

Sr. No

[SET-V]
Ph.D. Programme (Odd Semester)
CHEMICAL ENGINEERING

Marks: 100

Time: 2 hours

| | |
|-----------------|--------------------|
| Roll No.: _____ | Date: _____ |
| Time: _____ | Centre Name: _____ |

| INSTRUCTIONS FOR THE CANDIDATES | |
|--|---|
| 1. | Please do not open (Break the seal) of the question booklet before time |
| 2. | An OMR answer sheet is being provided separately along with this question booklet. Please fill up all relevant entries like Roll number, Centre code, Paper Number etc. in the spaces provided on the OMR answer sheet and put your signature in the box provided for this purpose. |
| 3. | There are 100 questions in this booklet. Against each question four alternative choices (A), (B), (C) and (D) are given, out of which only one is correct. Indicate your choice of answer by Darkening the suitable circle with Black/Blue Ball Pen in the OMR answer sheet supplied to you separately. |
| 4. | Each question carries one mark. There will be 1/4th negative marking. |
| 5. | Read and follow the instructions given on the backside of the OMR answer sheet carefully. |
| 6. | Do not write your name/Roll number or give any identification mark at any place on the OMR sheet. |
| 7. | Keep all your belongings outside the examination hall. Do not retain any paper except the ADMIT CARD. |
| 8. | Do not talk to each other. Do not borrow anything from other candidates. |
| 9. | Use of CALCULATOR (except programmable calculator) is allowed. |
| 10. | Any body found involved in malpractices, will be disqualified from appearing in the entrance test. |
| 11. | At the start of the examination, please ensure that all pages of your booklet are properly printed; your question booklet is not damaged in any manner and contains 100 questions. In case of any discrepancy, report to the invigilator immediately. No claim in this regard will be entertained at the later stage. |

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For Rough Work

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NOTE:

- (i) Attempt all questions. Each question carries one mark. There will be $1/4^{\text{th}}$ negative marking.
- (ii) **There are 100 questions in this booklet.** Against each question four alternative choices (A), (B), (C) and (D) are given, out of which only one is correct. Indicate your choice of answer by Darkening the suitable circle with **Black/Blue Ball Pen** in the OMR answer sheet supplied to you separately.

1. **At standard conditions, one kg-mole of an ideal gas occupies the volume of**
 - (A). 22 m³
 - (B). 22.414 litre
 - (C). 359 m³
 - (D). 22414x10³ c.c.
2. **Coal is subjected to ultimate analysis to know its**
 - (A). moisture, hydrogen, carbon and ash
 - (B). carbon, hydrogen, nitrogen and sulphur
 - (C). moisture, hydrogen, carbon, volatile matter, ash and GCV
 - (D). moisture, hydrogen, fixed carbon and GCV
3. **In bomb calorimeter, which of the following thermometer is used for temperature measurement?**
 - (A). Dilatometer
 - (B). Thermocouple
 - (C). Optical pyrometer
 - (D). Beckman thermometer
4. **Psychrometrics deals with the behavior of**
 - (A). combustible gases
 - (B). atmospheric air
 - (C). exhaust gases
 - (D). dry air
5. **Why is an entrainment separator used in evaporators?**
 - (A). To separate the liquid droplets from vapors
 - (B). To separate the solid particles from liquids
 - (C). To prevent the foaming
 - (D). To increase the boiling point rise
6. **Azeotropic distillation is used to separate**
 - (A). constant boiling mixtures
 - (B). high boiling mixtures
 - (C). mixture with very high relative volatility
 - (D). heat sensitive mixtures
7. **The large scale drying of wheat is done in a**
 - (A). fluidized bed dryer
 - (B). tray dryer
 - (C). spouted bed dryer
 - (D). rotary dryer
8. **Hot-wire anemometer is used for measuring the**
 - (A). gas volumetric flows
 - (B). gas temperature
 - (C). gas velocity
 - (D). gas pressure
9. **When the Bernoulli equation is applied to the potential flow, then the friction factor is taken as**
 - (A). 0.00
 - (B). 0.02
 - (C). 0.06
 - (D). 0.95
10. **The control valve used in chemical process industries is basically a**
 - (A). gate valve
 - (B). globe valve
 - (C). check valve
 - (D). audco plug valve

