Seat
No.

S.E. (Chemical Engg.) (Part - II) (Semester - IV) (Revised) Examination, May -2018
HEAT TRANSFER
Sub. Code : 63430

Day and Date :Monday, 14 - 05 - 2018   **Total Marks : 100**
Time : 10.00 a.m to 1.00 p.m.

Instructions :   1)   **Attempt any Three questions from each section.**
                   2)   **Assume suitable data if missing.**
                   3)   **Draw figures wherever necessary.**

SECTION - I

Q1) a)   Discuss the effect of temperature on the thermal conductivity of material and modes of heat Transfer.   **[8]**

   b)   A wall of an over is to be constructed by 10cm layer of a common brick having a thermal conductivity of 0.7 w/m°c and is followed by a 4cm layer of crypsum plaster with a thermal conductivity is 0.48 w/m°c. What thickness of rock wool insulation should be added to reduce heat loss through the over wall by 80 perecent?

   Thermal conductivity of rock - wool is 0.065 w/m°c.   **[8]**

Q2) a)   An oil is following through a tube having 10mm I.D and 10.4 mm 0.D at a rate of 3 kg/min. The oil enters at 35°c and is to be heated to 45°C by condensing the steam at atmospheric pressure on the outside of the tube. Calculate the length of the tube required by considering the properties of oil at 40°C.   **[8]**

   Specific heat = 1964 J/kg°c

   Thermal conductivity = 0.144 w/m°c

   Viscosity = 0.216 W. S/m^2

   density = 876 kg/m^3

P.T.O.

b) Show the temperature profile for co-current and countercurrent for a single pass flow heat Exchanger. And discuss how to construct overhall htc from individual htc. [8]

Q3) a) A single pass shell and tube heat exchanger is to be designed for a system in which oil is to be cooled from 95°c to 65°c which flows at 10×10^3 kg/hr [specific heat of oil is 2100 J/kg°c] by passing water at a rate of 5×10^3 kg/hr [specific heat is 4200 J/kg°c] and at a temperature of 15°c. Assume that overall heat Transfer coefficient is 240 w/m² °c. Intermine the surface area required for cocurrent flow, counter current flow and cross flow if F is 0.93. [8]

b) Discuss heat transfer in transition region and heat transfer to liquid metals. [8]

Q4) Write short notes (any three). [18]

a) Critical Radius of lagging.

b) Fouling factor.

c) Heat Transfer by forced convection.

d) Regimes of heat Transfer and Thermal Boundary layer.

SECTION - II

Q5) a) What is pool boiling of saturated liquid? Discuss the boiling phenomena with neat boiling curve, diagram. [8]

b) A small black body has a surface temperature is at 4727°c. Determine the heat flux due to thermal radiation, max. value of monochromatic emissive power and wave length at which max. monochromatic emmissive power occures. $C_1 = 0.596 \times 10^{-16}$ and $C_2 = 0.014384$. [8]

Q6) a) What do you mean by compact heat exchanger? Give the bread classification of heat exchanger and discuss kettle type reboiler with neat diagram. [8]

b) A saturated steam at 80°c condencer on the outside of a vertical tube of 1000mm high and is maintained at 70°c, calculate average h.t.c, local h.t.c, at 500mm height and film thickness at 500mm height for the following data.

$\varsigma_l = 974.8$ kg/m3 $\lambda = 2300$ kJ/kg°c

$\mu_l = 380.5 \times 10^{-6}$ N.s/m² $K_l = 0.6715$ w/m°c   [8]

Q7) a) A SEE is used to concentrate 4000 kg/hr an aqueous solution at 50°c from 7% to 32% solid content by at using a saturated steam at 2 bar gauge pressure. If U is 2kw/m² °c. Calculate the capacity, steam consumption, Economy and heat transfer area required. Vapor space pressure remains constant at 1.013 bar absolute.

Data : Heat capacity of feed = 4.2 KJ/kg °c

Steam pressure is 2 bar gauge = 2 + 1 = 3 bar (abs) corresponding to this pressure.

Ts = 135.55°c λs = 2163.9 KJ/kg Tsat = 100°c and λv =2256 KJ/Kg   [10]

b) Discuss heat transfer to packed bed and Agitated vessel.   [6]

Q8) Write short notes on anyThree.   [18]

a) Effect of non condensable gases on sate of condensation.

b) Shell and Tube Heat exchanger.

c) Methods of feeding for Evaporator.

d) Radiation between black surfaces.

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Seat
No.

