POST GRADUATE COMMON ENTRANCE TEST - 2015

DATE & TIME	COURSE	SUBJECT
08-08-2015 10.30 AM TO 12.30 PM	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 SERIAL NUMBER	310017
					VERSION CODE	A – 1

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 am.**
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 AM, TILL THEN;**
   - Do not remove the seal / staple present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

SEAL

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 am, remove the seal / staple stapled on the right hand side 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 ballpoint 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 (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 - 75)

CHEMICAL ENGINEERING

PART - 1

(Each question carry one mark) **(50 X 1 = 50)**

1. How many g moles are equivalent to 1.0kg of Hydrogen ?

   a. 250 g mole b. 500 g mole

   c. 750 g mole d. 900 g mole

2. The temperature measured by a bare thermometer or thermocouple is called

   a. Dry bulb temperature

   b. Wet bulb temperature

   c. Absolute humidity

   d. Relative humidity

3. The standard Heat of Reaction for the reaction $a\,A + b\,B \rightarrow c\,C + d\,D$ is given by,

   a. $\Delta H_r^0 = \left[C\Delta H_{r,c}^0 + d\,\Delta H_{r,d}^0\right] - \left[a\Delta H_{r,A}^0 + b\,\Delta H_{r,B}^0\right]$

   b. $\Delta H_r^0 = \left[a\Delta H_{r,A}^0 + c\,\Delta H_{r,C}^0\right] + \left[b\Delta H_{r,B}^0 + d\,\Delta H_{r,D}^0\right]$

   c. $\Delta H_r^0 = \left[b\Delta H_{r,B}^0 + c\,\Delta H_{r,C}^0\right] + \left[a\Delta H_{r,A}^0 + d\,\Delta H_{r,D}^0\right]$

   d. $\Delta H_r^0 = \left[a\Delta H_{r,D}^0 + a\,\Delta H_{r,A}^0\right] - \left[C\Delta H_{r,C}^0 + b\,\Delta H_{r,B}^0\right]$

4. The temperature to which a substance must be heated before it may burn is called

   a. Flash Point

   b. Critical Temperature

   c. Transition Temperature

   d. Ignition Temperature

5. The volume of 25kg of Chlorine at standard conditions is

   a. 6.9 m^2 b. 7.9 m^2

   c. 8.9 m^2 d. 9.9 m^2

6. A perfect gas

   a. is incompressible

   b. has zero viscosity

   c. cannot develop shear stress

   d. satisfies PV = nRT

7. An incompressible flow is one in which

   a. fluid is frictionless

   b. fluid compressibility is greater than zero

   c. density does not change due to pressure and temperature

   d. temperature of fluid remains constant

8. An example of Newtonian Fluid is

   a. Non-colloidal solution

   b. Sewage sludge

   c. Rubber latex

   d. Quick sand

9. The device which may be used for measuring small differences in pressures is

   a. U-tube Manometer

   b. Inclined Manometer

   c. Mercury Barometer

   d. Hydrometer

Space For Rough Work

10. Which of the following does not fall in the category of Variable-Head meters ?

a. Venturimeter b. Orifice meter

c. Pitot tube d. Rotameter

11. The crusher operates by

a. Impact b. Compression

c. Attrition d. Expansion

12. The centrifuging in a ball mill occurs at a speed called as

a. Normal speed

b. Critical speed

c. Operating speed

d. High speed

13. The vacuum filters are limited to a maximum filtering pressure of

a. 1 atmosphere

b. 2 atmosphere

c. 4 atmosphere

d. 5 atmosphere

14. In constant filtration

a. ΔP is minimum at start and maximum at the end of the filteration run

b. ΔP is constant throughout the run

c. ΔP is maximum at start and minimum at the end

d. ΔP is zero

15. A propeller is an

a. axial flow, low speed impeller

b. radial flow, high speed impeller

c. axial flow, high speed impeller

d. radial flow, low speed impeller

16. The First Law of Thermodynamics is based on

a. Law of conservation of mass

b. Law of conservation of energy

c. Law of equiparation of energy

d. Law of conservation of momentum

17. Which of the following is an Extensive property ?

a. Temperature b. Pressure

c. Density d. Volume

18. In reversible isothermal expansion of an Ideal gas

a. $\Delta u = Q$ b. $Q = w$

c. $\Delta u = P\Delta V$ d. $\Delta u = Q + P\Delta V$

19. In which of the following reaction equilibria, Kp and Ky will have the same value ?

a. $N_2 + 3H_2 \rightleftharpoons 2NH_3$

b. $N_2 + O_2 \rightleftharpoons 2NO$

c. $2SO_2 + O_2 \rightleftharpoons 2SO_3$

d. $2CO + O_2 \rightleftharpoons 2CO_2$

Space For Rough Work

20. For a real gas, the Fugacity Co-efficient is always

a. equal to one

b. lLess than one

c. greater than one

d. less than zero

21. An equation for the heat flow in the cube for constant thermal diffusivity is

$$\frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2}+\frac{\partial^2 T}{\partial z^2}=0$$

