POST GRADUATE COMMON ENTRANCE TEST-2016

DATE and TIME	COURSE	SUBJECT
03-07-2016 2.30 p.m. to 4.30 p.m.	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 - 1	208502

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 2.25 p.m.
4. The Serial Number of this question booklet should be entered and the respective circles should also be shaded completely 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 on the OMR answer sheet.
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 2.30 p.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 2.30 p.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.**

   Correct Method of shading the circle on the OMR answer sheet is as shown below :

   Ⓐ ● Ⓒ Ⓓ

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 4.30 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. Handover the **OMR ANSWER SHEET** to the room invigilator as it is.
7. After separating the top sheet (KEA copy), 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)

CH-A1

CHEMICAL ENGINEERING
PART – 1
Each question carries one mark. (50 × 1 = 50)

1. In a reversible isothermal process, the change in internal energy is

   (A) Positive

   (B) Negative

   (C) Zero

   (D) None of these

2. The densities of liquid and vapour of a substance become equal at its

   (A) Triple point

   (B) Boiling point

   (C) Critical point

   (D) None of these

3. The efficiency of Carnot reversible engine does not depend on

   (A) Working substance

   (B) Temperature of hot reservoir

   (C) Temperature of sink

   (D) All of these

4. When a liquid is converted into vapour, the entropy

   (A) Becomes zero

   (B) Decreases

   (C) Increases

   (D) Remains same

5. In the cross current extraction of immiscible liquid-liquid system, the slope of operating line for each stage is

   (A) Zero

   (B) Positive

   (C) Negative

   (D) Cannot be defined

6. Cavitation is caused by

   (A) High velocity

   (B) Low barometric pressure

   (C) High pressure

   (D) Low pressure

Space For Rough Work

7. The drag co-efficient for laminar flow varies as (where Re = Reynolds number)

   (A) Re

   (B) Re^{-1}

   (C) $Re^{0.5}$

   (D) $Re^{-0.5}$

8. In a flow field, at stagnation point

   (A) Pressure is zero.

   (B) Total energy is zero.

   (C) Pressure head is equal to velocity.

   (D) All the velocity head is converted to pressure head.

9. A fluid in which resistance to deformation is independent of the shear stress is called

   (A) Bingham plastic

   (B) Pseudo plastic

   (C) Dilatant

   (D) Newtonian

10. Head loss due to a sudden enlargement in a pipe is

    (A) $(v_1^2 - v_2^2)/2g$

    (B) $(v_1 - v_2)^2/2g$

    (C) $(v_1 - v_2)^2/g$

    (D) $(v_1^2 - v_2^2)/g$

11. Critical speed of a trommel (N) is related to its diameter (D) as

    (A) $N \propto 1/\sqrt{D}$

    (B) $N \propto \sqrt{D}$

    (C) $N \propto D$

    (D) $N \propto 1/D$

12. Filter aid is used

    (A) To increase the rate of filtration

    (B) To decrease the pressure drop

    (C) To increase the porosity of the cake

    (D) As support base for the system

Space For Rough Work

13. For a cylindrical particle whose length equals the equivalent diameter, the sphericity is

(A) < 1

(B) √2

(C) 2

(D) 1

14. Cyclones are used primarily for separating

(A) Liquids from liquids

(B) Solids from fluids

(C) Solids from solids

(D) All of these

15. Paddle agitator

(A) Is suitable for mixing low viscosity liquids

(B) Produces axial flow

(C) Moves at very high speed

(D) None of these

16. Lug support is most suitable for

(A) Large horizontal cylindrical vessels

(B) Tall but empty vessels

(C) Small vessels

(D) None of these

17. Diameter of the distillation column is set by

(A) Number of theoretical plates

(B) Allowable vapour velocity

(C) Static submergence

(D) Length of the straight rectangular weir on the cross flow tray

18. The equivalent diameter of an annulus for heat transfer would be

(A) $(D_2{}^2 - D_1{}^2)/D_1$

(B) $D_2 - D_1$

(C) $(D_2{}^2 - D_1{}^2)/D_2$

(D) None of these

Space For Rough Work

19. In declining balance method of depreciation calculation

(A) Value of the asset decreases linearly with time

(B) Annual cost of depreciation is same every year

(C) Annual depreciation is the fixed percentage of the property value at the beginning of the particular year

