Total No. of Printed Pages:4

SUBJECT CODE NO:- H-143
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Engineering Chemistry
(REVISED)

[Time: Three Hours] **[Max.Marks:80]**

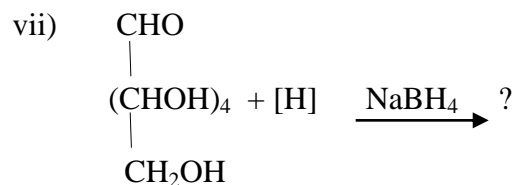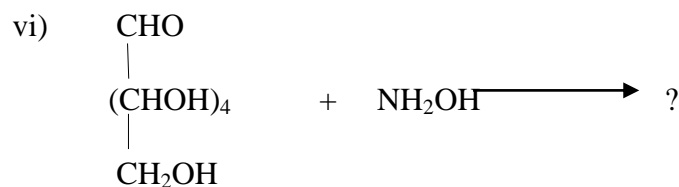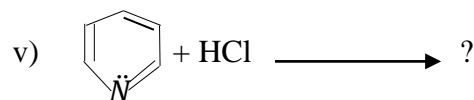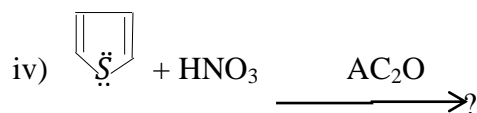Please check whether you have got the right question paper.
N.B   i) Question number 01 and 06 are compulsory.
        ii) Solve any two questions from remaining each section.

Section A

Q.1   Predict the product (any five)   10

COONa

i) [benzene ring with COONa] + NaOH $\xrightarrow[\Delta / \text{Heat}]{\text{CaO}}$?

ii) [naphthalene] $\xrightarrow{\text{CrO}_3/\text{CH}_3\text{COOH}}$?

iii) [furan ring with $\ddot{O}$] + H_2SO_4 $\xrightarrow[\Delta]{\text{Pyridine}}$?

iv) [thiophene ring with $\ddot{S}$] + HNO_3 $\xrightarrow{\text{AC}_2\text{O}}$?

v) [pyridine ring with $\ddot{N}$] + HCl $\longrightarrow$?

vi)   CHO
        |
        (CHOH)$_4$ + NH_2OH $\longrightarrow$?
        |
        CH$_2$OH

vii)   CHO
        |
        (CHOH)$_4$ + [H] $\xrightarrow{\text{NaBH}_4}$?
        |
        CH$_2$OH

viii)

$$\underset{\substack{\text{benzene ring}}}{\overset{\overset{\oplus}{N}\equiv\overset{\ominus}{N}Cl}{\bigcirc}} + KSH \longrightarrow ?$$

ix) $CH_3-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[\text{ether}]{LiAlH_4} ?$

x) $\underset{\bigcirc}{\overset{NH_2}{|}} + H_2SO_4 \xrightarrow{\Delta/180°C} ?$
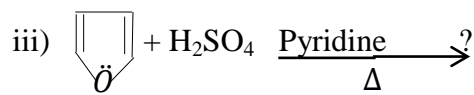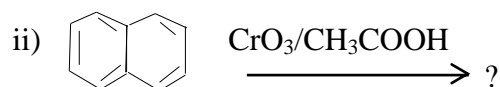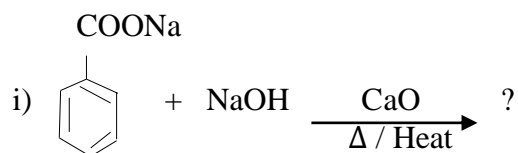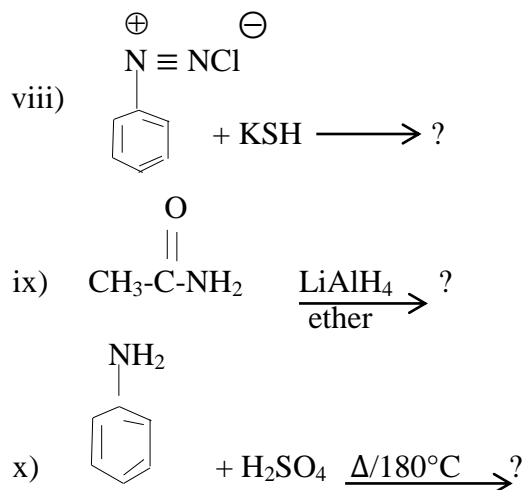
Q.2   a) How can you prepare naphthalene from benzene and succinic anhydride? Explain any three   06
         chemical properties of naphthalene.
      b) Give any five chemical properties of thiophene   05
      c) Discuss general physical properties and uses of pyridine.   04

Q.3   a) What are the requirements in order that coloring matter may function as dye? How would 06
         you fix indigo dye on cotton fibre?
      b) How can you prepare glucose from starch? Explain any three chemical properties of glucose. 05
      c) Explain in brief process of dyeing.   04

Q.4   a) How can you separate amines from their mixture using diethyl oxalate? Explain in detail. 06
      b) Give any five applications at benzene diazonium chloride.   05
      c) Explain any four chemical properties of amines.   04

Q.5   Write a short note on (any three)   15
         (1) Preparation of pyrrole from 1,4-dialdehyde and 1,4 – diketone.
         (2) Chemical properties of Quinolene
         (3) Methyl orange
         (4) Chemical properties of aniline.
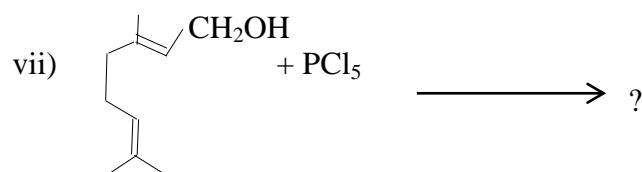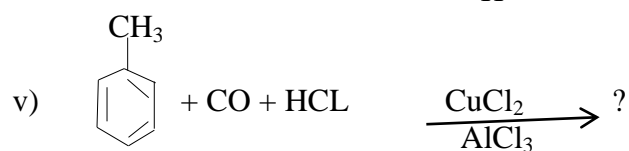   (5) Preparation methods of secondary amines

Section - B

Q.6   Predict the product (Any five)   10

      i) $CH_3-\overset{\overset{O}{\|}}{C}-OC_2H_5+[H] \xrightarrow[\text{ether}]{LAH} ?$

      ii) $CH_3-\overset{\overset{O}{\|}}{C}-OH+H_2O_2 \xrightarrow{H_2SO_4} ?$

iii) $C_6H_5\text{-}\overset{\overset{O}{\|}}{C}\text{-}\overset{\overset{O}{\|}}{C}\text{-}C_6H_5$ $\underrightarrow{CH_3ONa}$? ?

iv) $2\ CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}OC_2H_5$ $\xrightarrow[H^{\oplus}]{C_2H_5ONA}$?

v)   [benzene ring with CH_3] $+\ CO + HCL$ $\xrightarrow[AlCl_3]{CuCl_2}$?

vi)   [bicyclic structure] $+\ H_2O$ $\xrightarrow{dil.H_2SO_4}$?

vii)   [structure with CH_2OH] $+\ PCl_5$ $\longrightarrow$?

viii)   [structure with CHO] $+\ [H]$ $\xrightarrow[\text{ether}]{LAH}$?

ix)   [benzene ring with OH] $+\ HNO_3$ $\xrightarrow[\Delta]{H_2SO_4}$?

x) $CH_3\text{-}O\text{-}CH_3 + H_2SO_4$ $\longrightarrow$?
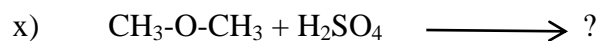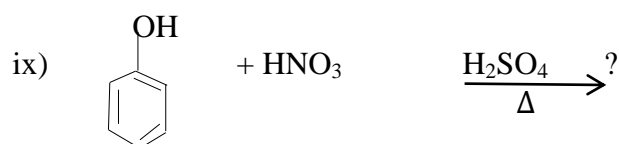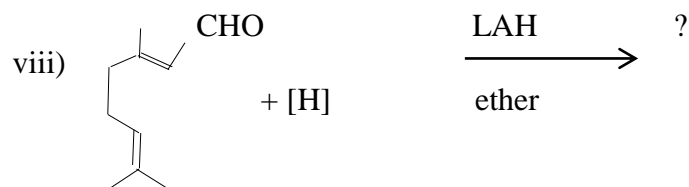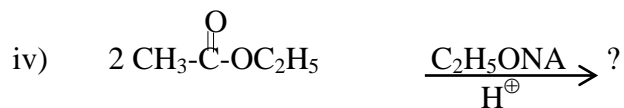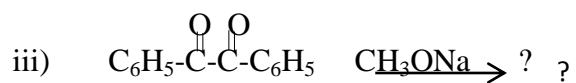
Q.7	a) What is sulphonation reaction? Explain with mechanism sulphonation of benzene.	06
	b) Give any five uses of peroxy acids	05
	c) Explain with mechanism nitration of benzene.	04
Q.8	a) What is claisen condensation? Explain with mechanism claisen condensation between two different esters.	08
	b) How can you convert pinacol into pinacolone? Explain with mechanism.	07