This equation is known as

a. Newton equation

b. Laplace equation

c. Poisson equation

d. Fourier equation

22 In forced convection, fluids move under the influence of

a. change in fluid pressure produced by external work

b. buoyant forces arising from changes in density

c. elastic forces

d. surface tension forces

23. Log mean heat transfer area for the two heat transfer areas A_1 and A_2 is given by

a. $\dfrac{A_1-A_2}{\mu\left(A_2/A_1\right)}$

b. $\dfrac{A_1-A_2}{\mu\left(A_1/A_2\right)}$

c. $(A_1-A_2)\mu\left(A_1/A_2\right)$

d. $\dfrac{\mu\left(A_1/A_2\right)}{A_1-A_2}$

24. In a double pipe heat exchanger, the outer dia. of inner pipe is d_1 and inner dia. of outer pipe is d_2. The equivalent dia of annulus for pressure degree calculation is

a. $\left(d_2^2-d_1^2\right)/d_1$ b. $4\left(d_2^2-d_1^2\right)/d_1$

c. $\left(d_2-d_1\right)$ d. $4\left(d_2-d_1\right)$

25. As the distances between heat source and object receiving the heat increases, the rate of heat transfer by radiation

a. remains constant

b. increases

c. decreases

d. increases linearly

Space For Rough Work

26. Fick's first law of diffusion for the z- direction is

a. $J_A = D_{AB}\frac{\partial C_A}{\partial Z}$

b. $J_A = -D_{AB}\frac{\partial C_A}{\partial Z}$

c. $J_A = D_{AB}\frac{\partial^2 C_A}{\partial Z^2}$

d. $J_A = -D_{AB}\frac{\partial^2 C_A}{\partial Z^2}$

27. The temperature at which a vapour-gas mixture becomes saturated when cooled at constant total pressure out of contact with a liquid is called

a. Bubble point

b. Dew point

c. Wet-bulb temperature

d. Dry-bulb temperature

28. In a distillation operation, total reflux requires

a. minimum no. of plates

b. minimum reboiler and condeser load

c. infinite no. of plates

d. flow of fresh feed must continue

29. The distribution coefficient for the system water (A) - Chloroform (B) - Acetone (C) is

a. 1 b. >1

c. <1 d. 0

30. Synthetic detergent powder is produced by drying deteregent slurry in a

a. Spray dryer

b. Cylinder dryer

c. Freeze dryer

d. Open post evaporator

31. The rate constant of a reaction depends on

a. Temperature of the System

b. Time of Reaction

c. Extent of Reaction

d. Initial concentration of Reactants

32. In an ideal plug flow reactor at steady state:

a. There may be diffusion along the flow path

b. There may be lateral mixing of fluid

c. Composition of reactant remains constant along flow path

d. Fractional conversion of reactant varies from point to point along a flow path

33. For a chemical reaction $A + B \xrightarrow{k} C$, the fractional conversion of reactant A is proportional to time. The order of reaction must be

a. 0 b. 1

c. $\frac{1}{2}$ d. 2

Space For Rough Work

34. Which of the following types of tracer input signal can be used to study the extent of Non-ideal flow ?

a. Periodical signal

b. Step signal

c. Pulse signal

d. All of the above

35. The action of a catalyst follows its ability to change the

a. Heat of reaction

b. Heat of formation of product

c. Activation energy

d. Equilibrium constant

36. The Laplace Transform of unit step change is

a. 1 b. $1/S$

c. S d. $1/(S+1)$

37. The response of a first-order system $[G(S) = 1/(TS+1)]$ to a unit-step change in input is given by

a. $\left(1-e^{-1/T}\right)/T$ b. $1-e^{-1/T}$

c. $\dfrac{e^{-1/T}}{T}$ d. $1+e^{-1/T}$

38. Root-locus method for stability of control systems

a. is a graphical procedure

b. difficult to apply to system containing transportation by

c. provides roots of characterestic equation

d. All of the above

39. Which of the controllers has smallest maximum deviation ?

a. P-controller

b. R-I controller

c. P-D controller

d. P-I-D controller

40. The transfer function of an ideal proportional controller is

a. K_c b. $1/K_c$

c. $1 + K_c$ d. $1/(K_c+1)$

41. The biochemical treatment of sewage effluents is essentially a process of

a. reduction

b. oxidation

c. dehydration

d. alkalinisation

Space For Rough Work

42. For protection of acquatic life in a fresh water stream, sewage effluent, dissolved oxygen content should not be less than

