Punjab Technical University

Maximum Marks: 90   **Time: 90Mins.**

Entrance Test for Enrollment in Ph.D Programme

Important Instructions

➡ Fill all the information in various columns, in Capital letters, with blue/black point pen for attempting the questions
➡ Use of calculators is not allowed.
➡ Make attempt by writing the answer in capital Letters in the box against each question number.
➡ All questions are compulsory. Each Question has only one right answer. No Negative marking for wrong answers.
➡ Questions attempted with two or more options/answers will not be evaluated.

Stream: …Engineering ...……………………………..

Discipline   …Chemical Engineering....…………………..

Name   …………………………………………………..

Fathers Name   …………………………………………………..

Roll Number   **Date: 13-07-2014**

Signature of Candidate: …………………………………………………..

Signature of Invigilator   …………………………………………………..

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1. 10 m for water column is equal to
   (a) 10 kN/m^2
   (b) 1 kN/m^2
   (c) 100 kN/m^2
   (d) 0.1 kN/m^2

2. Opening of 200 mesh screen (Taylor series) is
   (a) 0.0074 cm
   (b) 0.0074 mm
   (c) 0.0047 cm
   (d) None of the above

3. Heat sensitive material like orange juice is concentrated in a
   (a) Long tube evaporator
   (b) Basket evaporator
   (c) Falling film evaporator
   (d) Calendria Type Evaporator

4.

The rank of $\begin{bmatrix} 1 & 3 & 4 \\ 1 & 3 & 5 \\ 1 & 3 & 4 \end{bmatrix}$ is

    (a) 0   (b) 1

    (b) 2   (d) 3

5. The number of degrees of freedom at the triple point of water is

    (a) 1

    (b) 2

    (c) 3

    (d) 0

6. If $3x+2y+z=0$; $x+4y+z=0$; $2x+y+4z=0$ be a system of equations, then

    (a) It is inconsistent

    (b) It has only the trivial solution x=0, y=0, z=0

    (c) It can be reduced to a single equation and so a solution does not exist

    (d) The determinant of the matrix of coefficient is zero

7. A state function is

    (a) Temperature

    (b) Pressure

    (c) Specific volume

    (d) work

8. A rectangular box with square base is open at the top. The maximum volume of the box made from 300 m^3 wood is

    (a) 500

    (b) 1000

    (c) 1500

    (d) 2000

9. The drag coefficient (C_d) used for immersed solid is defined by

    (a) $\dfrac{(F_D / A_p)}{(\rho u_0^2 / 2g_c)}$ (b) $\dfrac{F_D}{(\rho u_0^2 / 2g_c)}$

    (c) $\dfrac{(F_D / A_p)}{(u_0^2 / 2g_c)}$ (d) $\dfrac{(F_D / A_p)}{(\rho u_0^2)}$

    Where, F_D = total drag

              A_p = projected area of solid body

              u_0 = velocity of the approaching stream

10. First law of thermodynamics is mathematically stated as

    (a) $dQ = dE + dW$

    (b) $dE = dQ + dW$

    (c) $dQ = dE - dW$

(d) $dW = dQ + dE$

11. Fugacity is most helpful in
    (a) representing actual behaviour of real gases
    (b) representing actual behaviour of ideal gases
    (c) the study of chemical equilibrium involving gases at atmospheric pressure
    (d) none of the above

12. Hydrogenation of vegetable oil is done to
    (a) Decrease the number of unsaturated bonds
    (b) Lower the melting point of oil
    (c) Increase the thermal conductivity of oil
    (d) Enable the oil to be packed in a tin container

13. The conductance has the units of
    (a) W/m^2
    (b) W/K
    (c) W/m.K
    (d) 1/K

14. Specific surface of spherical particles is given by (where D and ρ are diameter and density of particle)
    (a) $\dfrac{6}{D.\rho}$ (b) $\dfrac{2}{D.\rho}$
    (c) $\dfrac{4}{D.\rho}$ (d) $\dfrac{12}{D.\rho}$