S.E. (Chemical Engineering) (Semester - III)
Examination, April -2018
ENGINEERING MATHEMATICS - III
Sub. Code : 63421

Day and Date : Tuesday, 24 - 04 - 2018   **Total Marks : 100**
Time : 2.30 p.m to 5.30 p.m.

Instructions :   1)   Attempt any three questions from each section.
                  2)   Use of non programmable calculator is allowed.
                  3)   Figures to the right indicate full marks.

SECTION - I

Q1) a)   Solve $(D^3 - 5D^2 + 7D - 3) y = e^{2x}\cosh x$ [6]

b)   Solve $(D^2 + 4) y = \sin^2 x$ [5]

c)   Solve $(D^3 + 8) y = x^4 + 2x + 1$ [6]

Q2) a)   A tank contains 100 liters of an aqueous solution containing 10 gm of salt. Water is entering the tank at rate of 3 liters per minute and the well stirred mixture runs out at 2 liters per minute. How much salt will the tank contains at the end of one hour? After what time will the amount of salt in the tank be 625 gm?   [8]

b)   A pipe 20 cm in diameter contains steam at 150°C and is protected with a covering 5 cm thick for which k=0.0025. If the temperature of the outer surface of the covering is 40°, find the temperature half-way through the covering under steady state conditions.   [8]

P.T.O.

Q3) a) The function $f(x) = \cos x$ can be expanded as

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots\ldots\ldots$$ Compute the number of terms required

to estimate $\cos\left(\frac{\pi}{4}\right)$ so that the result is correct to at least two significant

digits. **[6]**

b) Find the positive root of $x^4 - x = 10$ correct to three decimal places, using Newton-Raphson Method. **[5]**

c) Find a root of the equation $x^3 - 2x - 5 = 0$ using secant method correct to four decimal places. **[6]**

Q4) a) Solve $\dfrac{d^2 y}{dx^2} - 4\dfrac{dy}{dx} - 5y = xe^{-x}$. **[5]**

b) Solve the simultaneous equations $\dfrac{dx}{dt} + 2y + \sin t = 0, \dfrac{dy}{dt} - 2x - \cos t = 0$.

[6]

c) Find the root of the equation $\cos x = xe^x$ using the bisection method correct to four decimal places upto fifth approximation. **[5]**

SECTION - II

Q5) a) Find the Laplace transform of $te^{2t}(\cos t - \sin t)$. **[5]**

b) Evaluate $\displaystyle\int_0^\infty \frac{\cos 4t - \cos 3t}{t}\, dt$ using Laplace transform. **[6]**

c) Find $L\left[\displaystyle\int_0^t e^{-3u}\frac{\sin 2u}{u}\, du\right]$ **[5]**

Q6) a) Find inverse Laplace transform of $\dfrac{s^2+1}{s^3+3s^2+2s}$ [6]

b) Using Convolution theorem obtain inverse Laplace transform of $\dfrac{s^2}{(s^2+1)(s^2+4)}$. [6]

c) Find $L^{-1}\left[\log\left(1+\dfrac{a^2}{s^2}\right)\right]$ [5]

Q7) a) Obtain the lines of regression from the following data.

x :	10	14	18	22	26	30
y :	18	12	24	6	30	36

Also estimate y when $x = 28$ [9]

b) Fit a straight line to the following data and find y when x = 7

x :	1	2	3	4	6	8
y :	2.4	3	3.4	4	5	6

[8]

Q8) a) Using Laplace transform solve the differential equation

$(D^2 - 3D + 2)\,y = 0$ with $y = 0$ and $y' = 1$ at $t = 0$. [8]

b) Fit a second degree parabola to the following data

Year :	1	2	3	4	5	6	7	8	9
Production :	2	6	7	8	10	11	11	10	9

Also estimate the production in the 10th year [8]

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Seat
No.

S.E. (Chemical) (Part-II) (Semester - III)
Examination, April - 2018
MECHANICAL OPERATIONS
Sub. Code : 63425

Day and Date : Saturday, 28 - 04 - 2018   **Total Marks : 100**
Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) Answer any Three questions from each section.
2) Assume suitable data, if necessary.
3) Draw the diagram wherever necessary.

SECTION-I

Q1) a) Define : [8]

     i) Angle of Repose

     ii) Equivalent diameter

     iii) Sphericity

     iv) Angle of internal friction

     b) Calculate : [8]

     i) Mean surface diameter and

     ii) Specific surface $(A\overline{w})$.

Data :

Aperture, mm	1.651	1.168	0.833	0.589	0.417	0.295	0.208
Mass %	0	21.2	19.6	17.4	14	15.8	12

Sp. gravity of sample is 5.0 and sphericity = 1.0.