Q.9   a) How can you prepare geraniol from citral-a?   06
            Explain any four chemical properties of geraniol.
        b) Give any five chemical properties of $\propto$-pinene.   05
        c) Discuss the isoprene rule with suitable examples.   04

Q.10   Write a short note on (any three)   15

            i)   Chlorination of benzene
            ii)   Benzil-Benzilic acid rearrangement
            iii)   Classification of terpenes.
            iv)   Uses of Lithiuum Aluminium hydride
            v)   Deckmann condensation.

Total No. of Printed Pages:2

FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Process Instrumentation & Analytical Tech.
(OLD)

[Time: Three Hours]   [Max.Marks: 80]

Please check whether you have got the right question paper.
N.B   1. Q.No.1 & 6 are compulsory.
         2. Answer any two questions from remaining each section.
         3. Assume suitable data if required & draw neat sketches wherever required.

Section A

Q.1   Solve any five: 10

            1) Inductive transducers
            2) Fidelity
            3) Thermal well
            4) Thermopile
            5) Vena contracta
            6) Barometer

Q.2   a) With suitable examples differentiate between direct & indirect measurement.   08
         b) Explain capacitive & inductive transducers for temperature level measurement.   07

Q.3   a) Describe principle, construction & working of bimetallic thermometers.   08
         b) State three thermoelectric laws and give their significance for thermocouples.   07

Q.4   a) Describe various float level gauges.   08
         b) List various gauges used for differential pressure measurement & vacuum measurement.   07

Q.5   Write short note: 15
            a) Instrumentation diagram
            b) Application of flow measurement
            c) Optical pyrometers.

Section B

Q.6   Solve any five: 10

       1) Stationary phase
       2) Carrier gas
       3) Reference electrode
       4) Coulometer
       5) Transmittance
       6) Oxidation reduction titration

Q.7   a) What is conductometry. Explain conductometric titration.   08
      b) Explain general procedure, preliminaries to analyst & tools of analyst.   07

Q.8   a) Write down theory, instrumentation & application of flame photometry.   08
      b) Describe Amperometric titration.   07

Q.9   a) Explain theory, instrumentation of gas chromatography.   08
      b) What are processes involved in thin layer chromatography.   07

Q.10   Write short note: 15
      a) Factors affecting on column separation processes.
      b) Flame & flame spectra
      c) Molecular vibration

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-178
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Physical Chemistry & Thermodynamics
(REVISED)

[Time: Three Hours]   **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B   1. Q.No.1 and 6 are compulsory.
        2. Solve any two questions from remaining questions from each section.
        3. Draw a well labeled diagram wherever necessary.

Section A

Q.1   Solve the following (any five)   10
        i)   Conductor's
        ii)   Types of electrodes
        iii)   Photochemistry
        iv)   Colloids
        v)   Foams
        vi)   Transport No
        vii)   Photochemical equilibrium

Q.2   a) Explain Langmuir's Unimolecular adsorption by explaining the adsorption isotherms.   08
        b) Explain heat of adsorption & factors influencing adsorption.   07

Q.3   a) Explain Debye Huckel Theory of strong electrolytes by explaining relaxation &   08
            electrophoretic effect.

        b) Define & explain surface tension with the help of liquid drop method.   07

Q.4   a) Define colloids. Explain the different preparation methods of colloidal solutions.   08
        b) Define photochemistry. Explain in detail with the help of diagram Lamberts law.   07

Q.5   Write short note   15
        a) Variation of adsorption with pressure at constant temperature
        b) Quantum efficiency
        c) Refractivity & Refractive Index

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Section B

Q.6   Solve the following (any five)   10
    i)   Joule –Thomson co-efficient
    ii)   Degrees of freedom
    iii)   Reversible process
    iv)   Heat capacities
    v)   Write short note on CoP "Co-efficient of performance".
    vi)   List assumptions in idealizing gas behavior
    vii)   Adiabatic process

Q.7   a) Determine the values of Cp and Cv in units of J/ (kg.k) for Helium provided $\gamma = 1.78$ and   07
        average molecular weight of air to be 4.002.

    b) Derive mathematical expression for second law of thermodynamics   08

Q.8   a) Calculate Enthalpy change methane, when one kmol of it is heated from 300K to 450K. for   06
        this temp range C_p^{ig} is given by $C_p^{ig} = R(a + bT + cT^2)$, where
        $a = 1.702, b = 9.08 \times 10^{-3} \& c = -2.160 \times 10^{-6}$

    b) Show that for constant volume process entropy change for ideal gas is given by   07
        $$\Delta S = C_v \ in\frac{T_2}{T_1} - - - - - -$$

Q.9   a) What is the significance of Joule's experiments in the formulation first law of   08
        thermodynamics

    b) Explain the concept of reversible & irreversible process with example.   07

Q.10   Write short note   15
    i)   Explain the different forms of thermodynamic energy
    ii)   Viral equation of state
    iii)   Expression for calculation of work done in adiabatic process

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Total No. of Printed Pages:3

FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Strength of Materials
(OLD)

[Time: Three Hours]   **[Max.Marks: 80]**

Please check whether you have got the right question paper.
N.B   1. Q.1 & Q.6 are compulsory. Solve any two questions from remaining in each section.
         2. Assume suitable data if required & state it clearly.

Section A

Q.1   Attempt any five   10

   a) Enlist the numbers of elastic constant for an isotropic elastic material. Write down all
       relationships exists between them.

   b) If free expansion of beam or material due to temperate is prevented. Write down the value of
       stress induced due to it.

   c) If beam carrying uniformly varying load of 10KN/m. over entire span of 5m. Find the value
       of equivalent load or total load.

   d) In case of beam carrying udl over entire span the maximum value of SF & BM will be =?
   e) Draw the loading diagram for the beam subjected to pure bending in some portion.
   f) Enlist the assumptions made in theory of pure bending.
   g) Define major & minor principle stress.
   h) Write down the expression for principle stresses for two dimensional stress systems.
   i) State the relationship between SF, BM & load intensity.
   j) What is strength of material?

Q.2   a) Derive the relationship between young's modulus, poison's ratio & modulus of rigidity.   08

        b) What are the assumptions made in theory of pure bending? Justify any three.   07

Q.3   a) Draw SFD & BMD for beam having cross sectional area $230 mm \times 450 mm$. Take density of 03
            concrete 25KN/m^3.

b) Draw SFD & BMD. Find the value of maximum bending moment. Locate point of contra flexure if any.   12
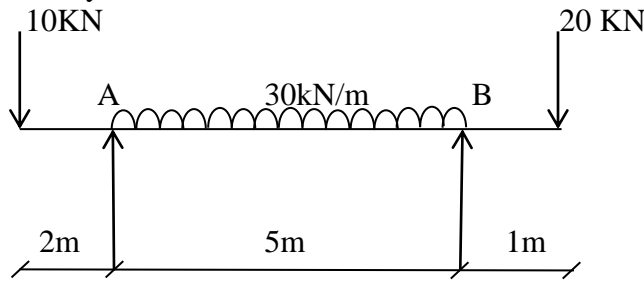

Fig.1

Q.4   a) Find the value of bending stresses at extreme fiber for the beam of Q3-b for an inverted 'T' section having flange $-200mm \times 20$, web thickness = 20mm & overall depth of 300 mm.   10

b) Draw shear stress distribution diagram for I section, T, I, L & circular section with τ_{max} & τ_{avg}.   05

