PGCET-2014

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DAY and TIME	COURSE	SUBJECT
DAY-1 10.30 am to 12.30 pm SESSION : FORENOON	ME/M.Tech/M.Arch courses offered by VTU/UVCE/UBDTCE	CHEMICAL ENGINEERING

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
100	150 MINUTES	120 MINUTES

MENTION YOUR PGCET NO.					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					A - 3	120075

DOs :

1. Check whether the PGCET No. has been entered and shaded in the respective circles on the OMR answer sheet.
2. Ensure whether the circles corresponding to course and the specific branch have been shaded on the OMR answer sheet.
3. This Question Booklet is issued to you by the invigilator after the **2nd Bell i.e., after 10.25 a.m.**
4. The Serial Number of this question booklet should be entered on the OMR answer sheet.
5. The Version Code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
6. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts :

1. **THE TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET SHOULD NOT BE DAMAGED / MUTILATED / SPOILED.**
2. The **3rd Bell rings at 10.30 a.m., till then;**
   - Do not remove the paper seal / polythene bag of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 75 (items) questions and each question will have one statement and four answers. (Four different options / responses.)
2. After the **3rd Bell is rung at 10.30 a.m.,** remove the paper seal / polythene bag of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
3. During the subsequent 120 minutes:
   - Read each question (item) carefully.
   - Choose one correct answer from out of the four available responses (options / choices) given under each question / item. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **only one response** for each item.
   - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALL POINT PEN against the question number on the OMR answer sheet.**
4. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
5. After the **last Bell is rung at 12.30 pm,** stop marking on the OMR answer sheet and affix your **left hand thumb impression** on the OMR answer sheet as per the instructions.
6. Hand over the **OMR ANSWER SHEET** to the room invigilator as it is.
7. After separating the top sheet, the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
8. Preserve the replica of the OMR answer sheet for a minimum period of **ONE year**.
9. Only **Non-programmable** calculators are allowed.

Marks Distribution

PART-1 : 50 QUESTIONS CARRY ONE MARK EACH (1 TO 50)
PART-2 : 25 QUESTIONS CARRY TWO MARKS EACH (51 TO 75)

CHEMICAL ENGINEERING

PART – 1

Each question carries one mark. **(50 × 1 = 50)**

1. Pressure drop in a packed bed for turbulent flow is given by _____ equation.
   (A) Kozeny – Karman (B) Blake – Plummer
   (C) Leva's (D) Hagen – Poiseulle's

2. Weber number is the ratio of inertial force to _____ force.
   (A) Surface tension (B) Gravity
   (C) Viscous (D) Elastic

3. For efficient grinding, ball mills must be operated
   (A) at a speed more than the critical speed
   (B) at a speed less than the critical speed
   (C) at a speed equal to the critical speed
   (D) with minimum possible small balls

4. Ribbon blenders are exclusively meant for
   (A) Blending miscible liquids (B) Non flowing powder & their pastes
   (C) Batch mixing (D) Continuous mixing

5. The function of gypsum addition during cement making is to
   (A) Increase the density of cement (B) Decrease the cement setting rate
   (C) Both (A) & (B) (D) Neither (A) nor (B)

6. _____ is produced using molasses.
   (A) Benzol (B) Dimethyl ether
   (C) Methyl alcohol (D) Ethyl alcohol

7. Ultrafine grinders operates principally by
   (A) Slow compression (B) Impact
   (C) Attrition (D) Cutting

Space For Rough Work

8. Chemical name of Soda ash is

(A) Sodium bicarbonate
(B) Sodium thiosulphate
(C) Potassium carbonate
(D) None of these

9. Cascade control means

(A) Feed forward control
(B) More than one feedback loop
(C) On – off control
(D) One feedback loop

10. For multicomponent multiple phases to be in equilibrium at the same pressure and temperature the _____ of each component must be same in all phases.

(A) Chemical potential
(B) Fugacity
(C) Both (A) & (B)
(D) Neither (A) nor (B)

11. A stable system is the one

(A) For which the output response is bounded for all bounded inputs
(B) Which exhibits an unbounded response to a bounded input
(C) Which satisfies the conditions for a servo problem
(D) None of these

12. In a shell and tube heat exchanger, the outlet temperature of heating / cooling fluid is the _____ variable.

(A) Load
(B) Manipulated
(C) Controlled
(D) None of these

13. From collision theory, the reaction rate constant is proportional to

(A) $\exp (- E / RT)$
(B) $\exp (- E / 2RT)$
(C) T
(D) $T^m \exp (- E / RT)$

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14. A space time of 3 hours for a flow reactor means that

(A) the time required to process one reactor volume of feed is 3 hours

(B) three reactor volumes of feed can be processed every hour

(C) it takes three hours to dump the entire volume of the reactor with feed

(D) conversion is cent percent after three hours

15. When the damping coefficient is unity, the system is

(A) Overdamped (B) Criticallydamped

(C) Underdamped (D) Highly fluctuating

16. The purpose of nitriding the steel is to

(A) Harden its surface (B) Soften its surface

(C) Improve its reliability (D) None of these

17. 18/8 steel is a/an _____ stainless steel.