P.T.O.

Q2) a) Explain the closed circuit operation with neat sketch. **[8]**

b) Derive an expression for critical speed of Ball Mill. **[9]**

Q3) a) Powdered coal with screen analysis given below 'feed' is fed to a vibrating 48 mesh screen. When the screen was new the oversize and undersize analyses were listed under columns 'new after 3 months' operation; the analysis are headed 'old'. What is the effectiveness of screen : **[8]**

   i)   When 'new' and

   ii) When 'old'

   Data. Differential weight fraction is given.

Mesh	Feed	Oversize		Undersize	
		New	Old	New	Old
−3+4	0.01	0.012	0.014	-	
−4+6	0.022	0.027	0.031	-	
−6+8	0.063	0.078	0.088	-	
−8+10	0.081	0.1	0.112	-	
−10+14	0.102	0.126	0.142	-	
−14+20	0.165	0.204	0.229	-	
−20+28	0.131	0.162	0.189	-	
−28+35	0.101	0.125	0.104	-	0.093
−35+48	0.095	0.117	0.065	-	0.171
−48+65	0.07	0.029	0.025	0.246	0.186
−65+100	0.047	0.015	0.008	0.183	0.146
−100+150	0.031	0.005	-	0.141	0.111
−150+200	0.020	-	-	0.105	0.071
−200	0.062	-	-	0.325	0.222

b) Explain the motion of screens with neat sketch. **[8]**

Q4) a) What is 3D mechanism of mixing? [7]

b) Give the list of industrial mixing equipment and explain any one with neat diagram. [10]

SECTION-II

Q5) a) State the principle of centrifugal filtration and explain the basket centrifuge. [9]

b) Explain the washing mechanism of cake with sketch. [8]

Q6) a) What is the basic principle used in the Sedimentation? [8]

b) Explain the Flocculation. [8]

Q7) a) What is principle of centrifugal settling processes? Explain any one centrifugal settling. [9]

b) Explain the fabric filter with industrial applications. [8]

Q8) a) Write in detail on a scrubber with diagram & industrial applications. [8]

b) Explain the gravity settling with industrial applications. [8]

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Seat No.

S.E. (Chemical Engineering) (Part-II) (Semester - III) (Revised) Examination, April - 2018
FLUID MECHANICS
Sub. Code : 63424

Day and Date : Friday, 27 - 04 - 2018   Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

Instructions :   1)   Attempt any Three questions from each section.
                  2)   Assume suitable data if missing.
                  3)   Draw figures wherever necessary.

SECTION-I

Q1) a)   Check the dimensional consistency of the following equation for drag force.   **[8]**

$F_D = f(D, V, \rho, \mu)$

Where f is a function

D is the diameter in mt, ρ density in kg/m^3,

V is velocity m/sec, μ viscosity in kg/m.sec.

b)   A solution is flowing through a pipe whose diameter is varying from 300 mm at point 'a' to 150 mm at point 'b' respectively. The volumetric flow rate of solution is 2400 LPM. The point 'a' is 10×10^3 mm above the datum and point 'b' is 6×10^3 mm above the datum. Find the intensity of the pressure at point 'b' if the point 'a' is at 400×10^3 N/m^2. Assume that solution density at operating condition is 1005 kg/m^3.   **[8]**

Q2) a)   What is fluid statics? Discuss the hydrostatic equilibrium equation in a centrifugal field.   **[8]**

b)   Water is flowing at a steady mass flow rate through a uniform dia pipe. The pressure at the entrace is 68.9 kN/m^2 and in the pipe which connects to a pump which supplies155.4 J/kg of fluid flowing in the pipe. The exit pipe from the pump is the same dia as the inlet pipe. The exit section of the pipe is 3.05 mt higher than the entrance and exit pressure is 137.8 kN/m^2. Assume that flow in the pipe is Turbulent. Calculate the frictional loss in the pipe.   **[8]**

Q3) a) A fluid is flowing at a flow rate of 5 m³/hr in a pipeline having an i.d. of 78×10^{-3} mt. Calculate the pressure drop and frictional loss over a length of 50 mt of pipe for the following data: **[8]**

Viscosity of fluid $=$ 0.8 cp and

Density of fluid $=$ 1000 kg/m³

b) Discuss the effect of Roughness and friction factor chart. **[8]**

Q4) Write short notes on any Three: **[18]**

a) Rheological properties of fluid.

b) Hagen-Poiseuille equation.

c) Manometer.

d) Flow through annulas.