15. A graph related to Antoine Equation is
    (a) Ostwald Chart
    (b) Cox Chart
    (c) Mollier's Chart
    (d) Enthalpy Concentration Chart

16. An ideal plate is define as one where
    (a) The vapour and liquid leaving streams are in equilibrium
    (b) The vapour and liquid entering stream are in equilibrium
    (c) The vapour leaving stream is in equilibrium with the liquid entering stream
    (d) The vapour entering stream is in equilibrium with the liquid leaving stream

17. Flash distillation is
    (a) Same as differential distillation
    (b) Used for multicomponent systems like crude refining
    (c) Same as simple distillation
    (d) Most useful for handling binary systems

18. Which of the following can be used as tower packings:
    (a) Raschig rings and spherical beads
    (b) Pall rings and Lessing rings
    (c) Tellertte and Berl saddles
    (d) All of the above

19. Heat load in a cooling tower means:
    (a) The amount of heat extracted (J/h) by cooling tower
    (b) The number of kg of water circulated times the cooling range
    (c) Both (a) and (b)
    (d) None of the above

20. Film coefficient is the ratio of
    (a) Thickness of the film of fluid to thermal conductivity
    (b) Thickness of the film of fluid to temperature drop through film of fluid
    (c) Thermal conductivity to temperature drop through film of fluid
    (d) Thermal conductivity to equivalent thickness of the film of fluid

21. In a furnace the wall thickness is 60 cm and is 100 wide and 150 cm high of material with thermal conductivity 0.4 W/mk. The temperature inside and outside are 1000ºC and 4ºC respectively. The thermal resistance is
    (a) 1 K/W   (b) 2 K/W
    (c) 18 K/W   (d) 15 K/W

22. In a distillation column the minimum reflux ratio
    (a) Is the maximum ratio which will require an infinite number of trays for the separation desired
    (b) Corresponds to the maximum reboiler heat load for the separation desire
    (c) Corresponds to the maximum condenser cooling load for the separation desired
    (d) Is always zero

23. Knudson diffusion is directly proportional to
    (a) T   (b) $\sqrt{T}$ (c) $1/\sqrt{T}$ (d) T^2

24. The dispersion number of perfect mixed flow is
    (a) 0   (b) >500   (c) ∞ (d) < 2100

25. If q is interpreted to be the fraction of the feed that is liquid , then the slope of the feed line in distillation operation is:
    (a) $-\dfrac{(1-q)}{q}$
    (b) $-q$
    (c) $-\dfrac{q}{(q-1)}$
    (d) $-\dfrac{q}{(1-q)}$

26. Most distillation column are designed for reflux ratio between (where R_{min} = minimum reflux ratio)
    (a) 3 to 5 times R_{min}
    (b) 1.2 to 1.7 times R_{min}
    (c) 2 to 10 times R_{min}
    (d) 0.2 to 0.7 times R_{min}

27. Constant rate period is that drying period during which the rate of vapourization
   (a) Per unit of drying surface area is constant
   (b) Continually decreases with time
   (c) Continually increases with time
   (d) None of the above

28. The space velocity is the proper performance measure of flow reactor. The space velocity has the unit of
   (a) time
   (b) time^{-1}
   (c) velocity
   (d) velocity^{-1}

29. For the gaseous reaction $2A \rightarrow B$, where the feed consists of 50 mole% of A and 50 mole% B in inerts condition, the expansion factor is
   (a) 1   (b) -0.5   (c) -0.25   (d) 0

30. Fluid flow in a real packed bed can be approximated as
   (a) Plug flow model
   (b) Dispersion model
   (c) Mixed flow model
   (d) Tank in series model

31. To reduce the tube side pressure drop the heat exchanger recommended is :
   (a) 1-2 heat exchanger
   (b) 1-1 heat exchanger
   (c) 3-2 heat exchanger
   (d) 2-4 heat exchanger

