POST GRADUATE COMMON ENTRANCE TEST-2017

DATE and TIME	COURSE	SUBJECT
01-07-2017 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	105047

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)

CHEMICAL ENGINEERING

PART – 1

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

1. All spontaneous processes are

   (A) Irreversible

   (B) Reversible

   (C) Adiabatic

   (D) Isothermal

2. First law of thermodynamics deals with

   (A) Direction of energy transfer

   (B) Reversible process only

   (C) Irreversible process only

   (D) Isothermal process

3. Equation which relates pressure, volume and temperature of gas is called

   (A) Gibbs – Duhem equation

   (B) Equation of state

   (C) Ideal gas equation

   (D) Real gas equation

4. $C_p - C_v = R$ is valid for

   (A) Gases at a very low temperature

   (B) Gases at very high temperature

   (C) Ideal gas

   (D) Real gas

5. Work done is a

   (A) Property of the system

   (B) Path function

   (C) Point function

   (D) State description of a system

6. Gain Margin is equal to

   (A) Amplitude ratio

   (B) Reciprocal of Amplitude ratio

   (C) Gain of P-D controller

   (D) Gain of steady state process

Space For Rough Work

7. A control system is said to be stable

(A) If it exhibits an unbounded response to a bounded input

(B) If its output response is unbounded for all unbounded input

(C) If it exhibits an bounded response to a unbounded input

(D) If its output response is bounded for all bounded input

8. The transfer function of a first order system is

(A) $\frac{S}{\tau S + 1}$

(B) $\frac{1}{\tau S + 1}$

(C) $\frac{\tau}{\tau S + 1}$

(D) $\frac{1}{\tau + S}$

9. When the damping co-efficient of the second order system is less than 1, it is called

(A) under damped system

(B) over damped system

(C) critically damped system

(D) vibrating system

10. In second order underdamped system

(A) Decay Ratio = Overshoot

(B) Decay Ratio = $(\text{Overshoot})^2$

(C) Overshoot increases for increasing damping co-efficient.

(D) Overshoot decreases for increasing damping co-efficient.

11. Which of the following is a controlling factor in very fast heterogeneous reaction ?

(A) Heat and mass transfer effects

(B) Temperature

(C) Pressure

(D) Composition of reactant

12. Rate determining step in a reaction consisting of a number of steps in series is the

(A) Fastest step

(B) Intermediate step

(C) Un-predictable step

(D) Slowest step

Space For Rough Work

13. Half life period of a chemical reaction is

(A) The time required to reduce the concentration of the reacting substance to half its initial value.

(B) Half of the space time of a reaction.

(C) Half of the residence time of a reaction.

(D) Double of the residence time of a reaction.

14. With increase in temperature, the equilibrium conversion of a reversible exothermic reaction

(A) Increases

(B) Remains unaffected

(C) Decreases

(D) Decreases linearly with temperature

15. The reaction in which rate equation corresponds to a stoichiometric equation is called

(A) Parallel reaction

(B) Autokinetic reaction

(C) Elementary reaction

(D) Non-elementary reaction

16. Oxygen percentage by weight in atmospheric air is

(A) 79

(B) 23

(C) 21

(D) 29

17. A gaseous fuel in order to develop luminosity on burning must contain

(A) Carbon monoxide

(B) Hydrocarbon

(C) Hydrogen

(D) Oxygen

18. Combustion of pulverised coal as compared to that of lump coal

(A) Develops a non-luminous flame

(B) Develops a low temperature flame

(C) Can be done with less excess air

(D) Provide a lower rate of heat release

Space For Rough Work

19. Incomplete combustion of fuel is characterized by

(A) Smoke formation

(B) High flue gas temperature

(C) High percentage of oxygen in flue gas

(D) High carbon monoxide content in flue gas

20. – 40 °C is equal to

(A) + 40 °F

(B) – 40 °F

(C) + 39 °F

(D) – 39 °F

21. A fluid in equilibrium means

(A) its viscosity is zero.

(B) shear stresses are acting on the fluid but no flow behaviour is manifested.

(C) it is free from shear stresses.

(D) a hypothetical situation because fluids are never in equilibrium.

22. Pitot tube is used to measure velocity head of

(A) Still fluid

(B) Turbulent flow

(C) Laminae flow

(D) Flowing fluid

23. Non-uniform flow occurs when

(A) Direction and magnitude of velocity at all points are identifical.

(B) Velocity of successive fluid particles, at any point is same at successive periods of time.

(C) Magnitude and direction of velocity do not change from point to point in the fluid.