11. What will be the approximate speed of the horizontal rotary drum filter to be used in effluent treatment plants?
- (A). 1 rpm
 - (B). 5 rpm
 - (C). 10 rpm
 - (D). 15 rpm
12. Which of the following device is used to remove the foreign material from a flowing fluid?
- (A). Coagulant
 - (B). Strainers
 - (C). Gravity settler
 - (D). Clarifier
13. To transport the pith separated from bagasse, which of the following system will be used?
- (A). Belt conveyor
 - (B). Pneumatic conveyor
 - (C). Screw conveyor
 - (D). Bucket elevator
14. The ball mill speed should be
- (A). less than the critical speed
 - (B). more than the critical speed
 - (C). equal to the critical speed
 - (D). equal to the motor speed
15. At a given pressure, the rate of reaction of a particular component is a function of its temperature and
- (A). composition
 - (B). specific volume
 - (C). specific gas constant
 - (D). molecular weight
16. Which of the following impeller generates the flow currents in parallel direction with the axis of the impeller shaft?
- (A). Radial flow impeller
 - (B). Axial flow impeller
 - (C). Tangential flow impeller
 - (D). None of the above
17. What will be the slip in percent between liquid and propeller in agitation vessels?
- (A). Zero
 - (B). Five
 - (C). Seven
 - (D). Nine
18. What is the state of hydrodynamic boundary layer and thermal boundary layer when the value of Prandtl number is unity?
- (A). The thickness of the both the layers are same
 - (B). The thickness of the both the layers are different
 - (C). The thickness of the hydraulic boundary layer is 50 percent that of thermal boundary layer
 - (D). The thickness of the thermal boundary layer is 50 percent that of hydraulic boundary layer
19. What is the value of fugacity of an ideal gas?
- (A). Value of its pressure
 - (B). Value of its temperature
 - (C). Value of its fugacity coefficient
 - (D). Value of its volume
20. Solid and liquid phases of substances are in equilibrium at
- (A). critical temperature
 - (B). melting point
 - (C). freezing point
 - (D). both 'b' and 'c'
21. Coke oven gas consists mainly of
- (A). H_2 and CH_4
 - (B). CO and CO_2
 - (C). H_2 and CO
 - (D). CH_4 and CO
22. The biochemical treatment of sewage effluents is essentially a process of
- (A). reduction
 - (B). oxidation
 - (C). dehydration
 - (D). alkalization
23. Energy requirement (per unit mass of material crushed) is highest for a
- (A). jaw crusher
 - (B). rod mill
 - (C). ball mill
 - (D). fluid energy mill