32. Fouling factor is used
   (a) In heat exchanger design as safety factor
   (b) In case of Newtonian fluids
   (c) When a liquid exchanges heat with gas
   (d) In case of non-Newtonian fluids

33. Time constant (τ) of a first order system is equal to
   (a) Resistance of the process
   (b) Capacitance of the process
   (c) Resistance × capacitance
   (d) None of the above

34. With a damping coefficient more than 1, the second order will be
   (a) Under damped
   (b) Oscillatory
   (c) Over damped
   (d) Critically damped

35. Routh test can not be used to test the stability of a control system containing
     (a) Controller
     (b) Transportation lag
     (c) Final control element
     (d) All of the above

36. The time required for the thermometer to react to a step change in the temperature and reach the resistance corresponding to 63.2% of total temperature change is equal to
     (a) One time constant
     (b) Two time constant
     (c) Three time constant
     (d) Four time constant

37. Triangular pitch tube layout as compared to square pitch in a shell and tube heat exchange
     (a) Permits the use of less tube in a given shell diameter
     (b) Facilitates comparatively easier external cleaning because of large clearance
     (c) Permits the use of more tube in a given shell diameter
     (d) None of the above

38. Fouling factor must be included in the calculation of overall heat transfer co-efficient when the liquid
     (a) Containing suspended solid flows at low velocity
     (b) Containing suspended solids flows at high velocity
     (c) Is highly viscous
     (d) Is of high specific gravity

39. Friction factor of turbulent flow in new pipe is equal to
     (a) $\dfrac{16}{N_{Re}}$
     (b) $\dfrac{0.04}{(N_{Re})^{0.16}}$
     (c) $0.22 N_{Re}^{0.5}$
     (d) $\dfrac{40}{N_{Re}}$

40. Diameter of the distillation column is set by
     (a) Number of theoretical plates
     (b) Allowable vapour velocity
     (c) Static submergence
     (d) Length of straight rectangular weir on cross flow tray

41. LMTD correction factor is used in heat exchanger design for
     (a) Double pipe heat exchanger
     (b) Multipass shell and tube heat exchanger
     (c) Fouling fluids
     (d) Counter flow of hot and cold fluids

42. Steam is preferred to be used as a heating medium in the exchangers because of its
    (a) Low cost
    (b) High latent heat
    (c) Non corrosive condensate
    (d) High film coefficient

43. Zeolite used in water softening process (cation exchange) is regenerated by washing with
    (a) Brine   (b) chloramines
    (c) sodium bisulphate   (d) liquid chlorines

44. Production of alcohol by fermentation of molasses is an
    (a) Anaerobic process
    (b) Aerobic process
    (c) Endothermic process
    (d) None of the above

45. Black liquor is converted into the white liquor by
    (a) Evaporation and burning the concentrate followed by causticisation of products
    (b) Multi-effect evaporation only
    (c) Selective liquid extraction
    (d) Extractive distillation

46. In kraft process of paper manufacture, white cooking liquor consists of caustic soda
    (a) sodium sulphide, sodium carbonate
    (b) sodium sulphite, sodium carbonate
    (c) sodium sulphite, sodium sulphide
    (d) none of the above

47. The power number N_p is defined by

    (a) $\dfrac{n^3 D_a^5 \rho}{P g_c}$

    (b) $\dfrac{q}{n D_a^3}$

    (c) $\dfrac{p g_c}{n^3 D_a^5 \rho}$

    (d) $\dfrac{n D_a^3}{q}$

48. Power required by a centrifugal pump is proportional to {where, D = diameter, N= rpm}
    (a) $N^3 D^3$
    (b) $N D^2$
    (c) $N^3 D^2$
    (d) $N^3 D^5$