(A) Austenitic (B) Ferritic

(C) Martensitic (D) None of these

18. The depreciation during the year 'n', in declining balance method of depreciation calculation is calculated by multiplying a fixed percentage 'N' to the

(A) Initial cost

(B) Book value at the end of (n – 1)th year

(C) Depreciation during the (n – 1)th year

(D) Difference between initial cost and salvage value

19. Entropy change in case of reversible adiabatic process is

(A) minimum (B) zero

(C) maximum (D) indeterminate

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20. "Break – even point" is the point of intersection of

(A) Fixed cost and total cost
(B) Total cost & sales revenue
(C) Fixed cost & sales revenue
(D) None of these

21. 'Six tenth factor' rule is used for estimating

(A) Equipment cost by scaling
(B) Equipment installation cost
(C) Cost of piping
(D) Cost of utilities

22. The exit age distribution curve E(t) for an ideal CSTR with the average residence time, τ is given by

(A) $e^{-t/\tau}$
(B) $e^{-t/\tau} / \tau$
(C) $1 - e^{-t/\tau}$
(D) $1 - (e^{-t/\tau} / \tau)$

23. 'n' number of plug flow reactors in series with a total volume 'V' gives the same conversion as one plug flow reactor of volume

(A) V / n
(B) V
(C) V . n
(D) I / V

24. Cast iron has very high

(A) Compressive strength
(B) Ductility
(C) Shock resistance
(D) Resistance to brittleness

25. For a mixed flow reactor operating at steady state, the rate of reaction is given by

(A) $F_{AO}/V - d\,C_A/dt$
(B) $F_{AO}/V + d\,C_A/dt$
(C) $F_{AO} \cdot X_A / V$
(D) $-d\,C_A / dt$

26. 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°

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27. Compressibility factor of a real gas is the ratio of the actual volume to that predicted by ideal gas law. As the pressure of the gas approaches zero, the compressibility factor approaches

(A) ∞ (B) 0

(C) 1 (D) 0.24

28. How many phases are present at eutectic point ?

(A) 1 (B) 2

(C) 3 (D) None of these

29. A vapour whose partial pressure is less than its equilibrium vapour pressure is called the _____ vapour.

(A) Saturated (B) Super heated

(C) Unsaturated (D) Dry gaseous

30. Fourier's law applies to the heat transfer by

(A) Convection (B) Radiation

(C) Conduction (D) All (A), (B) & (C)

31. Fouling factor

(A) is a dimensionless quantity

(B) does not provide a safety factor for design

(C) accounts for additional resistance to heat flow

(D) None of these

32. Flooding in a vapour liquid contacting equipment occurs in a tray, when the pressure drop through a tray is _____ the liquid head available in the down comer.

(A) less than (B) more than

(C) same as (D) very much less

Space For Rough Work

33. Milk is usually dried in a _____ dryer.

(A) Freeze (B) Spray

(C) Tray (D) Rotary

34. Which of the following is used to decolourise yellow glycerine ?

(A) Silica gel (B) Alumina

(C) Fuller's earth (D) Activated carbon

35. For an ideal black body

(A) Absorptivity = 1 (B) Reflectivity = 1

(C) Emissivity = 0 (D) Transmissivity = 1

36. 25 percent cut segmented baffle means that the baffle

(A) Height is 75% of the I.D. of the shell

(B) Height is 25% of the I.D. of the shell

(C) Spacing is 75% of its height

(D) Width is 25% of its height

37. A pipe is defined as hydraulically smooth if the friction factor

(A) is not a function of Reynolds number

(B) for a given Reynolds number remains constant even on further smoothening of the pipe