SECTION-II

Q5) a) What is Mach Number? How flows are classified based on Mach Number. Derive continuity equation and total energy balance equation for flow of compressible fluid. **[9]**

b) An organic solution of specific gravity 1.3 is supplied to an industry through a 50 mm I D pipe. A thin tipped orifice having diameter 25 mm is fitted in the pipe and a mercury manometer is connected across orifice. Manometer shows reading of 10 cm and coefficient for orifice is 0.61. If cost of solution is Rs. 10 per liter, Calculate charges to be paid by the industry per day. **[8]**

Q6) a) Give three methods of fitting the taps in orifice meter. Derive an expression for mass flow rate through orifice meter. **[8]**

-2-

b) Define Power number, Reynolds number and Froude no. in case of agitation. How power required for agitation is calculated? Hence solve the following: [8]

A tank 1 m diameter and height 1.5 m is filled to a depth 1.1 m with latex having viscosity 9 cp. and density 800 kg/m³. A three blade propeller 300 mm diameter is installed in which turns at 250 RPM. Determine power required for agitation.

Data:

at NRe = 30000, Np = 4.2

at NRe = 31875, Np = 4.0

at NRe = 33333, Np = 3.6

Q7) a) Derive Ergun's equation for flow of fluid through packed bed. [9]

b) A tubular catalytic reactor is to be backwashed with water. The bed height of specific catalytic particle is 200 cm, the diameter of particle is 6 mm & density is 1400 kg/m³. Calculate minimum fluidization velocity and N_{Re} for particle. [8]

Data : $\epsilon_m = 0.4$, $\mu = 0.85$ cp, $\phi_s = 1$

Q8) Solve any four of Following: [16]

a) A vertical cylindrical vessel is erected on plain ground vessel has diameter of 3 m & height 5 m. It is exposed to wind blow at 50 km/hr, calculate drag force acting on vessel if drag coefficient is 0.2 ($\rho = 1.18$ kg/m³.)

b) Discuss applications of fluidization.

c) Differentiate between variable head meter and variable area meter.

d) Write Short note on: Turbine meter.

e) Give in brief about different types of impeller.

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Seat No.

S.E. (Chem.) (Semester - III) (Revised) Examination, April - 2018
STRENGTH OF MATERIALS AND MATERIALS OF CONSTRUCTIONS

Sub. Code : 63423

Day and Date : Thursday, 26 - 04 - 2018   Total Marks : 100
Time : 2.30 p.m. to 5.30 p.m.

Instructions :   1)   All questions are compulsory.

2)   Figures to the right indicate full marks.

3)   Neat sketch should be drawn wherever necessary.

4)   Use of non-programmable calculator is permitted.

5)   Make assumptions wherever necessary.

6)   Use Separate Answer books for Section-I and Section-II.

SECTION - I

Q1) a)   Define-   [6]

i)   Hooks Law.

ii)   Poisson's ratio.

iii)   Factor of safety.

OR

a)   A copper specimen has a modulus of elasticity of 1.2×10^5 N/mm^2 and modulus of rigidity of 0.47×10^5 N/mm^2. Determine the Poisson's ratio of material.   [6]

P.T.O.

b) Two vertical rods one of steel and the other bronze are rigidly fastened at upper ends at a horizontal distance of 760 mm apart as shown in fig. Each rod is 3 m long and 25 mm in dia. A horizontal cross piece connects the lower ends of bars, Find the position of 5 Kn vertical load from steel rod should be placed on the cross piece, so that it remains horizontal after being loaded. Also determine the stresses in each rod. Take - Es – 2.1×10^5 N/mm^2, Eb – 1.125×10^5 N/mm^2. **[11]**
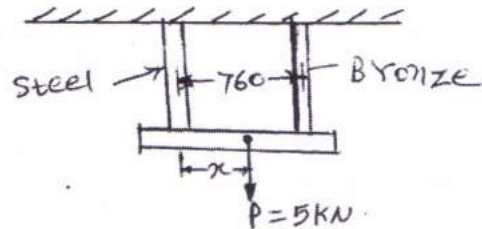
Q2) a) Explain Mohr's circle for finding normal and tangential stresses on a plane at an angle $\varnothing$ with the major principal plane when two like stresses are acting perpendicular to each other. **[5]**

b) The stresses on two perpendicular planes through a point in a body are 60 Mpa and 30Mpa both tensile along with shear stress 50Mpa. Find-

   i) Magnitude and direction of principal stress.

   ii) Planes of max. Shear stress.