24. What is the color coding used to indicate the raw water in pipeline?
 (A). Olive Green
 (B). Aqua
 (C). Dark Blue
 (D). Light green
25. What will happen to the head, developed by the pump, when the flow rate is increased?
 (A). Increase
 (B). Decrease
 (C). Constant
 (D). Zero
26. Which of the following equation is used to calculate the rate of heat transfer in mass convective heat transfer process?
 (A). $Q = m C_p \Delta T_{\text{Range}}$
 (B). $Q = m C_p \Delta T_{\text{Difference}}$
 (C). $Q = h A \Delta T_{\text{Range}}$
 (D). $Q = h A \Delta T_{\text{Difference}}$
27. Newton's law of viscosity relates
 (A). pressure, velocity, and viscosity
 (B). shear stress and rate of angular deformation in a fluid
 (C). temperature, viscosity and velocity
 (D). pressure, temperature, viscosity, and rate of angular deformation in a fluid
28. In forced convection heat transfer, fluid moves under the influence of
 (A). changes in fluid pressure produced by external work
 (B). buoyant forces arising from changes in density
 (C). elastic forces
 (D). surface tension forces
29. The Grashof number in heat transfer is proportional to
 (A). ratio of viscous force to buoyancy force
 (B). ratio of buoyancy force to viscous force
 (C). the ratio of buoyancy force to elastic force
 (D). the ratio of viscous force to inertial force.
30. The volume of an ideal gas is 100 cm^3 at 100°C . If the pressure is held constant, at what temperature will the gas have a volume of 200 cm^3 ?
 (A). 50°C
 (B). 200°C
 (C). 473°C
 (D). 746°C
31. The process of protection of iron by coating with zinc is called
 (A). tempering
 (B). galvanizing
 (C). nitriding
 (D). smelting
32. Which of the following devices of particulate collection is the least efficient?
 (A). Cyclone separator
 (B). Electrostatic precipitator
 (C). Fabric filter
 (D). Wet scrubber
33. A rotameter, through which air at room temperature and atmospheric pressure is flowing, gives a certain reading for a flow rate of 100 cc/s . If helium (Molecular weight 4) is used and the rotameter shows the same reading, the flow rate is:
 (A). 26 cc/s
 (B). 42 cc/s
 (C). 269 cc/s
 (D). 325 cc/s
34. The Clapeyron equation in thermodynamics is associated with
 (A). liquid phase process
 (B). vapor phase process
 (C). phase change process
 (D). solid phase process
35. S-pitot tube is used for monitoring the
 (A). velocity of ambient air
 (B). velocity of stack gas
 (C). flow of water in closed channel
 (D). flow of water in open channel
36. Water becomes turbid when contaminated with
 (A). dissolved solids
 (B). suspended solids
 (C). colloidal solids
 (D). dissolved oxygen

37. **Fertilizer plants get their nitrogen requirements from**
(A). fractionation of liquid air
(B). dissociation of oxides of nitrogen
(C). coal gas
(D). producer gas
38. **The boiling point elevation (BPE) of a solution in a multiple effect of evaporator system is**
(A). solution temperature – vapor temperature
(B). vapor temperature – live condensate temperature
(C). steam temperature – solution temperature
(D). steam temperature – foul condensate temperature
39. **What is the range of inclined angle of casing in degrees with reference to the horizontal plane in gyrating screens?**
(A). 10 to 15
(B). 16 to 30
(C). 35 to 45
(D). 45 to 60
40. **The atmospheric pressure of 101325 Pa corresponds to a hydrostatic pressure of**
(A). 12.5 cm of Hg
(B). 10 m of water
(C). 13 meters of Hg.
(D). 32 ft of water
41. **Coal is subjected to proximate analysis to know its**
(A). moisture, hydrogen, carbon and ash
(B). carbon, hydrogen, nitrogen and sulphur
(C). moisture, fixed carbon, volatile matter and ash
(D). moisture, hydrogen, fixed carbon and GCV
42. **On which law of thermodynamics is calibration of a thermocouple based on?**
(A). zeroth
(B). first
(C). second
(D). third law
43. **Mollier diagram is used for determining the properties of**
(A). air
(B). watervapour
(C). gas
(D). refrigerant
44. **The ratio of inertial forces to viscous forces is known as**
(A). Reynolds number
(B). Rayleigh number
(C). Prandtl number
(D). Graetz number
45. **In a shell and tube heat exchanger, the corrosive liquid is normally flowing on the**
(A). shell side
(B). tube side
(C). any one side
(D). both the sides
46. **In extractive distillation, solvent is**
(A). added to alter the relative volatility of the mixture
(B). of high volatility
(C). present in overhead stream
(D). of high viscosity to give tray efficiency
47. **In sugar industry, the sugar crystals are formed from concentrated sugar solution by**
(A). centrifuges
(B). hydrocones
(C). cyclones
(D). dryers
48. **The viscosity of gas**
(A). decreases with increase of temperature and pressure
(B). increases with increase of temperature and pressure
(C). decreases with increase of density
(D). increases with increase of density
49. **Hot-wire anemometer measures local instantaneous velocity based on the principle of**
(A). voltage change
(B). mass transfer
(C). pressure drop
(D). heat transfer