Q.5   Derive an expression for normal & shearing stress intensities for a plane inclined at an angle θ to the normal stress σ_x for the stress condition as shown in fig.   15
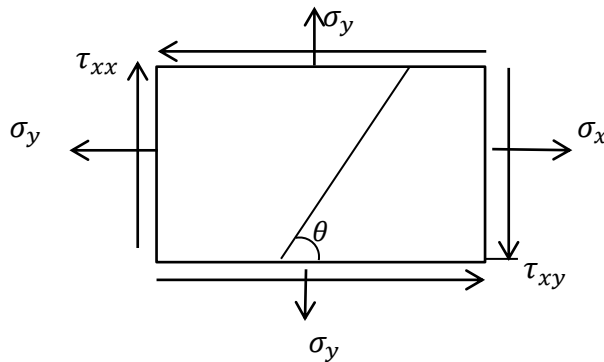
Section B

Q.6   Attempt any five.   10
    a) Draw strain energy & proof resilience.
    b) Define limiting eccentricity for no tension condition.
    c) Explain middle third rule.
    d) What are the end conditions for column?
    e) Define short column & long column.
    f) Write down the expression of stress develop due to impact loading.
    g) Define strength of shaft.
    h) Differentiate between solid shaft & hollow shaft
    i) State Lame's theory.
    j) What is basic difference between thick cylinder & spheres?

Q.7   a) A cylindrical shell 3m long has 1.2m internal diameter & 16mm thickness. Calculate the   08
            maximum & minimum value of tensile stresses induced due to internal pressure of 1.5N/mm^2.
            Also find change in length, change in volume if $\mu = 0.3$ & $E = 200\ GPa$

        b) A hollow circular shaft 200mm external diameter & 160mm internal diameter transmitting   07
            power at 180rpm the angle of twist on a length of 2m is found to be 0.55. Calculate power
            transmitted & maximum shear stress if modulus of rigidity is 80 GPa.

Q.8   a) A steel bar 3m long & 3500 mm^2 in area hangs vertically which is securely fixed on a collar   07
            at its lower end if weight of 20kN falls on the collor from a height of 10mm. determine the
            stress developed in the bar. What will be strain energy stored in bar? $E = 200\ GPa$

        b) A rectangular column $300mm \times 200mm$ is subjected to a compressive load of 450KN at   08
            point 'P' as shown in figure. Find the intensities of stresses at all corner of column.
            $e_x = 25mm$
            $e_y = 50mm$
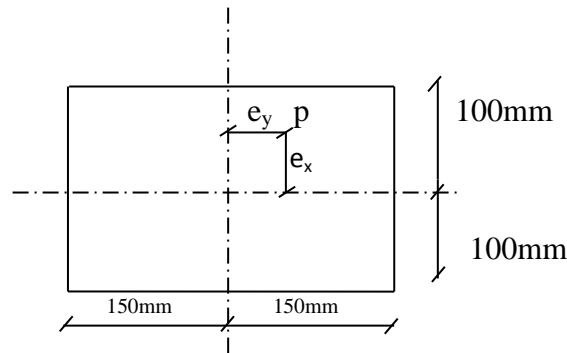
Q.9   A hollow cylindrical strut. External diameter 80mm & internal diameter 70mm is tested in direct   15
        compression & fails at 480KN. If same strut is tasted for both ends fixed. Over a length of 4m, the
        axial load for collapse is 280KN. Find the value of Rankine's constant.

Q.10   Solve any three   15
        a) Limitation of Euler's theory for mild steel
        b) Assumptions made in torsional theory
        c) Derive expression for change in volume for thick cylindrical shell
        d) Discuss chimney's subjected to combined stresses.

Total No. of Printed Pages:02

FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Heat Transfer
(REVISED)

[Time: Three Hours]   **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N.B
1. Question no.1 and 6 are compulsory.
2. Attempt any two questions from remaining question from each section
3. Figure to right indicate full marks.
4. Assume suitable data if necessary.

Section A

Q.1   Answer the following question.   10
   a) What is thermal conductivity? Write its unit
   b) Under which conditions, fins are used on the heat transfer surface?
   c) Write Fourier's law of heat conduction.
   d) What is free convection?
   e) Define fouling factor.

Q.2   a) Explain in detail conduction, convection and radiation.   08
       b) Derive an expression for the rate of heat transfer through a composite plane wall   07
          consisting of three heterogeneous layers having thermal conductivity; K1, K2 and K3
          respectively.

Q.3   Discuss the advantages and limitations of dimensional analysis. Derive a correlation equation   15
       for natural convection heat transfer.

Q.4   Calculate the critical radius of insulation for asbestos (K=0.172w/m ^{0}K) surrounding a pipe and   15
       exposed to room air at 300 ^{0}K with h = 2.8w/m^2 ^{0}K. Calculate the heat loss from a 475 ^{0}K,
       60mm diameter pipe when covered with critical radius of insulation and without insulation.

Q.5   Write note on
       a) Reynolds Analogy   07
       b) Lumped parameter analysis   08

Section – B

Q.6   Answer the following questions   10
       a) Define view factor
       b) Define LMTD
       c) Define the terms emissivity and absorptivity in radiation heat transfer
       d) Define 'Effectiveness' of a heat exchanger.
       e) What is subcooled boiling?

Q.7	Discuss the regimes of boiling heat transfer with the help of a boiling curve. Why is heat transfer coefficients lowered in film boiling as compared to nucleate boiling?	15

Q.8
    a) Show that absorptivity of a radiating body is equal to its emissivity   08
    b) State Stefan Boltzmann and Kirchhoff's law of thermal radiation   07

Q.9   Explain the theory of laminar film condensation and derive necessary equation   15

Q.10   Write note on
    a) NTU method for parallel flow heat exchanger   08
    b) Types of evaporators used in chemical industry   07

SUBJECT CODE NO:- H-214
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Mechanical Operations
(OLD)

[Time: Three Hours]   **[Max.Marks: 80]**

Please check whether you have got the right question paper.
N.B   1) Q. No. 1 and Q. No. 6 are compulsory.
                                  2) Solve any two questions from remaining of each section.
                                  3) Draw well labelled diagram if necessary.

Section A

Q.1   Define the following:-   10

        a) Bond's law
        b) Blinding of screen
        c) Arch formation
        d) Bulk density
        e) Critical speed of ball mill.

Q.2   What are the factors influencing the size of the product in a ball mill. Explain.   15

Q.3   Differentiate between:-   15
        a) Ball mill and tube mill
        b) Ideal screens and actual screens
        c) Primary crusher and secondary crusher.

Q.4   Calculate the power required in horse power to crush $150 \times 10^3 kg$ of feed if 80% of feed   15
        passes through 2.5 inches screen and 80% product passes through 1/8 inches screen.
        $(K_b = 4.784)$

Q.5   Write notes on:-   15

        a) Trommel
        b) Storage of solid particles
        c) Belt conveyor.

Section B

Q.6   Define   10
        a) Paramagnetic material
        b) Mixing index
        c) Filter medium
        d) Centrifugation
        e) Grizzly

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Q.7   Distinguish between:-   15

            a) Free and bindered settling.
            b) Vacuum filtration & pressure filtration
            c) Batch and continues thickner

Q.8   Explain the principal, working and application of
            a) Hydro cyclones   08

            b) Ultra filtration.   07

Q.9   a) Draw the sketches of flow pattern with propeller and turbine impeller.   08

            b) Explain the working and construction of Muller mixer and Ribbon blender.   07

Q.10   Write notes on:-   15

            a) Mechanical jig
            b) Floatation Cell
            c) Purpose of mixing.

Total No. of Printed Pages:2

FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Strength of Material
(REVISED)

**[Time: Three Hours]**   **[Max.Marks:80]**

Please check whether you have got the right question paper.
N.B   1) Attempt Q.1 & Q.6 are compulsory.
                                 2) Solve any two questions from each section.
                                 3) Assume suitable data, if necessary and state it clearly.

Section A

Q.1   Attempt any five from the following   10
                 i)   Elastic limit
                 ii)   Shear force & Bending moment
                 iii)   Poisson's ratio
                 iv)   Modulus of rigidity
                 v)   Volumetric strain
                 vi)   Strain energy.

