THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA, VADODARA

Ph. D. ENTRANCE TEST (PET) 2025

Signature of Invigilator

Roll. No.

Paper - II
Chemical Engineering

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Maximum Marks: 50   **No. Of Printed Pages: 8**

Instruction for the Candidate:

1. This paper consists of **FIFTY (50)** multiple choice type questions. Each Question carries **ONE (1)** mark.
2. There is no Negative Marking for Wrong Answer.
3. A separate OMR Answer Sheet has been provided to answer questions. Your answers will be evaluated based on your response in the OMR Sheet only. No credit will be given for any answering made in question booklet.
4. Defective question booklet or OMR if noticed may immediately replace by the concerned invigilator.
5. Write roll number, subject code, booklet type, category and other information correctly in the OMR Sheet else your OMR Sheet will not be evaluated by machine.
6. Select most appropriate answer to the question and darken appropriate oval on the OMR answer sheet, with black / blue ball pen only. DO NOT USE PENCIL for darkening. In case of over writing on any answer, the same will be treated as invalid. Each question has exactly one correct answer and has four alternative responses (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example: (A) ● (C) (D) where (B) is correct response.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. Calculators, Log tables any other calculating devices, mobiles, slide rule, text manuals etc are NOT allowed in the examination hall. If any of above is seized from the candidates during examination time; he/ she will be immediately debarred from the examination and corresponding disciplinary action will be initiated by the Center Supervisor as deemed fit.
10. DO NOT FOLD or TEAR OMR Answer sheet as machine will not be able to recognize torn or folded OMR Answer sheet.
11. **You have to return the OMR Answer Sheet to the invigilator at the end of the examination compulsorily** and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet on conclusion of examination.

Note: This paper contains **FIFTY (50)** multiple-choice questions. Each Question carries **ONE (1)** mark.

01) The term associated with the orientation of collisions in the case of Arrhenius equation is:
A) Rate constant
B) Activation energy
C) Frequency factor
D) Molecularity

02) Which of the following dimensionless numbers involves buoyancy force?
A) Reynolds
B) Grashoff
C) Peclet
D) Stanton

03) The mechanism of heat conduction in metals is due to:
A) Longitudinal oscillations
B) Free electrons
C) Elastic deformation
D) Collision of molecules

04) The percentage of particles in the total which are within a specified size range is:
A) Differential distribution
B) Cumulative distribution
C) Integral distribution
D) Rational distribution

05) Which of the following is more appropriate in the case of plug flow?
A) $D/uL \approx 0$
B) $D/uL < 0$
C) $D/uL = 100$
D) $D/uL \rightarrow \infty$

06) Which of the following is associated with laminar flow heat transfer?
A) Dittus-Boelter
B) Colburn
C) Sieder-Tate
D) Sherwood

07) Which of the following is associated with working capital?
A) Process equipment
B) Plant utilities
C) Maintenance and repairs
D) Depreciation

08) The catalyst used in the manufacture of nitric acid is:
A) Vanadium pentoxide
B) Ferric oxide
C) Zeolite
D) Platinum-Rhodium

09) Which flow reactor gives minimum conversion per unit volume
A) Plug flow
B) Mixed flow
C) Batch
D) None of these

10) Annual depreciation costs are constant when:
A) Straight line method is used
B) Sum-of-the-years-digits method is used
C) Declining-balance method is used
D) Averaging method is used

11) Which of the following is not a cubic equation of state?
A) Margules
B) Vander Waal
C) Redlich-Kwong
D) Peng-Robinson

12) Kirchoff's law is associated with:
A) Conduction
B) Convection
C) Radiation
D) Plate heat exchangers

13) Time constant in the case of mercury in glass thermometer is equal to:
A) hA/mC_p
B) mC_p/hA
C) AR
D) V/q

14) The rate constant of the reaction depends on:
A) The reaction time
B) Initial concentration of the reactants
C) The extent of reaction
D) Reaction temperature

15) The system which permits the exchange of energy as well as mass is known as:
A) Open system
B) Closed system
C) Isolated system
D) Insulated system

16) Which of the following is true for two identical centrifugal pumps connected in series?
A) Head increases
B) Flowrate increases
C) Head decreases
D) Flowrate decreases

17) When the feed to the distillation column is saturated vapour, which of the following is true?
A) q = 0
B) q = 1
C) q > 1
D) q < 1

18) The term ash layer is associated with:
A) Thiele modulus
B) Shrinking core model
C) Progressive conversion model
D) Kunii-Levenspiel model

19) The physical significance of Prandtl number is:
A) Ratio of molecular thermal diffusivity to molecular momentum diffusivity
B) Ratio of molecular momentum diffusivity to molecular thermal diffusivity
C) Heat transfer by convection to heat transfer by conduction
D) Heat transfer by conduction to heat transfer by convection

20) The nominal and effective interest rates are equal when the interest is compounded:
A) Monthly
B) Bi-annually
C) Semi-annually
D) Annually