50. **When the Bernoulli equation is applied to the flow of a fluid, kinetic energy correction factor will be applied to correct the**
 (A). friction variation along the length of the tube
 (B). entrance and exit losses of the tube
 (C). velocity variation across the cross section of the tube
 (D). pressure variation in the tube
51. **Which of the following information about pipe is given by the Schedule number?**
 (A). Nominal diameter
 (B). Thickness
 (C). Stresses developed
 (D). Pressure in the pipe
52. **Filtration of drinking water in any industry is carried out by**
 (A). plate and frame filter
 (B). vacuum leaf filter
 (C). pressure sand filter
 (D). bag filter
53. **To transport a sticky material, which of the following system will be used?**
 (A). Belt conveyor
 (B). Pneumatic conveyor
 (C). Screw conveyor
 (D). Bucket elevator
54. **Pine oil is used in froth flotation cell, where it acts as a**
 (A). collector
 (B). modifier
 (C). frother
 (D). separator
55. **The mesh size of filtration system indicates the number of perforations per linear**
 (A). foot
 (B). inch
 (C). meter
 (D). cm
56. **In a ball mill, as the product becomes finer the energy required for grinding will**
 (A). remain same as for the coarse grinding
 (B). increase
 (C). decrease
 (D). remain same as for intermediate grinding
57. **Ammonia synthesis reaction is a**
 (A). non-catalytic homogeneous reaction
 (B). catalytic homogeneous reaction
 (C). non-catalytic heterogeneous reaction
 (D). catalytic heterogeneous reaction
58. **In a particular reaction in which the rate equation corresponds to stoichiometric equation, the reaction is called**
 (A). preliminary reaction
 (B). elementary reaction
 (C). non-preliminary reaction
 (D). non-elementary reaction
59. **Thermal conductivity has the dimensions, where dimensions H, L t, and T are used for heat, length, time and temperature as**
 (A). $H L^{-1} t^{-1} T^{-1}$
 (B). $H^{-1} L^2 t T^{-1}$
 (C). $H L^{-2} t T$
 (D). $H^{-1} L^2 t T$
60. **A control volume is the volume**
 (A). of fluid flowing per unit time
 (B). fixed in space
 (C). in which a control device is situated
 (D). of the fluid controlling device
61. **Which of the following impeller generates the flow currents in a tangential direction with the axis of the impeller shaft?**
 (A). Radial flow impeller
 (B). Axial flow impeller
 (C). Parallel flow impeller
 (D). None of the above
62. **Water gas is mixed with which one of the following to give carbureted water gas?**
 (A). Carbohydrates
 (B). Hydrocarbons.
 (C). Halogens
 (D). Fluorocarbons
63. **While calculating the Boit Number in a heat treatment process, the thermal conductivity term used is of**
 (A). solid
 (B). gas
 (C). air
 (D). liquid