Q.2   (a) Draw shear force and bending moment diagram from the given beam.   10
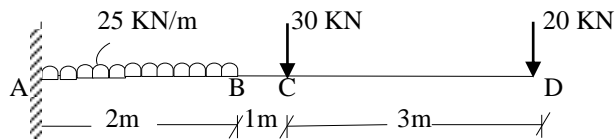
         (b) Derive the relationship between modulus of elasticity & bulk modulus.
                                                                                                          05

Q.3   Three bars made of copper, zinc and aluminium are of equal length have cross section 600, 800 & 15
         1000 mm^2 respectively. They are rigidly connected at their ends. If the compound members is
         subjected to a longitudinal pull of 280 KN, estimate the proportional of the load carried on each rod
         and the induced stresses. Take Ec=1.2 × 10^{5}N/mm^2 Ez=1 × 10^{5}N/mm^2 & Ea=0.8 × 10^{5}N/mm^2.

Q.4   An element in a stressed material has a tensile stress of 450 MN/m^2 and a compressive stress of 380   15
         MN/m^2 acting on two mutually perpendicular planes & equal shear stresses of 100 MN/m^2 on these
         planes. Find principal stresses & position of physical planes. Find also max. shearing stress.

Q.5   (a) What is core of section? Determine core of section for rectangular & circular section.   07
         (b) Derive equation for circumferential and longitudinal stress in cylindrical shell when subjected 08
             to internal fluid pressure.

Q.6   Solve any five (Explain)   10
      (i)   Principal stresses & strain
      (ii)   Pure torsion
      (iii)   Yield stress & Proof stress.
      (iv)   Direct Stress & bending stress
      (v)   Define resilience
      (vi)   Limit of eccentricity

Q.7   (a) Find the diameter of shaft required to transmit 60 KW at 150 r.p.m. if the maximum torque is   10
        likely to exceed to mean torque by 25% for a max. permissible shear stress of 60N/mm^2.
        Find also the angle of twist for a length of 2.5 m.

      (b) Derive equation of instantaneous tress in a bar due to impact load.   05

Q.8   (a) Derive the relation for a circular shaft subjected to torsion as given below   08
$$\frac{T}{J} = \frac{f_s}{R} = \frac{G_Q}{L}$$

      (b) A bar 1.5m long & 10 mm diameter hangs vertically and has a collar securely fixed at the   07
        lower end find the maximum stress induced in the bar when a load of 130N falls on the collar
        from a height of 18mm. Take E $= 2 \times 10^5$N/mm^2.

Q.9   A hollow cast from iron whose outside dia. is 200mm & has a thickness of 20mm is 4.8m long and   15
     fixed at both ends. Calculate the safe load by Rankines formulae using a factor of safety of 2.5. Find
     the ratio of Euler's to Rankines load. Take E= 1×10^5N/mm^2 & Rankines Constant $= \frac{1}{1600}$ for both
     ends pinned case & f$_c$=550N/mm^2

Q.10   A 250mm dia cast iron pipe has metal thickness 10mm. It is closely wound with 6mm diameter steel   15
     wire with an initial stress of 80N/mm^2. Find the final stresses developed in cylinder & wire when
     fluid is admitted at 3N/mm^2 pressure. Take Ec=100KN/mm^2 $\mu = 0.3$ & Es=200 KN/mm^2.

SUBJECT CODE NO:- H-286
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Heat Transfer
(OLD)

[Time: Three Hours]   **[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B
1. Question no.1 and 6 are compulsory
2. Attempt any two questions from remaining question from each section.
3. Figure to right indicate full marks.
4. Assume suitable data, if necessary
.

Section A

Q.1	Define the following	10
	a) Effectiveness of fins	
	b) Biots number	
	c) Mean film temperature	
	d) Insulation	
	e) Reynolds number	

Q.2   Name any four important dimensionless groups in heat transfer. What are their physical   15
significances?

Q.3   a) Derive the equation for laminar heat transfer over flat plate.   08
        b) Derive an expression for the rate of heat transfer through a composite plane wall   07
          consisting of three heterogeneous layers having thermal conductivity; K1, K2and K3
          respectively.

Q.4   Calculate the critical radius of insulation for asbestos $(K=0.172w/m^0K)$surrounding a pipe and   15
exposed to room air at 300^oK with $h=2.8w/m^2\ ^oK$. Calculate the heat loss from a 475^oK, 60mm
diameter pipe when covered with critical radius of insulation and without insulation.

Q.5   Write note on
        a) Critical radius of insulation   07
        b) Lumped parameter analysis   08

1

Section B

Q.6   Answer the following question   10
      a) Define view factor
      b) Define LMTD
      c) What is the capacity radio in an evaporator?
      d) Define 'Effectiveness' of a heat exchanger.
      e) What is subcooled boiling?

Q.7   Discuss the regimes of boiling heat transfer with the help of a boiling curve. Why is heat transfer   15
      coefficients lowered in film boiling as compared to nucleate boiling?

Q.8   a) Show that absorptivity of a radiating body is equal its emissivity.   07
      b) State Stefan Boltzmann and Wien's laws of thermal radiation.   08

Q.9   A single effect evaporator is used to concentrate 15000kg/h of a 20% solution of caustic soda to   15
      60% concentration. Heating medium is dry and saturated steam at 125°C. The vapour space
      pressure is 100mm Hg (absolute). Find out the steam consumption, steam economy and heat
      transfer area if the following data is available.
      Feed temperature = 37°C
      BPE= 52°C
      (Cp)feed = 0.92
      (Cp)product = 0.75
      U_0=1200w/m^{2} ^{o}C
      h_{fg}=2188KJ/Kg at 25°C from steam table
      h_v=2595KJ/Kg= enthalpy of vapour from steam table

Q.10   Write note on   15
      a) NTU method for parallel flow heat exchanger
      b) Types of evaporators used in chemical industry
      c) Plate type heat exchanger

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SUBJECT CODE NO:- H-334
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Fluid Mechanics
(OLD)

[Time: Three Hours]   **[Max.Marks:80]**

Please check whether you have got the right question paper.
N.B   1. Q. no.1 & Q.no.6 are compulsory.
                2. Solve any two questions from each section from remaining.
                3. Draw neat & labeled diagram wherever required.
                4. Make suitable assumptions if required.

Section A

Q.1   Solve any five from the following.   10
        a) Define specific weight and specific volume of a fluid.
        b) Explain the term dynamic viscosity.
        c) Define surface tension.
        d) Define steady flow
        e) Define the term velocity potential function.
        f) Give one example of non uniform flow.
        g) Give the formula for eddy viscosity.
        h) Define Laminar flow.

Q.2   a) Obtain expression for hydrostatic force on plane surface.   08
        b) Obtain expression for barometric equation.   07

Q.3   a) Derive an equation for angular momentum.   08
        b) Derive the equation for ideal gas.   07

Q.4   a) Explain the terms.   10
            1) Boundary layer and Boundary layer separation.
            2) Wake formation.

        b) How does viscosity of a fluid vary with temperature?   05

Q.5   Explain the term.   15
            I.   Hydrostatic force on curved surface.
            II.   Explain viscosity and momentum flux
            III.   Laminar and turbulent flow.

1

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Section B

Q.6   Answer any five   10
       a) Define incompressible fluid
       b) Define laminar and turbulent flow
       c) Give the types of drags.
       d) Define pumps.
       e) What is priming?
       f) What is minimum fluidization velocity?
       g) Define Newtonian fluid.

Q.7   a) Starting from fundamentals derive the Ergun's equation.   08
       b) Starting from fundamentals derive the Kozeny- Carman equation.   07

Q.8   A centrifugal fan is used to take flue gas at rest and at a pressure of 700mm. Hg and a temperature 15
       as 91.3°C and discharge it at a pressure 765mm. Hg and a velocity of 42.7m/s. Calculate the
       power needed to move 16.990m³/h of gas using standard condition as 29.92in. Hg and 32°F. The
       efficiency of the fan is 65 percent and the molecular weight of the gas is 31.3.

Q.9   a) Derive the equation for pressure by formula Hagen-Poiseuille.   08
       b) Derive the equation for average velocity for turbulent flow.   07

Q.10   Write notes on   15
       a) Explain Mood's chart
       b) Working of pitot tube with neat sketch
       c) Fluidization

2

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SUBJECT CODE NO:- H-335
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical) (CGPA)
Fluid Mechanics
(REVISED)

[Time: Three Hours]   **[Max. Marks: 80]**

Please check whether you have got the right question paper.
N.B   i) Q. No 1 & Q. No 6 are compulsory.
            ii) Answer any two questions from remaining of each section.
            iii) Assume suitable data, if required and draw neat sketches whenever needed.