49. The loss of head due to sudden enlargement is attributed to
      (a) Viscosity of fluid
      (b) Generation of heat
      (c) Roughness of pipe
      (d) Production and dissipation of turbulent energy

50. Overall heat transfer coefficient is used in case of

      (a) Convection and radiation
      (b) Radiation and conduction
      (c) Conduction and convection
      (d) Conduction, convection and radiation

51. The heat flow through the wall can be increased by putting

      (a) Insulating material
      (b) Extra slab on the surface
      (c) Composite tube on the surface
      (d) Fins on the surface

52. In pool boiling the highest heat transfer coeeficient occurs in

      (a) Subcooled boiling zone
      (b) Nucleate boiling zone
      (c) Partial film boiling zone
      (d) Film boiling zone

53. Flash distillation is suitable for separating component which :

      (a) Boils at very close temperature
      (b) Boil at widely different temperature
      (c) Form minimum-boiling azeotrope
      (d) Form maximum-boiling azeotrope

54. At plait point for a ternary system:

      (a) The selectivity of the solvent will be unity
      (b) The distribution coefficient for solute will be unity
      (c) The density difference between the two equilibrium phases becomes zero
      (d) All of the above

55. Wetted wall tower experiment determines:

      (a) Molal diffusivity
      (b) Volumetric coefficient
      (c) Mass transfer coefficient
      (d) None of the above

56. Channelling is most severe in:

      (a) Towers packed with stacked packing
      (b) Towers packed randomly with crushed solids
      (c) Dumped packing of regular units
      (d) All of the above

57. H_2S present in naphtha reformed gas can be removed by absorbing with:

   (a) Ethanolamine
   (b) K_2CO_3
   (c) HCl
   (d) None of the above

58. Fick's law is valid for

   (a) Solids
   (b) Liquids
   (c) Gases
   (d) All of the above

59. According to Chilton-coulburn analogy for mass transfer $N_{st}N_{sc}^{2/3}$ is equal to

   (a) f
   (b) $f/2$
   (c) $2f$
   (d) $1/f$

60. Rotary driers are:

   (a) Used to make milk powder
   (b) Used to make synthetic detergent powder
   (c) Suitable for free flowing granular materials
   (d) Suitable for handling sticky materials

61. In a reaction the threshold energy is equal to

   (a) Activation energy
   (b) Activation energy + normal energy of reactants
   (c) normal energy of reactants
   (d) Activation energy- normal energy of reactants

62. Which of the following does not influence the rate of reaction:

   (a) Temperature
   (b) Concentration of reactants
   (c) Catalyst
   (d) Number of molecules of reactants

63. The rate constant of a reaction is increased by

   (a) Increasing the concentration of reactants
   (b) Increasing pressure
   (c) Increasing the temperature
   (d) Carrying the reaction for longer time

64. Equilibrium state is

   (a) Dynamic
   (b) Static
   (c) Neither dynamic nor static
   (d) Sometimes dynamic sometimes static

65. The half life period ($t_{1/2}$) of a zero order reaction A→ products is given by

    (a) $t_{1/2} = \dfrac{C_{A0}}{K}$

    (b) $t_{1/2} = \dfrac{0.693}{K}$

    (c) $t_{1/2} = \dfrac{1}{K}$

    (d) $t_{1/2} = \dfrac{C_{A0}}{2K}$

66. Back mixing is most predominant in

    (a) A well stirred batch reactor
    (b) Plug flow reactor
    (c) A single CSTR
    (d) CSTR connected in series

67. An ideal solution follows:

    (a) Boyle's law
    (b) Rault's Law
    (c) Amagat's law
    (d) Trouton's rule

68. In a chemical process the recycle stream is purged for:

    (a) Increasing the yield
    (b) To increase the conversion
    (c) Enriching the product
    (d) Limiting the inerts

69. U tube manometer is:

    (a) Half order system
    (b) Second order system
    (c) Zero order system
    (d) First order system