64. What is the value of ' R/C_p ' for monatomic gases such as Argon, Helium, etc. at moderate temperatures?
 (A). 0.2
 (B). 0.3
 (C). 0.4
 (D). 0.5
65. The ideal pulp for the manufacture of paper should have high
 (A). cellulose content
 (B). lignin content
 (C). hemi-cellulose only
 (D). both 'a' and 'b'
66. Acrylonitrile is mainly used in which of the following industry?
 (A). Polymer
 (B). Printing
 (C). Dyeing
 (D). Vegetables oil
67. Recycle ratio for a process is given by
 (A). kg of fresh feed/ kg of recycle stream
 (B). kg of (fresh+recycle) feed/kg of recycle stream
 (C). kg of recycle stream/kg of fresh feed
 (D). kg of recycle stream/kg of (fresh+recycle) feed
68. Dispersion number in mixed region and smaller plug flow region is given by:
 (A). UL/D
 (B). D/UL
 (C). D^2/UL
 (D). UL/D^2
- where,
 D = effective longitudinal dispersion,
 L = length,
 U = longitudinal velocity.
69. What is the unit of filter-medium resistance, R_m ?
 (A). 1/meter
 (B). 1/Newton
 (C). 1/Joule
 (D). 1/Watt
70. What is the approximate value of heat transferred in the radiation zone?
 (A). About 90 percent
 (B). About 75 percent
 (C). About 60 percent
 (D). About 55 percent
71. If a cold fluid is heated from 40°C to 130°C by steam at 150°C in either parallel or counter flow heat exchanger, then LMTD in parallel flow would be
 (A). lower than the LMTD in counter flow
 (B). greater than the LMTD in counter flow
 (C). equal to the LMTD in counter flow
 (D). zero.
72. Which of the following is the most viscous fluid?
 (A). Water
 (B). Glycerine
 (C). Coal tar
 (D). Ethyl alcohol.
73. In natural convection heat transfer, fluid moves under the influence of
 (A). changes in fluid pressure produced by external work
 (B). buoyant forces arising from changes in density due to change in temperature
 (C). elastic forces
 (D). surface tension forces
74. The triple point of water occurs at 0.00602 atm and temperature
 (A). 0.01°C
 (B). 4°C
 (C). 100°C
 (D). 444.6°C
75. The hottest part of flame in the combustion process lies in its
 (A). blue zone
 (B). luminous zone
 (C). non-luminous zone
 (D). zone of unburnt air
76. The minimum degrees of freedom at the triple point of pure water is
 (A). 0
 (B). 1
 (C). 2
 (D). 3

77. Which of the following elements present in fuel oil is not combustible?
 (A). Carbon
 (B). Hydrogen
 (C). Sulphur
 (D). Oxygen
78. Dilute sulfuric acid is handled in vessels made of
 (A). Stainless steel
 (B). Brass
 (C). Lead
 (D). Cast iron
79. A suspension of uniform particles in water at a concentration of 500 kg of solids per cubic meter of slurry is settling in a tank. Density of the particles is 2500 kg/m^3 and terminal velocity of a single particle is 20 cm/s. What will be the settling velocity of suspension? Richardson-Zaki index is taken as 1.0.
 (A). 3.58 cm/s
 (B). 14.3 cm/s
 (C). 16 cm/s
 (D). 20 cm/s
80. In Joule Thomson effect, the coefficient μ is greater than zero in which of the following region?
 (A). Vapor region
 (B). Liquid region
 (C). Cooling region
 (D). Heating region
81. There are 10 lamps in a hall. Each one of them can be switched on independently. The number of ways in which hall can be illuminated is
 (A) 10^2
 (B) 1023
 (C) 2^{10}
 (D) 10!
82. What is (?) in the following table?