Section A

Q.1   Define and explain
            a) Sonic velocity   03
            b) Mach Number   03
            c) Turbulence   03

Q.2   a) State and explain Pascal's law.   07

          b) Starting from fundamental derive an Euler's equation.   08

Q.3   a) If $15m^3$ of certain oil weighs 45kN calculate the specific weight, specific gravity and mass   05
              density of the oil.

          b) A two liquid double column enlarged-ends manometer is used to measure pressure   10
              difference between two points . The basins are partially filled with liquid of specific gravity
              0.75 and the lower portion of U-tube is filled with mercury of specific gravity 13.6. The
              diameter of the basin is 20 times higher than that of the U-tube. Find the pressure difference
              if the U-tube reading is 25 mm and the liquid in the pipe has a specific weight of 0.475
              N/M^3.

Q.4   Distinguish between a) Laminar and Turbulent flow b) uniform flow and steady state flow c)   15
          Newtonian fluid and non Newtonian fluid.

Q.5   Write short note on:
            a) Boundary layer separation & wake formation.   05
            b) Manometers   05
            c) Hydrostatic forces on plane and curved surface.   05

Section B

Q.6   Define & explain following terms.
            a) Free and hindered settling   03
            b) Skin friction and wall shear   03
            c) Suction lift & cavitation   04

335   1

Q.7 A 20 cm × 10cm venturimeter is provided in a vertical pipe line carrying oil of sp.gr. 0.9 , the flow 15 being upwards . The difference in elevation of the throat section and entrance section of the venturimeter is 20cm. the differential U-tube mercury manometer shows a deflection of 20 cm. Calculate : i) discharge of oil and ii) the pressure difference between the throat section and entrance section. Take C_d=0.99 and sp.gr. of mercury as 13.6.

Q.8 a) With the neat sketch explain Pitot tube . How will you measure fluid flow by using Pitot tube. 07

b) Show that V_{avg} /u_{max} =0.5 for laminar low of Newtonian fluids. 08

Q.9 With a neat sketch explain the process of fluidization. State any two applications in detail. 15

Q.10 Write short note on
    a. Effect of roughness parameter. 05
    b. Blowers 05
    c. Airlift pump. 05

SUBJECT CODE NO:- H-369
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Engineering Chemistry
(OLD)
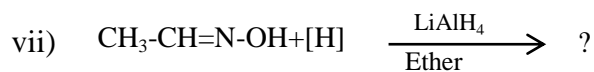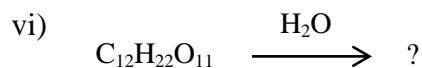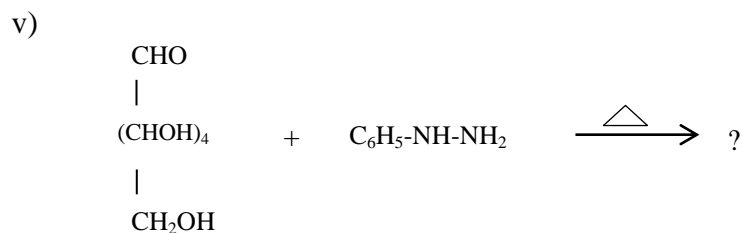**[Time: Three Hours]**   **[Max.Marks:80]**

Please check whether you have got the right question paper.
N.B   i.   Question number 01 and 06 are compulsory.
                       ii.   Solve any two questions from remaining each section.
Section A

Q.1   Predict the product (any five)   10

    i)

$$\underset{\triangle}{\overset{CaO}{\longrightarrow}}$$

+ NaOH → ?

    ii)

+ H_2SO_4 $\overset{\triangle}{\longrightarrow}$?

    iii)

+ C_4H_9Li → ?

    iv) $2\ CH \equiv CH + H_2S$ $\xrightarrow[673°k]{Al_2O_3}$?

    v)

CHO
|
(CHOH)$_4$ + C_6H_5-NH-NH$_2$ $\overset{\triangle}{\longrightarrow}$?
|
CH$_2$OH

    vi) $C_{12}H_{22}O_{11}$ $\overset{H_2O}{\longrightarrow}$?

    vii) CH_3-CH=N-OH+[H] $\xrightarrow[Ether]{LiAlH_4}$?

1

viii)

$\overset{\oplus}{N}H_3\overset{\ominus}{cl}$ (on benzene ring) $+$ NaOH $\xrightarrow{\triangle}$?

ix)

NH_2 (on benzene ring) $+$ CH_3-I $\longrightarrow$?
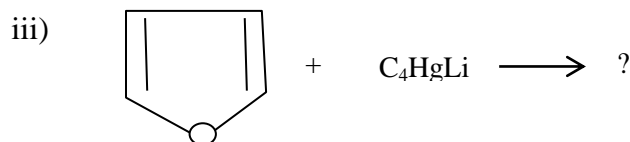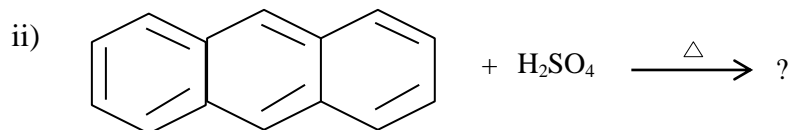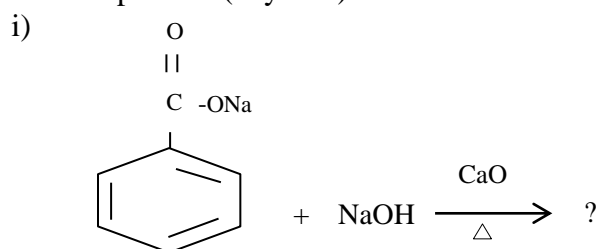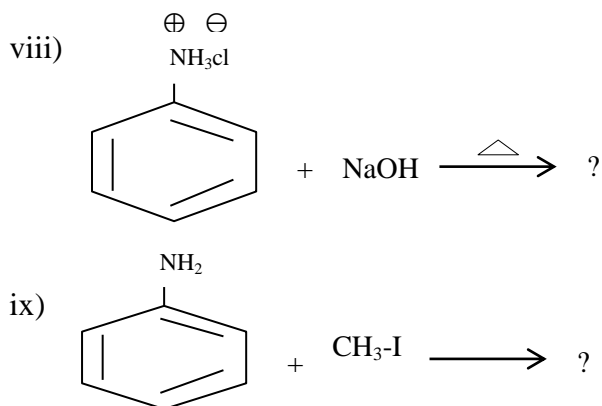
Q.2   a) How can you prepare quinolone from aniline and glycerol? Explain general physical properties of quinolone.   06

    b) Discuss any five chemical properties of naphthalene.   05

    c) Explain with mechanism preparation of pyrrole from 1,4-diketone and ammonia.   04

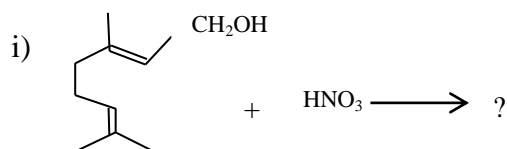Q.3   a) How can you prepare glucose from starch? Explain any four chemical properties of glucose.   06

    b) What is dye? Explain in brief methods of dyeing.   05

    c) Explain general physical properties and uses of sucrose.   04

Q.4   a) What is diazotization reaction? Explain any four applications of benzene diazonium chloride.   06

    b) Explain any five chemical properties of aniline.   05

    c) Discuss general physical properties of amines.   04

Q.5   Write a short note on (any three)   15

    i) Chemical properties of benzene

    ii) Preparation methods of primary amines.

    iii) Hinsberg method for separation of amines.

    iv) Methyl orange

    v) Preparation of furan from 1,4-dialdehyde and 1,4-diketone.

Section B

Q.6   Predict the product (any five)   10

    i)

CH_2OH ... $+$ HNO_3 $\longrightarrow$?