(D) Velocity depth, pressure, etc. change point to point in the fluid flow.

24. The loss of head due to sudden expansion of a pipe is

(A) $h_L = \frac{V_1^2 - V_2^2}{2g}$

(B) $h_L = \frac{0.5V_1^2}{2g}$

(C) $h_L = \frac{(V_1 - V_2)^2}{2g}$

(D) $h_L = \sqrt{(V_1 - V_2)} / 2g$

Space For Rough Work

25. The work done by impeller of a centrifugal pump on water per second per unit weight of water is given by

(A) $\frac{1}{g} V_{w_1} u_1$

(B) $\frac{1}{g} V_{w_2} u_2$

(C) $\frac{1}{g} (V_{w_2} u_2 - V_{w_1} u_1)$

(D) $V_{w_1} u_1 g$

26. Horse power required for a roll ceusher is directly proportional to

(A) Reduction ratio

(B) Size of product

(C) Motor size

(D) Size of feed

27. Length to diameter ratio of a ball Mill is usually around

(A) 0 – 25

(B) 1 – 1.5

(C) 10

(D) 100

28. Screen having maximum capacity is

(A) Grizzles

(B) Trammels

(C) Shaking screen

(D) Vibrating screen

29. Compressibility co-efficient for an absolute compressible cake is

(A) 0

(B) 1

(C) 100

(D) infinite

30. A sphere settles freely through a pool of liquid and the settling is in Stoke's law range. The terminal velocity of sphere will

(A) Be independent of the liquid viscosity

(B) Increases linearly with viscosity

(C) Decreases linearly with viscosity

(D) Decreases inversely with the square of viscosity

31. Provision of fins on a given heat transfer surface will be more if there are

(A) fewer number of thin fins

(B) fewer number of thick fins

(C) large number of thin fins

(D) large number of thick fins

Space For Rough Work

32. Rate of heat conduction through a thick sphere (Q) of radius r_1 and r_2 is equal to

(A) $\frac{4\pi k\,(t_1 - t_2)}{r_2 - r_1}$

(B) $\frac{4\pi k\, r_1 r_2}{(r_2 - r_1)}$

(C) $\frac{4\pi k\, r_1 r_2 (t_1 - t_2)}{(r_2 - r_1)}$

(D) $\frac{4\pi r_1 r_2}{(t_1 - t_2)}$

33. Ratio of heat transfer co-efficient to the flow of heat per unit temperature rise due to the velocity

(A) Stanton Number

(B) Prandtl Number

(C) Grashoff's Number

(D) Mach Number

34. Fouling Factor is used

(A) In heat exchange design as a safety factor

(B) In case of Newtonian fluids

(C) When liquid exchanges heat with gas

(D) Pressure drop calculation

35. In natural correction, nusselt number is a function of

(A) Reynold's Number & Prendtl Number

(B) Grashoff's Number & Prendtl Number

(C) Prendtl Number

(D) Froude Number & Reynold's Number

36. The Z-component of the total mass flux of a component A in a binary mixture of A and B is given by

(A) $C_A (N_{AZ} + N_{BZ}) - D_{AB} \frac{\partial C_A}{\partial Z}$

(B) $C_A (N_{AZ} + N_{BZ}) + D_{AB} \frac{\partial C_A}{\partial Z}$

(C) $-D_{AB} \frac{\partial C_A}{\partial Z}$

(D) $\frac{C_A}{C_1} (N_{AZ} + N_{BZ})$

37. Adsorption of gases on solids

(A) Increases with increasing temperature.

(B) Decreases with increasing temperature.

(C) Decreases with increasing pressure.

(D) Remains constant with increasing temperature.