70. On-off controller is a special case of

    (a) P controller
    (b) P-I controller
    (c) P-D controller
    (d) PID controller

71. Cavitation

    (a) Is formation and collapse of vapour cavities
    (b) Is responsible for audible noise
    (c) Generally begins at higher static pressure and lower velocities in larger line sizes
    (d) All of the above

72. In an open channel flow can be measured by

   (a) V-notch weir
   (b) Rectangular weir
   (c) Cliplolletti weir
   (d) All of the above

73. Filter aid is used

   (a) To increase the rate of filtration
   (b) To decrease the pressure drop
   (c) To increase the porosity of cake
   (d) As a support base for the system

74. 25 percent cut segmental baffle means that the baffle

   (a) Height is 75% of the ID of the shell
   (b) Height is 25% of the ID of the shell
   (c) Spacing is 75 5 of its height
   (d) Width is 25 % of its height

75. Vertical vessels are not supported by

   (a) Brackets
   (b) Skirts
   (c) Columns
   (d) saddle

76. Producer gas mainly consists of

   (a) CO, CO_2, N_2, H_2
   (b) CO, H_2
   (c) CH_4, H_2
   (d) CO_2, C_2H_2, H_2

77. Essential oils are usually obtained using

   (a) Steam distillation
   (b) Extractive distillation
   (c) Solvent distillation
   (d) Leaching

78. The proximate analysis of coal gives

   (a) C, H_2 and ash
   (b) Volatile matter, moisture,
   (c) Ash and fixed carbon
   (d) C,H_2,S and N_2
   (e) Volatile matter, moisture, N_2, and fixed carbon

79. The volume of oxygen at STP required for complete combustion of 2 litres of CO at STP in litres is

    (a) 0.5
    (b) 1
    (c) 2
    (d) 4

80. A coarse crusher is

    (a) Crushing rolls
    (b) Gyratory crusher
    (c) Ball mill
    (d) Pin mill

81. Most suitable equipment for removing the fine dust particles (<1 micron) from air below its dew point will be

    (a) Bag filter
    (b) Electrostatic precipitator
    (c) Cyclone separator
    (d) Gravity settling chamber

82. Sugar is leached from sugar beats with

    (a) Cold water
    (b) Hot water
    (c) Sulphuric acid
    (d) Nitric acid

83. The rate of drying during constant rate period

    (a) Is unaffected by the air humidity
    (b) Increases with increased humidity
    (c) Decreases with increased humidity
    (d) Increases linearly with increase in air humidity.

84. An undesirable characteristic for the solvent used in gas absorption is

    (a) Low vapour pressure
    (b) Low viscosity
    (c) High gas solubility
    (d) None of the above

85. Molecular sieves are

    (a) Porous, synthetic zeolite crystals, metal aluminosilicates
    (b) Obtained by destructive distillation of wood
    (c) Porous form of aluminium oxide
    (d) All of the above

86. Factors which determines the amount of entrainment in a distillation column is:

   (a) Plate spacing
   (b) Depth of liquid above bubble cap slot
   (c) Vapour velocity in the column between the plates
   (d) All of the above

87. Fourdrinier machine is used in the manufacture of

   (a) Soap
   (b) Detergent
   (c) Paper
   (d) leather

88. Dry bulb temperature of unsaturated air is _____ than wet bulb temperature

   (a) Lesser
   (b) Higher
   (c) Equal
   (d) None of the above

89. If 'n' is the order of reaction then the units of rate constant are:

   (a) $\dfrac{1}{(time)(concentration)^{n-1}}$
   (b) $(time)^{-1}(concentration)^{n-1}$
   (c) $(time)^{n-1}(concentration)^{-1}$
   (d) None of the above

90. The flooding in a distillation column is detected by:

   (a) A sharp increase in pressure drop
   (b) A sharp increase in Murphee plate efficiency
   (c) A sharp decrease in pressure drop
   (d) A sharp decrease in liquid hold up in the column