2

ii)

 $+$ I_2 $\xrightarrow{PCl_3}$?

iii)

 $+$ HNO_3 $\xrightarrow[\triangle]{H_2SO_4}$?

iv) $CH_3\text{-}OH + H_2SO_4$ $\xrightarrow{\triangle}$?

v)

$CH_3\text{-}CH_2\text{-}Cl + H_2O_2$ $\xrightarrow{NaOH}$?

vi) $C_6H_5\text{-}CH=CH\text{-}COOCH_3 + CH_2(COOCH_3)_2$ $\xrightarrow{C_2H_5ONa}$?

vii)

$\underset{\displaystyle CH_3\text{-}C\text{-}Cl + [H]}{\overset{\displaystyle O \atop \displaystyle \|}{}}$ $\xrightarrow[\text{Ether}]{LiAlH_4}$?

viii)

 $+ CO + HCl$ $\xrightarrow[AlCl_3]{CuCl_2}$?

ix)

 $\xrightarrow[H^{\oplus}]{NaOH}$?
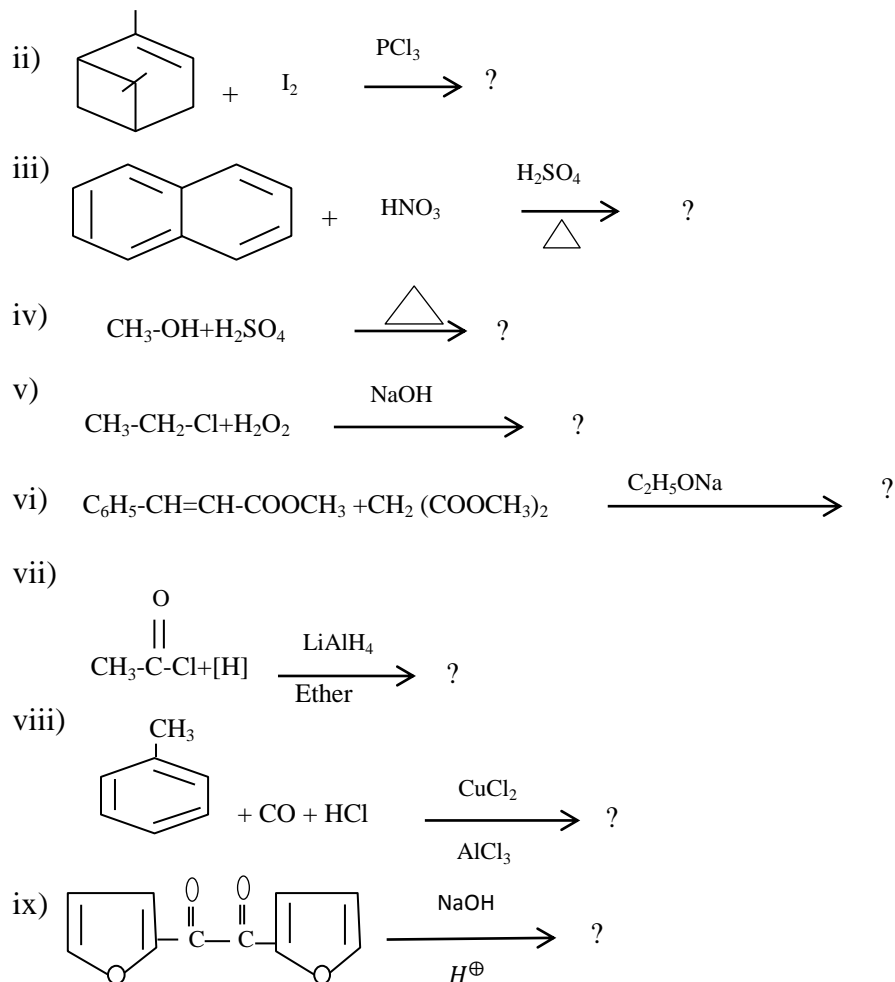
Q.7 a) What is halogenation reaction? Explain with mechanism chlorination of benzene. 06
  b) Give any five uses of peracids. 05
  c) What are nitrating agents? Discuss general physical properties of nitro compounds. 04

Q.8 a) How pinacol is converted into pinacolone? Explain with mechanism. 08
  b) What is knoevenagel reaction? Explain with mechanism knoevenagel condensation 07
    between acetaldehyde and malonic ester.

Q.9 a) What are terpenes? Explain in brief classification of terpenes. 06
  b) How geraneol is prepared from citral-a? Explain general physical properties of geraneol. 05
  c) Discuss any four chemical properties of α −pinene. 04

Q.10 Write a short note on (any three) 15
    i) Sulphonation of lauryl alcohol and dimethyl ether
    ii) Uses of lithium aluminum hydride
    iii) Benzil-benzilic acid rearrangement
    iv) BHC
    v) Isoprene rule

3

Total No. of Printed Pages:02

FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical) (CGPA)
Process Instrumentation& Analytical Tech.
(REVISED)

[Time: Three Hours]   **[Max.Marks:80]**

Please check whether you have got the right question paper.
N.B   1) Q. No.01 & Q. No. 06 are compulsory
             2) Solve any two questions from remaining of each section.
             3) Wherever necessary draw the neat sketch
SECTION – A

Q.1   Explain the following terms (Any five)   10

        1) Registering type instrument
        2) Signaling type instrument
        3) Pressure head
        4) Thermal well
        5) Drift
        6) Bourdon tube

Q.2   a) Describe the construction, working of U – tube manometer.   07

        b) Explain the static and dynamic characteristics of the instruments.   08

Q.3   a) Describe the construction, working of Bourdon pressure gauge.   07

        b) Explain the principle of industrial thermocouples with it working and industrial application.   08

Q.4   a) Explain the pressure spring thermometer with neat figure and applications.   07

        b) Describe in detail the principle, construction and working of the radiation pyrometer. 08

Q.5   a) With suitable example explain the direct and indirect level measurement.   07

        b) With neat figure, explain the orifice flow meter.   08

1

Q.6   Explain the following terms   10

      1) Transmittance
      2) Adsorption
      3) Principle of flame photometer
      4) Colorimetric analysis
      5) TLC plate

Q.7   Describe principle, construction and working
      a) Flame photometry   08

      b) Infra-red Spectrometer   07

Q.8   a) Describe the Karl fisher titration method for the analysis.   07

      b) Explain the principle, construction and working of the Gas chromatography.   08

Q.9   a) Explain different methods of quantitative & qualitative analysis of Polarography.   07

      b) Explain the Instrumentation of Amprometric titrations.   08

Q.10   a) Explain the various applications of Polarographic titrations.   07

      b) Explain the construction and application of Spectrophotometer.   08

Total No. of Printed Pages:03
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Instrumentation) (CGPA)
Network Analysis & Synthesis
**(REVISED)**

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.
N.B   1) Solve <u>three</u> questions <u>from each section</u>.
            2) <u>Q. No. 1 from Section A & Q.No.6 from Section B are</u> compulsory.
SECTION – A

Q.1   Attempt <u>any five</u>   10
           a) Define the term tree & Co – tree.
           b) What is the necessity of network topology.
           c) State integration property of Laplace transform
           d) What do you mean by network analysis?
           e) What is linear & non-linear network?
           f) What is stability of the network?
           g) What is ideal & practical voltage source?
           h) Define Reciprocity theorem.
           i) What is active & passive network
           j) What do you mean by oriented graphs?

Q.2   a) Explain duality in detail.   07

           b) State & prove Thevenin's theorem.   08

Q.3   a) Discuss different terms associated with network graph.   07

           b) Obtain delta network equations from the star network.   08

Q.4   a) Examine the polynomial as Hurwitz or not?   07
              $S^5 + 8S^4 + 2S^2 + 6S + 3 = 0$

           b) Calculate current through 10Ω resistance using loop analysis.   08

1

402
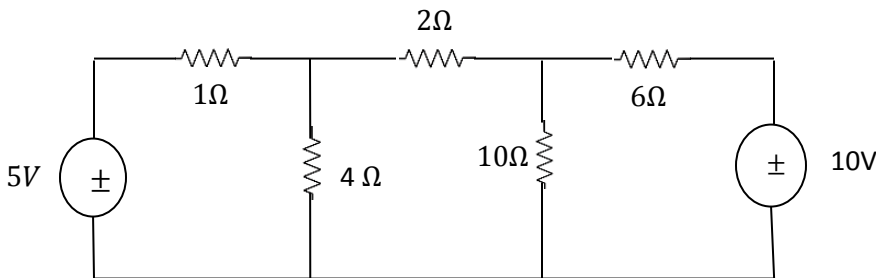
Q.5   Write notes on

     a) Super position theorem   07

   b) Delta to Star network transformation   08

SECTION – B

Q.6   Attempt <u>any five</u>   10
     a) List out properties of Chebyshev filter
     b) What is current ratio transfer function
     c) What is ladder network? Why is if necessity?
     d) What is two port network?
     e) What is pole & zero?
     f) Write standard equations of Y – parameters.
     g) Why Z – parameters are called open current impedance parameters?
     h) What is high pass filter?
     i) What is linear phase filter?
     j) What is frequency domain analysis?