Space For Rough Work

38. For the n^{th} try (counted from the top of a distillation column) the murphee try efficiency is defined by

(A) $\frac{Y_n - Y_{n+1}}{Y^*_n - Y_{n+1}}$

(B) $\frac{Y_n - Y_{n-1}}{Y^*_n - Y_{n-1}}$

(C) $\frac{Y^*_n - Y_{n+1}}{Y_n - Y_{n+1}}$

(D) $\frac{Y_n - Y_{n+1}}{Y_n^{\cdot} - Y_{n-1}}$

39. Lewin Number = 1 signifies

(A) $N_{pr} = N_{sc}$

(B) $N_{sc} = N_{Re}$

(C) $N_{pr} = N_{Re}$

(D) $N_{st} \cdot N_{pr}$

40. The variation of Knudren diffusion co-efficient (D_{KA}) with the absolute temperature (T) follows

(A) $D_{KA} \times T$

(B) $D_{KA} \times T^{3.2}$

(C) $D_{KA} \times T^{1/2}$

(D) $D_{KA} \times T^2$

41. Secondary Nutrients in fertilizers are

(A) Boron, Copper, Manganese

(B) Calcium, Molybdenum, Zinc

(C) Iron, Sulphur, Molybdenum

(D) Calcium, Magnesium, Sulphur

42. Raw materials for production of urea are

(A) Carbon dioxide and brine

(B) Carbon dioxide and Ammonia

(C) Carbon disulphide and ammonia

(D) Carbon disulphide, brine and ammonia

43. Crude oil is made up mainly of

(A) Alkanes, Cycloalkanes and Aromatics ties

(B) Alkanes, Aldehydes and Ketones

(C) Alkanes, Alkenes and Alkynes

(D) Heavy metals & Gases

44. Thermoplastic serine are not usually

(A) soft

(B) stronger

(C) Less brittle

(D) Can be reclaimed from the wastes

Space For Rough Work

45. Fire clay is

(A) Basic Refractory

(B) Acidic Refractory

(C) Mentral Refectory

(D) Not a refractory material

46. Which of the following is a man made source of air pollution ?

(A) Automobile exhaust

(B) Forest fire

(C) Bacterial action in soil and swamp areas

(D) Volcanoes

47. Carbon monoxide is a pollutant, which causes

(A) respiratory disease (eg. ashthma)

(B) Asphyxiation (suffocation leading to death)

(C) Retardation in crop growth

(D) Damage to building materials like marble

48. Which of the following fire dust removal equipment is the most efficient

(A) Bas filter

(B) Scrubber

(C) Electrostatic Precipitator

(D) Cyclone Separator

49. Polluted water having Low BOD are most economically treated in

(A) Sedimentation tank

(B) Oxidation ponds

(C) Sludge digester

(D) Clarifier

50. Pick out the one which is not a chemical coagulant

(A) Aluminium sulphate

(B) Ferrous sulphate

(C) Hydrated lime

(D) Chloramine

Space For Rough Work

PART – 2

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

51. For zero order constant volume reaction A → R taking place in a batch reactor, the conversion is 50% of A after 5 minutes. If the initial concentration of A is 1.2 mol/lit. What is the conversion after 5 minutes if the initial concentration is 1 mol/lit. ?

(A) 40%

(B) 50%

(C) 60%

(D) 70%

52. What is the relation between E and F curves ?

(A) $E = \frac{dF}{dt}$

(B) $F = \frac{dE}{dt}$

(C) $t = \frac{dE}{dF}$

(D) $A = \frac{dF}{dU}$

53. Rate constants for two reactions are k_1 and k_2 at 300 K. A_1 and A_2 are arrhenius constants. What is the ratio E_1/E_2 if $k_1/k_2 = A_1/A_2$?

(A) 4

(B) 3

(C) 2

(D) 1

54. Keeping all else same in the operation of mixed flow adiabatic reactor, what happens to conversion if the feed temperature is increased for an endothermic reaction ?

(A) Conversion increases

(B) Conversion decreases

(C) Conversion remain constant

(D) Conversion increases linearly

55. A single effect evaporator is fed with 4000 kg/hr of weak liquor containing 17% caustic by weight and is concentrated to get thick liquor containing 40% by weight of caustic. Calculate the amount of water evaporated.

(A) 2100 kg/hr

(B) 2200 kg/hr

(C) 2300 kg/hr

(D) 2400 kg/hr

Space For Rough Work

56. Convert 588 g/lit. H_2SO_4 to normality.

(A) 9

(B) 10

(C) 11

(D) 12

57. How many moles of H_2SO_4 will contain 64 kg of S ?

(A) 1

(B) 2

(C) 3

(D) 4

58. A gas mixture contains 0.28 kgmol of HCl, 0.34 kgmol of N_2 and 0.09 kgmol of O_2. What is the average molecular weight of the gas ?

(A) 31.8

(B) 41.8

(C) 53.8

(D) 63.8

59. Chemical potential of its components of a system is given by

(A) $\mu_i = \left(\frac{\partial A}{\partial n_i}\right)_{T, P, n_j}$

(B) $\mu_i = \left(\frac{\partial G}{\partial n_i}\right)_{T, P, n_j}$

(C) $\mu_i = \left(\frac{\partial A}{\partial n_i}\right)_{T, P}$

(D) $\mu_i = \left(\frac{\partial G}{\partial n_i}\right)_{T, P}$

60. 20 kg of water is vaporized at constant temperature of 100 °C and 1 atm pressure. The heat added to the system is 2257 kJ/kg. The specific volume of liquid and vapor are 1.04×10^{-3} and 167.2×10^{-2} m^3/kg respectively. Find ΔU.