(D) None of these

20. Internal rate of return is that discount rate which makes the value of net present value equal to

(A) Zero

(B) 1

(C) Some positive value

(D) Some negative value

21. Penicillin is separated from fermented broth by

(A) Extraction with amyl or butyl acetate

(B) Ternary azeotropic distillation

(C) Evaporation in calendria

(D) Extractive distillation

22. The presence of sodium sulphate in pulp

(A) Makes the pulp bleachability easier

(B) Reduces strength of paper

(C) Makes the pulp bleaching poor

(D) None of these

23. The hydrogenation of oils in presence of nickel catalyst is a/an

(A) Endothermic reaction

(B) Exothermic reaction

(C) Homogenous reaction

(D) None of these

24. Advantage of emulsion polymerisation is

(A) Easiness of temperature control

(B) High rate of process

(C) Homogeneity of the polymer

(D) All of these

Space For Rough Work

25. Nylon-6 is a

(A) Polyamide

(B) Thermosetting resin

(C) Polyester

(D) None of these

26. The power number depends on

(A) The angle at which liquid leaves the impeller

(B) Ratio of the tangential liquid velocity at the blade tip to the blade tip velocity

(C) Ratio of the width of blades to impeller diameter

(D) All of these

27. Ratio of inertial forces and the square root of pressure forces is known as

(A) Euler number

(B) Weber number

(C) Froude number

(D) Mach number

28. The degree(s) of freedom when water is in equilibrium with mixture of water vapour and nitrogen is

(A) Zero

(B) 1

(C) 2

(D) 3

29. For laminar flow in a pipe, average velocity (U_{avg}) is equal to

(A) U_{max}

(B) $0.5 U_{max}$

(C) $0.25 U_{max}$

(D) $2 U_{max}$

30. $Nu = $ (constant) $Re^m Pr^n$ represents heat transfer under

(A) Free convection

(B) Forced convection

(C) Combined convection

(D) None of these

Space For Rough Work

31. Free energy change at equilibrium is

    (A) Zero

    (B) Positive

    (C) Negative

    (D) None of these

32. The ratio energy transferred by convection to that by conduction is called

    (A) Stanton number

    (B) Nusselt number

    (C) Biot number

    (D) Peclet number

33. In a shell and tube heat exchanger, baffles are provided on the shell side to

    (A) Prevent the stagnation of shell side fluid

    (B) Improve heat transfer

    (C) Provide support for the tubes

    (D) All of these

34. In a long cylindrical rod of radius 'R' and a surface heat flux of 'q_o', the uniform internal heat generation rate is

    (A) $2q_o/R$

    (B) $2q_o$

    (C) q_o/R

    (D) q_o/R^2

35. Stanton number is a ratio of Nusselt number to

    (A) Reynolds number

    (B) Prandtl number

    (C) Product of Reynolds and Prandtl number

    (D) None of these

36. The unit of diffusion co-efficient is

    (A) m^2/s

    (B) m/s

    (C) mol/m^2s

    (D) None of these

Space For Rough Work

37. Fick's law is valid for molecular diffusion in

(A) Solids

(B) Liquids

(C) Gases

(D) All of these

38. The rate of leaching depends on

(A) The particle size

(B) The temperature

(C) The agitation

(D) All of these

39. For a drum dryer

(A) The heat transfer is a controlling factor.

(B) Diffusion is controlling factor.

(C) Both (A) and (B)

(D) None of these

40. Minimum number of ideal stages are required in a fractionating column, when the reflux ratio is equal to

(A) Minimum reflux ratio

(B) Optimum reflux ratio

(C) Zero

(D) Infinity

41. Offset is zero for

(A) P- controller

(B) PD controller

(C) P and PD controller

(D) PI and PID controller

42. The amplitude ratio (AR) for the sinusoidal response of a first order system is always

(A) < 1

(B) > 1

(C) 1

(D) 0

43. Thermopile is used for the measurement of

(A) Current

(B) e.m.f.

(C) Temperature

(D) Flow rate

Space For Rough Work

44. Mechanical measurements are classified into

(A) Mechanical type

(B) Power type

(C) Both (A) and (B)

(D) None of these

45. _____ has highest thermal conductivity.