Q.7   a) What is high pass filter? Explain in detail.   07

     b) Find Y- parameters for the network shown bellows.   08
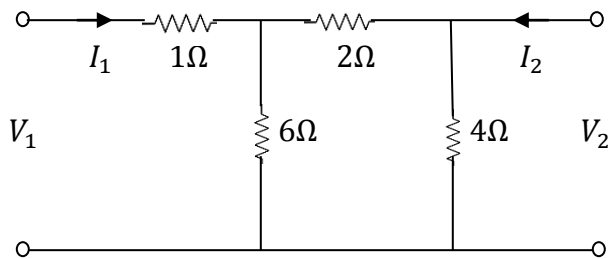
Q.8   a) For an equation $I(S) = \dfrac{S}{(S+2)(S^2+2S+1)}$ 07

       Draw Pole – zero plot. Obtain $i(t)$

     b) How Z – parameters converted in to T – parameters.   08

2

Q.9   a) Find the network function $Z_{11}(s)$ & $Z_{21}(s)$ for the network shown below.   07
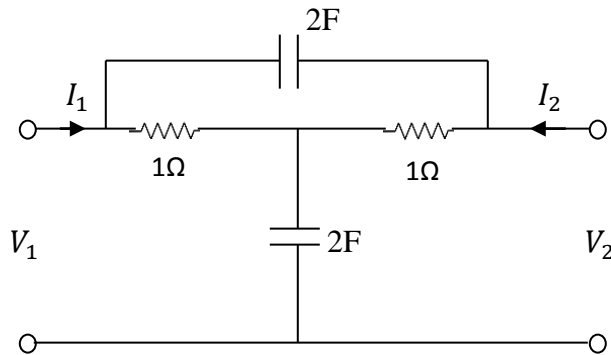
        b) Discuss significance of poles & Zeros.   08

Q.10   Write notes on   15

      a) H – parameters
      b) Chebyshev filter design
      c) Frequency response of filter.

Total No. of Printed Pages:02

FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Physical Chemistry & Thermodynamics
(OLD)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.
N.B
i) <u>Q.No.1 & Q.No.6 are compulsory</u>.
ii) Solve <u>any two</u> questions <u>from the remaining questions</u>.
iii) Draw a well labelled diagram & Assume suitable data wherever necessary.

SECTION – A

Q.1 Explain the following terms (<u>any five</u>) 10

    i) Surface tension
    ii) Conductance
    iii) Gels
    iv) Quantum efficiency
    v) EMF
    vi) Ionic mobility
    vii) Hydrophilic systems

Q.2 a) Explain the term surface tension and parachor value and discuss in detail the determination of surface tension by capillary rise method. 08

    b) Explain in detail radiation chemistry and ionization by radiation. 07

Q.3 a) Discuss in detail the freundlich adsorption isotherm & explain the unimolecular & bimolecular layer formation. 08

    b) State & explain Debye & Hackle theory. 07

Q.4 a) Discuss in detail the various properties of colloidal systems diagrammatically. 08

    b) 1) Explain Lambert's Beer's law. 07
       2) Stark Einstein law.

Q.5 Write short notes on. 15

    a) Ionic & covalent bonds.

    b) Photosensitized Reactions.

    c) Electrolysis & electrode potential.

SECTION – B

Q.6   Define the following: 10

      a) Work
      b) Specific heat
      c) Phase rule
      d) Ideal gas
      e) Heat engine

Q.7   Two kilogram of CO_2 gas is contained in a piston cylinder assembly at a pressure of 6.5 bar and a   15
temp of 300K. The piston has a mass of 5000Kg and a surface area of $1\ m^2$. The friction of the
piston on the walls is significant and cannot be ignored. The atmospheric is 1.01325 bar. The latch
holding the piston is suddenly removed & the gas is allowed to expand. The expansion is arrested
when the volume is double the original volume. Determine the work appearing in the surrounding
will it be the same as the work done by the gas.

Q.8   The PVT behaviour of nitrogen is represented by the viral gas equation $PV = nRT$ where n is the   15
number of moles of the gas & R the ideal gas constant $(R = 8.314KJ/KmolK)$. The heat capacities
of the gas are $C_V = 20.8$ and $C_P = 29.15\ KJ/Kmol\ K$. The gas initially at 10 bar & 280K is
undergoing a change of state to the final condition of 10 bar and 280 K. is undergoing a change of
state to the final condition of 1 bar and 340K. Determine the change in internal energy & the change
in enthalpy.

Q.9   Show that   15

      a) $ds = c_p \dfrac{dT}{T} - \left(\dfrac{\partial V}{\partial T}\right)_P dP$

      b) $ds = C_V \dfrac{dT}{T} + \left(\dfrac{\partial P}{\partial T}\right)_V dV$

      Notation have same significance.

Q.10   Write notes on: 15

      a) Heat engines
      b) Application of phase rule two component systems.
      c) First law of thermodynamics.

SUBJECT CODE NO: H-404
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical) (CGPA)
Mechanical Operation
(REVISED)

[Time: Three Hours]   [Max.Marks:80]

Please check whether you have got the right question paper.
N.B   1) Q. No. 1 and Q. No.6 are compulsory.
             2) Solve any two questions from remaining of each section.
             3) Draw well labelled diagram if necessary.
                            SECTION – A

Q.1   Answer the following:

        a. State kick's law?   03

        b. What is the application of cyclone separator   02

        c. What is the principle working of jaw crusher.   03

        d. What is arch formation in storage tanks.   02

Q.2   What are the different types of screening equipment's used in an industry. Explain with neat sketch   15
        any two.

Q.3   How are solids stored? Draw neat sketches and explain.   15

Q.4   Explain with neat sketch, construction, working of the following.

        a) Tumbling Mill   07

        b) Gyratory crusher   08

Q.5   Write short notes: 15

        a) Silos
        b) Belt conveyor
        c) Screw conveyor

Q.6   Answer the following

      a)   What are filter aids?   02

      b)   What is mixing index?   03

      c)   Draw neat sketches of various phases of settling in a column.   03

      d)   Explain any one type modifiers? What is its application.   02

Q.7   Distinguish between: 15
      a)   Impellers & Agitators

      b)   Plate & frame filter press and Moore filter press.

      c)   Banbury mixer & sigma mixer.

Q.8   a)   With neat sketch give the principle and working of mechanical jig?   08

      b)   With neat sketch give the principle and working of cyclone separator.   07

Q.9   Define filtration? Explain the working, sketch and application of following: 15
      a)   Sand filtration
      b)   Vacuum filtration

Q.10   Write notes on: 15

      a)   Ribbon blender
      b)   Rake classifier
      c)   Bulk density

SUBJECT CODE NO:- H-441
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical)
Chemical Process Calculations
(OLD)

[Time: Three Hours]   [Max.Marks: 80]

Please check whether you have got the right question paper.

N.B   i.   Q.No.1 from section A and Q.No.6 from section B are compulsory.
                            ii.   Attempt any two questions from the remaining questions in each section.
                            iii.   Assume suitable data if required.

Section A

Q.1   Answer the following :(any five)   10

               1) Phase rule.
               2) Dew point temperature.
               3) Solubility diagram.
               4) Mole fraction.
               5) Stoichiometric ratio.
               6) Selectivity of reactant.

Q.2   In a textile industry it is desired to produce 24% caustic soda solution by wt. the above solution   15
           is prepared in two steps first caustic soda is dissolved in correct quantity of water in a
           dissolution tank to prepare 50% by wt. solution. After dissolution and cooling is complete this
           solution is taken to a dilution tank where some more water is added for producing 24% by wt.
           caustic soda solution. Assume no evaporation loss of water in dissolution tank to bypass water to
           the dilution tank.