a. 15 ppm
b. 10 ppm
c. 5 ppm
d. 20 ppm

43. The most efficient equipment for removal of sub micron dust particles from blast furnace gas is

a. Venturi Scrubber
b. Gravity Settling Chamber
c. Electrostatic Precipitator
d. Cyclone Seperator

44. Which of the following nitrogen oxides is neutral in character

a. N_2O_4
b. N_2O_5
c. N_2O
d. N_2O_3

45. Gas temperature is an important consideration in the design of fabric filter because it affects

a. gas velocity
b. gas density
c. selection of fabric
d. all of the above

46. The best fertilizer for rice paddies is

a. Urea
b. Ammonium sulphate
c. Super phosphate
d. Calcium Ammonium nitrate

47. Crude petroleum consists of

a. 84 -87 percent carbon and 11 - 14 percent Hydrogen
b. 11 -14 percent carbon and 84 - 87 percent Hydrogen
c. 54 percent carbon and 25 percent Hydrogen
d. 70 - 72 percent carbon and 5 - 7 percent Hydrogen

48. Which of the following products contain minimum sulphur ?

a. Naptha
b. Kerosene
c. High speed Diesel oil
d. Furnace oil

49. Formation of soap involves

a. Hydrolysis
b. Esterification
c. Hydrogenation
d. All of the above

50. The products of saponification of a fat are

a. Glycerol and salts of higher fatty acids
b. Glycerol and higher aliphatic alcohols
c. Glycerol and organic acids
d. Ethylene Glycol and organic acids

Space For Rough Work

PART - 2

(Each question carries two marks)

(25 X 2 = 50)

51. Calculate the standard heat of reaction :

	CaC_2	+ $2H_2O$	⟶	$Ca(OH)_2$	+ C_2H_2
ΔH_f	ϕ				
Cal / mol	−15000	−68317.4		−235800	541941

a. − 29971.2 Cal / mol

b. − 39971.2 Cal / mol

c. − 49971.2 Cal / mol

d. − 59971.2 Cal / mol

52. Calculate the enthalpy of sublimation of Iodine from the following reaction and data:

(A) $H_2(g) + I_2(s) \rightarrow 2HI(g)$ $\Delta H = 57.9$ kJ

(B) $H_2(g) + I_2(s) \rightarrow 2HI(g)$ $\Delta H = -9.2$ kJ

Desired reaction is $I_2(S) \rightarrow I_2(g)$

a. 67.1 kJ b. 47.1 kJ

c. 57.1 kJ d. 77.1 kJ

53. What is the volume of 25kg of Chlorine at standard condition ?

a. 6.9 m^3 b. 7.9 m^3

c. 8.5 m^3 d. 9.1 m^3

54. A plate 0.6 mm distant from a fixed plate, moves at 0.24 m/s and requires a force per unit area of 1N/m^2 to maintain this speed. The fluid viscosity of the substance between the plates in N/s m^2 is _____

a. 1.5×10^{-3} N/s m^2

b. 2.5×10^{-3} N/s m^2

c. 3.5×10^{-3} N/s m^2

d. 4.5×10^{-3} N/sm^2

55. What will be the power required to crush 150 tonnes per hour of limestone if 80 percent of feed passes 50 mm screen and 80 percent of product a 3.125 mm screen ?

Work index of lime stone =12.74

a. 155.4 kW b. 200 kW

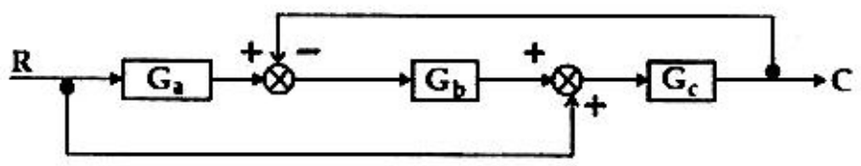
c. 256.4 kW d. 300 kW

56. A centrifugal pump with an efficiency of 65% is driven by an electric motor having an efficiency of 90%. The pump delivers water at a rate of 4 kg/s against a total head of 25m. What is the power delivered by the motor ?

a. 508 W b. 1000 W

c. 1509 W d. 1600 W

57. Find the transfer function C/R for the block diagram shown in the figure



a. $\frac{G_a + G_a G_b G_c}{1 + G_b G_c}$ b. $\frac{G_c + G_a G_b G_c}{1 + G_b G_c}$

c. $\frac{G_a G_b G_c}{1 + G_a G_b G_c}$ d. $\frac{G_a G_b G_c}{1 + G_b G_c}$

58. The number of poles in the open loop transfer function $G(s) = \frac{1}{(S^3 + 6S^2 + 11S + 6)}$ are

a. 1 b. 2

c. 3 d. 0

Space For Rough Work

59. The characterestic equation for the control system with a closed loop transfer function $\frac{G_1}{1+G}$ is

a. $\frac{G_1}{1+G}=0$ b. $1+G=0$

c. $G=0$ d. $G_1=1+G$

60. For continuous reverse air cleaning in a fabric filter, gas-to-fabric ratio normally varies from

a. 8 to 15 cfm / sq ft

b. 0.2 to 0.5 cfm / sq ft

c. 50 to 60 cfm / sq ft

d. 0.01 to 0.1 cfm / sq ft

61. The lowest layer of atmosphere is called

a. Ionosphere

b. Troposphere

c. Stratosphere

d. Exosphere

62. A closed vessel contains equal number of O_2 and H_2 molecules at a total pressure of 760mm of Hg. If O_2 can be removed from the system, the pressure will be

a. 380 mm Hg

b. 1520 mm of Hg

c. Remain unchanged

d. Initial decrease but will soon reach original Value

63. What is the change in internal energy when 5g of air is heated from 0^oC to 2^oC ? The specific heat at constant volume is 0.172 cal/^oC

a. 0.172 cal b. 1.72 cal

c. 17.2 cal d. 0

64. In a reversible isothermal process an ideal gas expands to four times its initial volume. The change in entropy is

a. $R \log_{10} 4$ b. $R \log 4$

c. $C_v \log_{10} 4$ d. $C_v \log 4$

65. The general formula of paraffins is

a. C_nH_{2n} b. C_nH_{2n-2}

c. C_nH_{2n+2} d. C_nH_{2n+1}

66. For petroleum products, ^0API is given by

a. $^0API = \frac{131.5}{s} - 141.5$

b. $^0API = \frac{141.5}{s} - 131.5$

c. $^0API = \frac{145}{s} - 130$

d. $^0API = 141.5 - \frac{131.5}{s}$

Space For Rough Work

67. Producer gas is obtained by

a. Thermal cracking of Naptha

b. Passing steam and air through red hot coke

c. Passing air through red hot coke

d. Passing steam through red hot coke

68. Which of the following is a polysaccharide ?

a. Starch b. Sucrose

c. Glucose d. Fructose

69. Nitrile rubber is a polymer of

a. Acrylonitrile and styrene

b. Butadiene and styrene

c. Butadiene and acrylonitrile

d. Isobutylene and isoprene

70. In the sulphate pulp process, the digestor conditions are

a. 120 - 130°C and 5 atm

b. 120 - 130°C and 1 atm

c. 75 - 80°C and 15 atm

d. 175 - 180°C and 10 atm

71. Space time and holding time are equal to each other for

a. Batch reactor

b. Plug flow reactor

c. Mixed flow reactor

d. semi-batch reactor

72. Temperature of hot fluid changes from 80°C to 50°C which will heat another fluid from 30°C to 60°C in a counter-current heat exchanger. What is logrithmic mean temperature difference ?

a. 0 b. 20°C

c. 1 d. Not defined

73. Minimum number of ideal stages in a distillation column corresponds to reflux ratio equal to

a. 0 b. 1

c. 2 d. Infinity

74. A wet solid is to be dried from 80 to 10 % moisture on wet basis. The moisture to be evaporated per 1000 kg of dried product is

a. 630 kg b. 3888.89 kg

c. 700 kg d. 3500 kg

75. The following parallel reaction is carried out in a CSTR in which concentration of A changes from 1 to 0.5 mol/lt. There is no R and S present in the feed. What is the concentration of R at the exit?

$A \rightarrow R,\ r_R = 0.2C_A^2, mol/lt\,\text{min}$

$A \rightarrow S,\ r_s = 0.4C_A, mol/lt\,\text{min}$

a. $\frac{5}{14}$ b. $\frac{7}{13}$

c. $\frac{3}{8}$ d. $\frac{1}{3}$

Space For Rough Work

SEAL