21) Which catalyst is used for hydrotreating?
A) Cobalt-Molybdenum
B) Platinum-Rhodium
C) Vanadium pentoxide
D) ZnO

22) The expression for Gibbs Energy is:
A) $G = U - PV$
B) $G = H - TS$
C) $G = U - TS$
D) $G = U + RT$

23) The arrangement of the liquids in the increasing order of thermal conductivity will be:
A) Mercury, Molten sodium, Water, Ethanol
B) Molten sodium, Mercury, Water, Ethanol
C) Water, Ethanol, Mercury, Molten sodium
D) Ethanol, Mercury, Molten sodium, Water

24) The statement, "For a first order system the time taken for the output to reach 63.2% of the ultimate value is called time constant" holds for which input?
A) Impulse
B) Ramp
C) Sinusoidal
D) Step

25) The phase rule for non-reacting systems is:
A) $F = 2 + \pi + N$
B) $F = 2 - \pi + N$
C) $F = 2 + \pi - N$
D) $F = 2 - \pi - N$

26) The Membrane cell process is associated with the manufacture of:
A) Caustic soda
B) Soda ash
C) Diammonium phosphate
D) Phosphoric acid

27) The reason for reduction in heat transfer in shell & tube heat exchangers due to cooling water is:
A) Corrosion
B) Erosion
C) Fouling
D) Clogging

28) Which of the following is an intensive entity?
A) Normality
B) Moles
C) Volume
D) Mass

29) For an under-damped second order system, which of the following is correct?
A) Decay ratio = Overshoot
B) Decay ratio = $(\text{Overshoot})^3$
C) Decay ratio = $(\text{Overshoot})^2$
D) Decay ratio = $(\text{Overshoot})^{1/2}$

30) The term dihydrate is associated with:
   A) Hydrochloric acid
   B) Sulfuric acid
   C) Nitric acid
   D) Phosphoric acid

31) Which of the following is not correct in the case of baffles in a shell and tube heat exchanger:
   A) Supports tube-sheets
   B) Increases heat transfer
   C) Supports tubes
   D) Induces turbulence

32) Sulfur and nitrogen based compounds decrease the catalytic activity by
   A) Fouling
   B) Sintering
   C) Erosion
   D) Poisoning

33) A binary system forms an azeotrope if:
   A) $\alpha_{12} = 1$
   B) $\alpha_{12} = 0$
   C) $\alpha_{12} < 1$
   D) $\alpha_{12} = \infty$

34) The Laplace transform of unit impulse input is:
   A) S
   B) 1/S
   C) 1
   D) S^2

35) The flow is considered to be turbulent if:
   A) NRe < 1100
   B) NRe < 2100
   C) 2100 < NRe < 4000
   D) NRe > 4000

36) According to the penetration theory, the mass transfer coefficient is directly proportional to:
   A) D_{AB}
   B) $(D_{AB})^2$
   C) $(D_{AB})^{1.5}$
   D) $(D_{AB})^{0.5}$

37) The term associated with NPSH in the case of centrifugal pumps is:
   A) Cavitation
   B) Erosion
   C) Sintering
   D) Sedimentation

38) Which of the following falls in the category of area meters?
   A) Rotameter
   B) Orificemeter
   C) Venturimeter
   D) Pitot tube

39) Which of the following is used as an antipyretic?
   A) Paracetamol
   B) Penicillin
   C) Chloroquine phosphate
   D) Ibuprofen

40) At total reflux the capacity of the distillation column is:
   A) Zero
   B) Maximum
   C) Minimum
   D) Optimum

41) As the chemical reaction advances, the rate:
   A) Increases
   B) Decreases
   C) Remains constant
   D) Becomes unpredictable

42) The steady state gain term in the transfer function arises due to:
   A) Dimensional inconsistency
   B) Experimental error
   C) Nonlinearity
   D) Periodicity

43) Preparation of tea and coffee are examples of:
   A) Absorption
   B) Leaching
   C) Adsorption
   D) Extraction

44) Which of the following is a second order system?
   A) Mercury manometer
   B) CSTR following first order kinetics
   C) Liquid level in tank
   D) Simple pendulum

45) For steady state equimolar counter diffusion of two gases A and B, the ratio $N_A/(N_A + N_B)$ will be:
A) 0
B) 1
C) ∞
D) 0.5

46) Friction due to formation of wakes is called:
A) Skin friction
B) Form friction
C) Disc friction
D) Wall friction

47) For critically damped second order system, the damping coefficient will be:
A) Equal to 1
B) Greater than 1
C) Less than 1
D) Equal to zero

48) Which of the following is a thermosetting polymer?
A) Polystyrene
B) Polypropylene
C) Bakelite
D) PTFE

49) DEW P calculation means:
A) To calculate y and T for given x and P
B) To calculate x and P for given y and T
C) To calculate y and P for given x and T
D) To calculate x and T for given y and P

50) The raw material used for manufacturing phenol is:
A) Cumene
B) Ethylbenzene
C) Toluene
D) Ethylene

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Rough Work: