or (C) depending on reactants involved.
181. For efficient extraction in liquid-liquid process, the dispersed phase should be admitted as
~~(A) very fine particles~~
 (B) droplets of considerable size
 (C) continuous liquid flow
 (D) all of these
182. Inside the distillation columns, the
~~(A) driving force for the liquid flow is its weight~~
 (B) highest temperature is near the feed plate
 (C) vapours are not always at their dew points
 (D) all of these
183. Which of these is a carcinogen ?
~~(A) Benzopyrene~~ (B) Carbon monoxide
 (C) Carbon dioxide (D) Phosgene
184. In order to react, a molecule at the time of collision must have a minimum energy, known as
~~(A) Activation energy~~ (B) Free energy
 (C) Heat of reaction (D) Threshold energy

185. Consider a body that has
 Absorptivity = 0
 Reflectivity = 1
 Transmittivity = 0
 What is this body called ?
 (A) Black body (B) Gray body
 (C) Transparent body ~~(D) White body~~
186. The slope of the operating line for the stripping section of distillation column is
 (A) 0 (B) < 1 (C) ∞ ~~(D) > 1~~
187. Entrainment in a distillation column
 (A) is defined as the liquid carried with the vapour from one tray to the tray above
 (B) is detected by decrease in Murphree plate efficiency.
 (C) may be detrimental since it can carry non-volatile constituents upward.
~~(D) all of above~~
188. Radiation pyrometers are used to measure the temperature in the range of
~~(A) 800 °C to 2000 °C~~ (B) 100 °C to 600 °C
 (C) 300 °C to 1100 °C (D) 0 °C to 400 °C
189. The use of space time is preferred over the mean residence time in the design of
 (A) batch reactor ~~(B) ideal tubular reactor~~
 (C) slurry reactor (D) CSTR
190. Runge-Kutta methods agree with Taylor series solution upto the terms of
~~(A) h^1~~ (B) h^{r-1} (C) h^{r+1} (D) h^r
191. In the 4th order Runge-Kutta method, if the equation $\frac{dy}{dx}$ is a function of x alone, then the Runge-Kutta reduces to
 (A) Avogadro's rule (B) Thumb rule
~~(C) Simpson's rule~~ (D) Lechatelier's rule
192. To test the experimental data of variables in x and y in an empirical equation of $y = a + bx$ to obtain a straight line suggest a suitable method of plotting.
~~(A) plot y v/s x on rectangular coordinate~~
 (B) plot y v/s x on logarithmic coordinate
 (C) plot y v/s x on semi-logarithmic coordinate
 (D) plot $\log y$ v/s $\log x$ on rectangular coordinate

193. Solve the following linear system

$$2x_1 + 3x_2 - x_3 = 5$$

$$-2x_2 - x_3 = -7$$

$$-5x_3 = -15$$

~~(A)~~ $x_1 = 1, x_2 = 2, x_3 = 3$

(B) $x_1 = x_2 = x_3 = 6$

(C) $x_1 = 0, x_2 = 1, x_3 = 3$

(D) $x_1 x_2 = 1, x_2 x_3 = 2, x_3 x_1 = 3$

194. Expression for power number in agitation is given by

(A) $P \rho^2 D_i / \mu^3$

~~(B)~~ $P / n^3 D^2 \rho$

(C) $n^3 D^2 \rho / P$

(D) $n^3 D^3 \rho / P$

195. Depreciation is _____ in profit with time

~~(A)~~ decrease

(B) increase

(C) no change

(D) none of these

196. A matrix is called singular if it's determinant is

(A) 1

~~(B)~~ 0

(C) more than one

(D) both (A) and (B)

197. Propeller agitators are used for liquids of

(A) high viscosity

~~(B)~~ low viscosity

(C) medium viscosity

(D) all viscosity ranges

198. The bulk diffusion coefficient (D) in a binary gas mixture is related to temperature (T) as

~~(A)~~ $D \propto T^{1.5}$

(B) $D \propto T^{0.5}$

(C) $D \propto T$

(D) $D \propto T^2$

199. In turbulent flow regime pressure drop is represented by

~~(A)~~ $\frac{\Delta P}{\rho} = \frac{4 f L \bar{V}^2}{2 g_c D}$

(B) $\frac{\Delta P}{\rho} = \frac{f L \bar{V}^2}{2 g_c D}$

(C) $\frac{\Delta P}{\rho} = \frac{4 f L^2 \bar{V}}{2 g_c D}$

(D) $\frac{\Delta P}{\rho} = \frac{4 f L \bar{V}}{2 g_c D}$

where f is fanning friction factor

200. The Taylor series expansion of the function $F(x) = x/(1+x)$ around $x = 0$ is

(A) $x + x^2 + x^3 + x^4 \dots$

(B) $1 = x + x^2 + x^3 + x^4 \dots$

(C) $2x + 4x^2 + 8x^3 + 16x^4 \dots$

~~(D)~~ $x - x^2 + x^3 - x^4 \dots$