(C) is zero irrespective of the Reynolds number

(D) None of these

38. Third law of thermodynamics is concerned with the

(A) Value of absolute entropy (B) Energy transfer

(C) Direction of energy transfer (D) None of these

Space For Rough Work

39. Leiden frost point is a term concerned with the

(A) Condensation of the saturated vapour on a cold surface

(B) Concentration of a corrosive solution by evaporation

(C) Heat transfer between two highly viscous liquids

(D) Boiling of a liquid on a hot surface

40. Grashoff number is defined as the ratio of the

(A) Buoyancy to inertial forces

(B) Buoyancy to viscous forces

(C) Inertial to viscous forces

(D) Buoyancy to surface tension forces

41. In a distillation column, with increase in the reflux ratio, the heat removed in the cooler

(A) Increases (B) Decreases

(C) Remains unaffected (D) Heat required in reboiler decreases

42. The coefficient of discharge of an orifice is usually

(A) 0.42 (B) 0.62

(C) 0.82 (D) 0.98

43. For the same terminal conditions and valve size, the pressure drop in a fully opened globe valve as compared to that in a gate valve is

(A) more (B) less

(C) equal (D) depends on viscosity of the fluid

44. With increase in the capacity of screens, the screen effectiveness

(A) Remain unchanged (B) Increases

(C) Decreases (D) Decreases exponentially

Space For Rough Work

45. Reduced pressure of a gas is the ratio of its
(A) Pressure to critical pressure
(B) Critical pressure to pressure
(C) Pressure to pseudo critical pressure
(D) Pseudo critical pressure to pressure

46. Filtration should be stopped in a filter press, if
(A) Cake becomes very dense
(B) Liquor stops flowing out to the discharge
(C) Filtration pressure rises suddenly
(D) Both (B) & (C)

47. Styrene is produced from ethyl benzene by the process of
(A) Dehydrogenation (B) Oxidation
(C) Alkylation (D) Dehydration

48. The expression nRT In (P1/P2) is for the _____
(A) Compressibility
(B) Work done under adiabatic condition
(C) Work done under isothermal condition
(D) Coefficient of thermal expansion

49. In which of the following unit operations, the selectivity is an important parameter ?
(A) Distillation (B) Solvent extraction
(C) Absorption (D) None of these

50. As the reflux ratio increases, the slope of the operating line for rectifying section.
(A) Increases
(B) Decreases
(C) Remains constant
(D) Cannot be predicted from above information

Space For Rough Work

PART – 2

Each question carries two mark. **(25 × 2 = 50)**

51. The initial valve (t=0) of the unit step response of the transfer function [(S + 1) / (2S + 1)] is

(A) 0 (B) 1/2

(C) 4 (D) 2

52. 1 m^3 of an ideal gas at 500 K and 1000 kPa expands reversibly to 5 times its initial volume in an insulated container. If the specific heat capacity (at constant pressure) of the gas is 21 J/mol . K, the final temperature will be

(A) 35 K (B) 174 K

(C) 274 K (D) 154 K

53. The thermal radiative flux from a surface of emissivity 0.4 is 22.68 KW/m^2.

The approximate surface temperature (K) is _____

(Stefan – Boltzman constant = 5.67×10^{-8} $w/m^2 K^4$)

(A) 1000 (B) 727

(C) 800 (D) 1200

54. In a closed loop system, the process to be controlled is an integrating process with transfer function 1/2S. The controller proposed to be used in an integral controller with transfer function $1 / \tau_1 S$. When a step change in set point is applied to such a closed loop system, the controlled variable will exhibit

(A) Overdamped response (B) Underdamped response

(C) Undamped response (D) Unstable response

55. For the reversible reaction $A \leftrightarrow 2B$, if the equilibrium constant K is 0.05 mol/litre, starting from 2 moles of A and zero moles of B, how many moles of B will be formed at equilibrium ?

(A) 0.253 (B) 0.338

(C) 0.152 (D) 0.637

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56. The following half life data are available for the irreversible liquid phase reaction A → products :

Initial concentration k mol / m^3	Half – life
2	2
8	1

The overall order of reaction is

(A) 0.5 (B) 1
(C) 1.5 (D) 2

57. A machine has an initial value of ₹ 5000, service life 5 years and final salvage value of ₹ 1000. The annual depreciation cost by straight line method is ₹.

(A) 300 (B) 600
(C) 800 (D) 1000

58. Due to a 20% drop in the product selling price the pay back period of a new plant increased to 1.5 times that estimated initially the production cost and the production rate remaining unchanged. If the production cost is Cp and the zero selling price is Cs then Cp / Cs is

(A) 0.2 (B) 0.4
(C) 0.5 (D) 0.6

59. A wall has two layers of materials A and B; each made of a different material. Both the layers have the same thickness. The thermal conductivity of material. A is twice that of B. Under the equilibrium, the temperature difference across the wall is 36 °C. The temperature difference across the layer A is _____ °C.