(A) 21,798 kJ/kg

(B) 33,798 kJ/kg

(C) 41,798 kJ/kg

(D) 51,798 kJ/kg

Space For Rough Work

61. Fundamental principle of refrigeration is based on

(A) Zeroth Law

(B) First Law

(C) Second Law

(D) Third Law

62. A thin flat plate 2m × 2m is hanging freely in air. The temperature of the surroundings is 25 °C. Solar radiation is falling on one side of three plates at the rate of 500 W/m^2. Temperature of the plate will remain constant at 30 °C, if the convective heat transfer coefficient (in w/m^2 °C) is

(A) 25

(B) 50

(C) 100

(D) 200

63. A counterflow shell and tube exchanger is used to heat water with hot exhaust gases. The water (C = 4180 J/kg °C) flows at a rate of 2 kg/s while the exhaust gas (1030 J/kg °C) flows at the rate of 5.25 kg/s. If the heat transfer surface area is 32.5 m^2 and the overall heat transfer coefficient is 200 W/m^2 °C, what is the NTU for the heat exchanger ?

(A) 1.2

(B) 2.4

(C) 4.5

(D) 8.6

64. 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

(A) 992

(B) 812

(C) 464

(D) 567

65. The equivalent diameter for flow through a rectangular duct of width B and height H is

(A) $\frac{HB}{2(H+B)}$

(B) $\frac{HB}{(H+B)}$

(C) $\frac{2HB}{H+B}$

(D) $\frac{4HB}{(H+B)}$

Space For Rough Work

66. Drag force is expressed mathematically as,

(A) $F_D = \frac{1}{2} Su^2 C_D A$

(B) $F_D = Su^2 C_D A$

(C) $F_D = 2Su^2 C_D A$

(D) $F_D = 2SuC_D A^2$

67. Reynolds number is significant in,

(A) Supersonics, as with projectile end jet propulsion.

(B) Full immersion or completely enclosed flow, as with pipes, aircraft wings, nozzles etc.

(C) Simultaneous motion through two fluids where there is a surface discontinuity, gravity forces, and wave making effect with seip hull's.

(D) Evaporation of liquid.

68. For particle (coefficient of friction = μ) to be caused by a. Smooth roll crusher (angle of nip = α), which of the following relationships has to be satisfied.

(A) $\alpha \geq 2 \tan^{-1} \mu$

(B) $\mu \geq \frac{1}{2} \tan^{-1} \alpha$

(C) $\alpha \leq 2 \tan^{-1} \mu$

(D) $\mu \leq 2 \tan^{-1} \alpha$

69. In constant pressure filtration,

(A) The filtrate flow rate is maximum at the start and deceases continuously to the end.

(B) The filtrate flow rate is minimum at the start and increases continuously to the end.

(C) The filtrate flow rate is constant.

(D) Increases slowly to a constant value.

Space For Rough Work

70. A binary hydrocarbon liquid mixture of A and B (k_A = 1.5) containing 60 mole % A is flash vaporized. If 40% of the feed is vaporized, the mole fraction of A in the liquid product is

(A) 0.6

(B) 0.4

(C) 0.3

(D) 0.5

71. For a certain mass transfer process, $K_l = 1 \times 10^{-3}$ cm/s and $D_{AB} = 1 \times 10^{-5}$ cm^2/s. The film thickness in 'cm' is then

(A) 0.1

(B) 0.01

(C) 0.001

(D) 0.0001

72. The drying rate in the constant rate period in kg/m^2 is

(A) 1.00

(B) 1.03

(C) 1.06

(D) 1.09

73. The proportional band of a pneumatic controller with a scale range of 0 – 120 °C when the output changes from 20 – 100 kN/n^2 as the temperature rises from 95 – 110 °C is

(A) 5.33

(B) 10.6

(C) 83.33

(D) 12.5

74. For a unit step input, a system with forward path transfer function $G(s) = \frac{20}{S^2}$ and feedback path transfer function H(S) = (S + 5), has a steady state output of

(A) 0

(B) 0.5

(C) 0.2

(D) 0.6

75. The number of roots of the equation

$$2S^4 + S^3 + 3S^2 + 5S + 7 = 0$$

that lie in the right half of S plane is

(A) two

(B) zero

(C) one

(D) three

Space For Rough Work

Space For Rough Work