| | | |
|----|----|----|
| 8 | 54 | 27 |
| 9 | 71 | ? |
| 10 | 90 | 45 |

 (A) 39
 (B) 37
 (C) 35.5
 (D) 34.5
83. If 'THIS MAN IS GOOD' is coded as 153. What will be the code for 'THAT MAN IS NOT GOOD'?
 (A) 200
 (B) 195
 (C) 190
 (D) 180
84. A earned Rs 84000. One third of it went to taxes. The rest was invested and appreciated by one half. Two third of that went into business. Additional tax was paid equal to $\frac{2}{3}$ of the remaining amount. How much money was left with A?
 (A) 8790
 (B) 8777
 (C) 9000
 (D) 9333
85. If Aneesh is paternal first cousin of Rahul, how is their father's mother is related to them?
 (A) Mother
 (B) Grandmother
 (C) Paternal aunt
 (D) Maternal aunt
86. I got my first job on May 22, 1983. Which day of the week it was?
 (A) Monday
 (B) Tuesday
 (C) Friday
 (D) Sunday
87. A petrol dealer adds 20% kerosene oil to petrol. If purchase price of petrol is Rs. 60 per litre and that of kerosene is Rs. 20 per litre, and sale price of the petrol is Rs. 61 per litre, what is his percentage profit?
 (A) 14.25
 (B) 14.37
 (C) 14.50
 (D) 14.70
88. Anant parked his motorcycle at 9th place from the left and 28th from the right. How many motorcycles are parked in the row?
 (A) 37
 (B) 36
 (C) 35
 (D) 34

89. In an imaginary language digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are substituted by t, d, j, o, r, m, u, x, b and z. 10 is written as dt and so on. Use the above information and find the value of expression given below:

$$\{(or - dj) \times u\} \div dj$$

- (A) 9
(B) 10
(C) 11
(D) 12
90. Seven friends meet at their college reunion, shake hand with each other once. How many hand shake will be there altogether?
- (A) 21
(B) 42
(C) 27
(D) 49
91. Ms Anandita starts at left and moves 8 Kms. She then turns right and moves 4 Kms. Then she turns right again for 8 Kms. How far is she from the initial position?

- (A) 20 Kms
(B) 10 Kms
(C) 08 Kms
(D) 04 Kms

92. Lunch-dinner pattern of a person for 'm' days is given below. He has a choice of VEG or NON-VEG meal for his lunch/dinner.

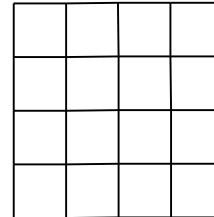
- (i) If he takes a NON-VEG lunch, he will have only VEG dinner
(ii) He takes NON-VEG dinner for 9 days
(iii) He takes VEG lunch for 11 days
(iv) He takes a total of 14 NON-VEG meals

What is 'm'?

- (A) 18
(B) 20
(C) 24
(D) 38
93. 20% students of a particular course get jobs within one year of passing. 20% of the remaining students get jobs by end of the second year of passing. If 16 students are still jobless, how many students had passed the course?
- (A) 25
(B) 50

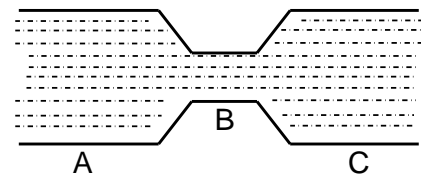
- (C) 62
(D) 84

94. How many rectangles (which are not squares) in the following figure?:



- (A) 56
(B) 70
(C) 80
(D) 96

95. Water is flowing through a tube as shown below:



The cross-sectional area of A and C are equal and greater than the cross-sectional area of B. If the flow of water is steady, then the pressure on the walls at B is

- (A) less than that at A and that at C
(B) more than that at A and that at C
(C) same as that at A and that at C
(D) more than that at A but less than that at C
96. Processor IC chip was developed by?
- (A) AMD
(B) Intel
(C) DIX
(D) Both (A) and (B)
97. If $5472 = 9$, $6342 = 6$, $7584 = 6$. What is 9236?
- (A) 2
(B) 3
(C) 4
(D) 5
98. Chipko movement was started by?
- (A) Arundhati Roy
(B) Medha Patkar
(C) Ila Bhatt
(D) Sunder lal Bahuguna

99 What is the following is not a natural hazard?

- (A) Earthquake
- (B) Tsunami
- (C) Flash floods
- (D) Nuclear accident

100 Which of the following team won the 9th IPL cricket T-20 tournament?

- (A) Kolkata Knight Riders
- (B) Sun Risers Hyderabad
- (C) Mumbai Indians
- (D) Royal Challengers Bangalore