(A) 6 (B) 12
(C) 18 (D) 24

Space For Rough Work

60. In a solution containing 0.30 k mol of solute and 600 kg of solvent, the molality is

(A) 0.5 (B) 0.6

(C) 2 (D) 1

61. In a binary distillation column, if the feed contains 40 mole % vapour, the q – line will have a slope of

(A) 1.5 (B) – 0.6

(C) – 1.5 (D) 0.6

62. The accumulation in a steady state combustion process, burning 1 k mol of carbon with 1 k mol of oxygen thereby producing 1 k mol of carbon dioxide, is _____ k mol.

(A) 1 (B) 0

(C) 16 (D) 44

63. For a current carrying wire of 20 mm diameter exposed to air ($h = 25\ w/m^2\ K$), maximum heat distribution occurs when the thickness of insulation ($k = 0.5\ w/mK$), is

(A) 20 mm (B) 10 mm

(C) 1.5 mm (D) 0 mm

64. The unit impulse response of a unit feedback control system is given by

(A) $(S + 1) / (S + 2)^2$ (B) $(2S + 1) / S^2$

(C) $(S + 1) / (S + 1)^2$ (D) $(S + 1) / S^2$

65. For the gaseous reaction $2A \rightarrow B$ where the feed consists of 50 mol % of A and 50 mole % B with on inerts, the expansion factor is

(A) 1 (B) – 0.5

(C) – 0.25 (D) 0

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66. The Newton Raphson method is used to solve the equation $(x-1)^2 + x - 3 = 0$.

The method will fail in the very first iteration if the initial guess is

(A) Zero (B) 0.5

(C) 1 (D) 3

67. The general solution of the differential equation $d^2y/dx^2 - dy/dx - 6y = 0$ with C_1 and C_2 as constants of integration is

(A) $C_1 e^{-3x} + C_2 e^{-2x}$ (B) $C_1 e^{3x} + C_2 e^{-2x}$

(C) $C_1 e^{3x} + C_2 e^{2x}$ (D) $C_1 e^{-3x} - C_2 e^{2x}$

68. A liquid mixture of benzene and toluene is in equilibrium with its vapour at 101 KPa and 373 K. The vapour pressures of benzene and toluene at 373 K are 156 and 63 KPa respectively. Assuming that the system obeys Raoult's law, the mole fraction of benzene in the liquid phase is

(A) 0.65 (B) 0.04

(C) 0.065 (D) 0.41

69. What is the Laplace transform of sin t ?

(A) $1 / (S^2 + 1)$ (B) $S / (1 + S^2)$

(C) $1 / (S^2 - 1)$ (D) $S / (S^2 - 1)$

70. 1 kcal / kg. °C is equivalent to _____ BTU / lb. °F.

(A) 1 (B) 2.42

(C) 4.97 (D) None of these

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71. A flue gas produced on burning furnace oil contain 0.15 gm mole of CO_2, 0.05 g mol of oxygen & 0.80 gm mole of N_2. What is its molecular weight ?

(A) 28.6 (B) 30.0

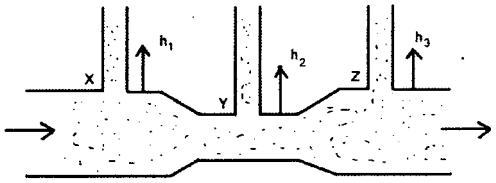
(C) 30.6 (D) 32.6

72. Hot water (0.01 m^3/min) enters the tube side of a counter current shell and tube heat exchanger at 80 °C and leaves at 50 °C. Cold oil (0.05 m^3/min) of density 800 kg/m^3 and specific heat of 2 kJ/kg. K enters at 20 °C. The log mean temperature difference in °C is approximately

(A) 32 (B) 37

(C) 45 (D) 50

73. For flow through a venturi at a particular discharge, the correct relationships among heads at points X, Y and Z are



(A) $h_1 > h_2 < h_3$ (B) $h_1 > h_2 > h_3$

(C) $h_2 < h_1 < h_3$ (D) $h_1 < h_2 < h_3$

74. On mixing 56 gm of CaO with 63 gm of HNO_3, the amount of $Ca(NO_3)_2$ formed is _____ gm.

(A) 82 (B) 164

(C) 41 (D) 8.2

75. A gas mixture contains 6 moles of H_2 and 2 moles of N_2. If the total pressure of the gaseous mixture is 4 kgf/cm^2, then the partial pressure of N_2 in the mixture will be _____ kgf/cm^2.

(A) 1 (B) 2

(C) 4 (D) 8

Space For Rough Work

A-3