(A) Air

(B) Water

(C) Oxygen

(D) Hydrogen

46. Enzymes are

(A) Hemoglobins

(B) Proteins

(C) Micro-organisms

(D) Fungi

47. A characteristic of an ideal plug flow reactor is

(A) Axial dispersion

(B) Uniform mixing

(C) Flat velocity profile

(D) None of these

48. The half-life period $(t_{1/2})$ and the rate constant (k) of a first order reaction are related by

(A) $t_{1/2} = k$

(B) $t_{1/2} = 2.303/k$

(C) $t_{1/2} = 0.693/k$

(D) $t_{1/2} = 7.67/k$

49. Equilibrium of a chemical reaction when the system is at _____ as viewed by kinetics.

(A) Dynamic steady state

(B) Static steady state

(C) Dynamic unsteady state

(D) None of these

50. Rate of gaseous reaction is given by $-dP_A/dt = k\, P_A^2$, the unit of rate constant is

(A) atm^{-1}

(B) hr^{-1}

(C) $atm^{-1}.hr^{-1}$

(D) $atm.hr^{-1}$

Space For Rough Work

51. A wet solid containing 25% moisture content is dried with hot air to reduce moisture content to 20%. If the bone dry solid quantity is 100 kg, how much water is evaporated ?
    (A) 5 kg
    (B) 3.75 kg
    (C) 4.25 kg
    (D) 4 kg

52. 6 kg of C is burnt with excess air. The flue gases contain 4.4 kg of CO_2 and the rest of carbon in the form of CO. What is the amount of CO formed ?
    (A) 5.6 kg
    (B) 11.2 kg
    (C) 8.4 kg
    (D) 17.6 kg

53. An ideal gas mixture contains 20% methane, 10% O_2 and the rest N_2. If 10 kmol of this mixture is burnt with 20% excess air, find the number of kmol of CO_2 formed if 10% carbon is burnt to CO and the conversion in the process is 90%.
    (A) 1.8
    (B) 0.81
    (C) 1.62
    (D) None of these

54. The equation of state for a gas is given by : PV = RT + aP, where 'a' is a positive constant, $(\partial U/\partial V)_T$ is equal to
    (A) P

    (B) aP

    (C) Zero

    (D) (a – 1)P

55. The heat of formation of CO as per the following reaction scheme is

    $C + O_2 \rightarrow CO_2$ $\qquad \Delta H = -94$ kcal

    $CO + \frac{1}{2} O_2 \rightarrow CO_2$ $\quad \Delta H = -67.6$ kcal

    (A) ΔH_f (for CO_2 from C) – ΔH_f (for CO_2 from CO)

    (B) –26.4 kcal

    (C) Both (A) and (B)

    (D) None of these

Space For Rough Work

56. An equimolar mixture of Benzene and Toluene is contained in a piston and cylinder assembly at temperature T. What is the maximum pressure (in mm Hg) below which the mixture exists as vapour phase alone ? At the given temperature vapour pressures of benzene and toluene are 1530 and 640 mm Hg respectively. Assume the system is ideal.

(A) 1035

(B) 890

(C) 1085

(D) 1280

57. A 10 kg of solid ($C_p = 0.8$ kJ/kg°C) is immersed in 40 kg of liquid ($C_p = 4$ kJ/kg°C) at temperature 20 °C. The temperature of the system after a very long time (if the system is well insulated) will be

(A) 26

(B) 24

(C) 30

(D) 28

58. A furnace is made of a red brick wall of thickness 0.5 m and conductivity 0.7 W/mK. For the same heat loss and temperature drop, this wall can be replaced by a layer of diatomic earth of conductivity 0.14 W/mK, and its thickness (in metres) will be

(A) 0.5

(B) 0.1

(C) 0.2

(D) 1.0

59. The Fourier law of heat conduction presumes

1. Steady state conditions

2. Constant value of thermal conductivity

3. Uniform temperature at wall surfaces

4. One-dimensional heat flow

(A) 1, 2 and 3 are correct.

(B) 1, 2 and 4 are correct.

(C) 2, 3 and 4 are correct.

(D) 1, 3 and 4 are correct.

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60. The radiative heat transfer rate per unit area (W/m^2) between two plane parallel grey surfaces (emissivity = 0.9) maintained at 400 K and 300 K is

   $(\sigma = 5.67 \times 10^{-8} W/m^2K^4)$

   (A) 992

   (B) 812

   (C) 464

   (D) 567

61. The diffusivity of a gas increases by _____ times, if absolute temperature is increased by 2 times and the pressure decreased to 1/2 of its original value.