Q.3   a) Calculate molality, molarity and normality of a solution prepared by dissolving 5gm of   07
               $Na_2 Co_3$ in 14% of water at $25°c$.

           b) A crystallizer is charged with looks of solution containing 25% $Ba(NO_3)_2$ in water .on   08
               cooling 10% of the water (original) was present evaporates.
               Calculate the yield of crystal when the solution is cooled to 283K. The solubility at 283K
               is $7.0\ kg\ (Ba(NO_3)_2/100\ kg$ total water.

Q.4   a) The dry bulb temperature and dew point of ambient air were found to be 302K and291K   07
               respectively. Barometer reads 100KPa. Given vapor pressure of water at 291K is 2KPa
               &vapor pressure of water at 302K is 4.0KPa. Calculate humid heat & humid volume.

           b) How to estimate critical properties for pure substance.   08

1

Q.5   Write note on: 15

           a) Purging & pass operation.
           b) Material balance without chemical reaction.
           c) Heat capacity & specific heat.

Section B

Q.6   Answer the following: (any five)   10

           1) Heat of combustion.
           2) Application of energy balance.
           3) Theoretical air requirement.
           4) Heat of solution & mixing.
           5) Specific heat of a substance.
           6) Heat capacity of gaseous mixture.

Q.7   Chlorobenzene is nitrated using mixture of HNO_3 & H_2SO_4 . Daring pilot plant run charge   15
           consist of mixture of HNO_3 & H_2SO_4 chlorobenzene as 106.5kg &65.5% by wt.$HNO3$ as108.5kg
           & 93.6 by wt. Of H_2SO_4 & $100kg$ chlorobenzene. After 2hr. operation. The final mixture was
           analyzed & found that final product contained 2% unreacted chlorobenzene. Product distribution
           to be 66% P-nitro chlorobenzene & 34% O-nitrochlorobenzene calculate-
           i)   Analysis of charge.
           ii)   % conversation of chlorobenzene.
           iii)   Composition of product mixture.

Q.8   The temperature of oxygen is raise from $77°c \ to \ 1227°c$. Calculate the amount of heat that must 15
           be supplied of 2kmol oxygen.
           $$C_P^° = a + bT + cT^2 + dT^3$$
           For oxygen
           $a = 26.0252$
           $b = 11.7551 \times 10^{-3}$
           $c = -2.3426 \times 10^{-6}$
           $d = -0.5623 \times 10^{-9}$

2

Q.9   a) Calculate the std. heat of formation of (C_2H_2) std. heat of combustion of acetylene is   07
          -1299 KJ std. heat of combustion of carbon is -393 KJ& std. heat of formation of water
          is -285.84 KJ

       b) A natural gas the following composition on male basis   08
             $CH_4 = 84\%$
             $C_2H_6 = 13\%$
             $N_2 = 3\%$

          Calculate heat to be added to heat 200KJ natural gas from 311K to 533K
                             $C_{P_m}^{\circ}$ $KJ/(Kmol.K)$

Gas	$C_{P_m}^{\circ}(311 - 298K)$	$c_{P_m}^{\circ}(533 - 298K)$
CH_4	36.0483	41.7800
C_2H_6	53.5240	67.4954
N_2	29.1317	29.3578

Q.10   Write note on: 15

       a) Mass balance in distillation column
       b) Enthaphy change in chemical reaction
       c) Calorific value of fuel.

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Total No. of Printed Pages:3
FACULTY OF ENGINEERING AND TECHNOLOGY
S.E. (Chemical) (CGPA)
Chemical Process Calculations
(REVISED)
[Time: Three Hours]   [Max.Marks: 80]

Please check whether you have got the right question paper.

N.B
    i.   Q.No.1 from section A and Q.No.6 from section B are compulsory.
    ii.   Attempt any two questions from the remaining questions in each section.
    iii. Assume suitable data if required.

Section A

Q.1   solve any five: 10

1. Define with example-
   a. Equivalent weight.
   b. Normality.
2. Define-
   a. Mole percent.
   b. Mole fraction.
3. Define-
   a. Dalton's law.
   b. Amagaf's law.
4. Explain average molecular Wight of gas mixture.
5. Explain steady state process.
6. Explain material balance of evaporation.

Q.2   a) The ground nut seeds containing 45% oil and 45% solids are fed to expeller the cake   07
           coming out of expeller is found to contain 80% solids and 08% oil. Find the percentage
           recovery of oil.

    b) A feed to a continuous fractioning column analyses by weight 28% benzene & 72%   08
           toluene. The analysis of distillate shows 52% weight benzene & 5 weight % benzene was
           found is the bottom product calculate the amount of bottom & distillate product per 1000
           kg of feed per hour calculate percent recovery of benzene.

Q.3   Gaseous benzene (C_6H_6) react with hydrogen in presence of Ni catalyst as per the reaction: 15
$$C_6 H_{6(g)} + 3H_{2(g)} \xrightarrow{Ni} C_6H_{12(g)}$$

30% excess hydrogen is used above that required by the above reaction. Conversion 50% & yield
is 90% calculate the requirement of benzene and hydrogen gas for 1000 moles of cyclohexane.

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Q.4   In synthesis of methanol fresh feed containing 32% CO, 64% H_2 & 4% inert (by volume) is   15
       mixed with recycle feed. Mixed feed entering the reaction results in 20% per pass conversion of
       CO. The product stream from reactor are fed to condenser where all methanol formed gets
       condensed and the gases from condenser are recycled. In order to prevent buildup of inert in
       recycle loop a small portion of gases leaving the condenser is continuously purged. If mixed feed
       contains 13 mole % inert calculate recycle ratio, purge ratio.

Q.5   Nine liters of a gaseous mixture containing of a gaseous organic compound A and just sufficient   15
       amount of oxygen required for complete combustion yielded on burning of 6 lit of Co_2, 4 lit of
       water and 1 lit of N_2. All volumes required at same temperature and pressure. If the compound A
       contains C, H & N only then how many lit of O_2 are required for complete combustion.

Section B

Q.6   Solve any five: 10

            1) Define-
                        a)   Kinetic energy.
                        b) Potential energy.
            2) Explain heat capacity.
            3) Heat of combustion.
            4) Adiabatic reaction.
            5) Latent heat of sublimation.
            6) Adiabatic saturation temperature.

Q.7   a) A natural gas the following composition on mole basis: 15
                $CH_4 = 84\%$
                $C_2H_6 = 13\%$
                $N_2 = 3\%$
             Calculate
             a) The heat added to heat 2Kmol of gas mixture from 311K to 533K
             b) The heat to be added to heat 200kg of natural gas from 311K to 533K

             $C_{P_m}^{\circ}$ values in $KJ/(Kmol.K)$

Gas	$C_{P_m}^{\circ}(311 - 298K)$	$c_{P_m}^{\circ}(533 - 298K)$
CH_4	36.0483	41.7800
C_2H_6	53.5240	67.4954
N_2	29.1317	29.3578

Q.8   The dry bulb temperature and dew point of ambient air were found to be 303K and 298K   15
       respectively. Calculate-
       i)   Absolute molal humidity
       ii)   Absolute humidity
       iii)   % RH
       iv)   Hamid heat
Vap. Pressure of water at 298K=1.818Kpa
Vap. Pressure of water at 303K=4.243Kpa
Barometric pressure =100Kpa

Q.9   The ultimate analysis of a residual fuel oil sample is as given below   15
       C=88.4%, H=9.4%, S=2.2 %(by wt.)
       It is used as a fuel in a power generating boiler with 25% excess air
       Calculate:
       a) The theoretical dry air requirement.
       b) The actual dry air supplied.
       c) The orsat analysis of flue gases.

Q.10   Obtain an empirical equation for calculating heat of reaction of any temperature T for the   15
       following reaction.
       $$CH_{4(g)} + C_2H_{4(g)} \rightarrow C_3H_{8(g)}$$
       $$\Delta H_R^\circ \; at \; 298 \; K = -82.66 \; KJ/mol$$
       $$C_P^\circ = a + bT + CT^2 + dT^3 \; KJ/(kmol.k)$$

Component	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
$CH_{4(g)}$	19.2494	52.1135	11.973	-11.3173
$C_2H_{4(g)}$	4.1261	155.0213	-81.5455	16.9755
$C_3H_{8(g)}$	-4.2227	306.264	-158.6316	32.1455

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