   (A) $2^{2.5}$

   (B) $2^{3.0}$

   (C) 2

   (D) $2^{1.5}$

62. For equimolar counter diffusion of two gases 'A' and 'B' the ratio of $N_A/(N_A + N_B)$ is equal to

   (A) Zero

   (B) 1

   (C) 0.5

   (D) ∞

63. A binary liquid mixture of A and B (relative volatility = 1.5) containing 60 mol% A is flash vaporized. If 40% of the feed is vaporized the mole fraction of A in the liquid and vapour products respectively is

   (A) 0.25, 0.85

   (B) 0.5, 0.75

   (C) 0.15, 0.90

   (D) 0.4, 0.8

64. A certain thermocouple has a specific time constant of 2 seconds. If process temperature abruptly changes from 800 to 900 °C, then the temperature in an indicator attached to the thermocouple after 6 seconds will be approximately

   (A) 660 °C

   (B) 900 °C

   (C) 890 °C

   (D) 895 °C

65. A System has the transfer function : $Y/X = 10 / (S^2 + 1.6S + 4)$, a step input of 4 units magnitude is introduced in this system. The percent overshoot is

   (A) 20

   (B) 30

   (C) 25

   (D) 35

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66. A second order under damped system has a damping factor of 0.8. If a sinusoidal input of unit amplitude is applied, then the resonant peak of the output will be

   (A) 25%

   (B) 110%

   (C) 91%

   (D) None of these

67. A plant has a capacity of producing 25,000 units per year. The annual fixed cost is ₹ 90,000. The variable cost per unit is ₹ 16. The price of the product is ₹ 20 per unit. The break even point in terms of capacity of the plant will be

   (A) 20%

   (B) 70%

   (C) 80%

   (D) 90%

68. A production equipment costs ₹ 2 lakhs. Its salvage value is ₹ 20,000. The expected return is ₹ 50,000 per annum. The corporate taxes are 40%. The payback period (in years) will be

   (A) 4

   (B) 6

   (C) 8

   (D) 10

69. The present worth of a cash flow of ₹ 14,611 during the fourth year with an interest rate of 10% is

   (A) ₹ 10,000

   (B) ₹ 21,436

   (C) ₹ 11,000

   (D) ₹ 12,458

70. An irreversible gas reaction is given by $2A \rightarrow 3B$. Feed consists of 40% A, 20% B and the rest is inert. The fractional change in volume (ε_A) is given by

   (A) 0.5

   (B) 0.2

   (C) 0.4

   (D) 0.6

71. In a chemical reaction $X + Y + Z \rightarrow P$, the rate of formation of P

   1. Is doubled on doubling the concentration of X

   2. Is quadrupled on doubling the concentration of Y

   3. Is unchanged on doubling the concentration of Z

   Then the order of the reaction is

   (A) 1

   (B) 2

   (C) 3

   (D) 0

Space For Rough Work

72. For multiple reactions $2A \rightarrow R$ and $2R \rightarrow S$, what is the number of moles of S present when the number of moles of A and R are 0.3 and 0.5 respectively ? (Only 2 moles of A were present initially.)

(A) 0.125

(B) 0.175

(C) 0.535

(D) 0.355

73. The intercept and slope on a Eadie-Hofstee plot for a competitive inhibitor are (K_M = Michaelis constant, V_M = Maximum reaction velocity, K_I = Dissociation constant of enzyme-inhibitor complex)

(A) $V_M/(1 + I/K_I), -K_M$

(B) $V_M/(1 + I/K_I), K_M$

(C) $V_M, -K_M$

(D) $V_M, -K_M(1 + I/K_I)$

74. What is the exit concentration of reactant A for a zero order reaction taking place in a CSTR with the following data ? (Rate constant = 1 mol/lit.min, Reactor volume = 1 lit., Feed concentration = 1 mol/lit, Feed flow rate = 0.5 lit./min)

(A) 50%

(B) 75%

(C) 100%

(D) 200%

75. The conversion of a reactant undergoing a first order reaction and at a time equal to three times the half life of the reaction is

(A) 0.875

(B) 0.5

(C) 0.425

(D) Not possible to find

Space For Rough Work

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