   iii) Normal and shear stresses on planes of max. Shear stress. **[12]**

OR

b) A hollow shaft having an internal dia. 0.4 times external dia. transmits 562.5 Kw power at 100 rpm. Determine the external dia. of the shaft if the shear stress is not to exceed 60 N/mm^2 and the twist in a length of 3.75 m should not exceed 1.95 degrees. Assume max. torque = 1.25 times mean torque and modulus of rigidity = 9×10^4 N/mm^2. **[12]**

Q3) a) Explain the lame's equations for thick cylinder and thick shells. **[5]**

b) Determine the max. and min. hoop stress across the section of a pipe of 500 mm internal dia. and 100 mm thick, when the pipe contains a fluid at a pressure of 10 N/mm². Also sketch the radial pressure distribution and hoop stress distribution across the section. **[11]**

OR

b) Find the stresses developed at the four corners of a masonry pillar subjected to a concentrated load of 300Kn at point P as shown in fig.**[11]**
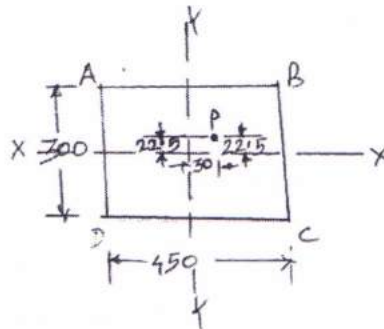
SECTION - II

Q4) Attempt any two questions from the following:

a) What are the different mechanical properties of metals? Explain in detail.**[9]**

b) Explain in detail the principal service conditions. **[8]**

c) Explain the high and low temperature materials. **[8]**

Q5) Attempt any two questions from the following:

a) What is the difference between rubber and elastomer? Explain rubber lining. **[9]**

b) Explain fabricating characteristics of metal in detail. **[8]**

c) i) Explain the purpose of alloying. **[4]**

ii) Explain glass and glass wool. **[4]**

Q6) Attempt any two questions from the following:

a) Why refractory is considered an important material of construction for furnace. [8]

b) How material failure occurs? Explain in detail. [8]

c) Explain [8]

    i) GRP

    ii) Cladding

Seat
No.

S.E. (Chemical) (Part-II) (Semester - III)
Examination, April - 2018
CHEMISTRY - I
Sub. Code : 63422

Day and Date : Wednesday, 25 - 4 - 2018   **Total Marks : 100**
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) Question No. 4 and 8 are compulsory.
2) Attempt any two questions each from remaining questions of Section-I & Section-II
3) Draw neat labelled diagrams wherever necessary.
4) Assume suitable data, wherever necessary.
5) Figures to the right indicate full marks.

SECTION - I

Q1) a) Define order of a reaction, molecularity of a reaction and half life period. Show that for first order reaction, the half life period is independent of the initial concentration.   **[6]**

b) What is meant by quantum yeild? Explain the reason for low and high quantum yield.   **[6]**

c) What is volumetric analysis? Give it's importance in analytical chemistry.   **[4]**

Q2) a) A first order reaction is 15% complete in 20 minutes. How long will it take to be 60% complete?   **[6]**

b) Explain water system with neat phase diagram.   **[6]**

c) A certain system absorbs 3.0×10^{16} quantum of light per second on irradiation for 10minutes, 0.002 mole of reactant was found to have reacted. Calculate the quantum efficiency of the process ($N = 6.023 \times 10^{23}$).   **[4]**

P.T.O.

Q3) a) What is meant by quantum energy and Einstein energy? State Einstein law of photochemical equivalence. **[6]**

   b) Explain the following terms with suitable examples. **[6]**

   i) Phase

   ii) Component

   iii) Degree of freedom

   c) What is the molarity of a solution prepared by dissolving 75.5 g of pure koH in 540 ml of solution. **[4]**

Q4) Write note on (any four): **[18]**

   a) Distribution law.

   b) Photosensitized Reactions.

   c) Redox tritrations.

   d) Second order reaction.

   e) Pseudo unimolecular reaction.

SECTION - II

Q5) a) Define polymerization and give mechanism of free radical polymerization of ethylene to polyethylene. **[6]**

   b) Explain process of manufacture of soap by modern process with neat flow sheet. **[5]**

   c) Give synthesis and applications of methyl orange. **[5]**

Q6) a) Explain the process of industrial preparation of nitrobenzene by continuous process. **[6]**

   b) Explain Chromophore - Auxochrome theory of colour and constituents. **[5]**

   c) Explain structure, formation and stability of carbonion. **[5]**

Q7) a) What are dyes? Give classification of dyes based on methods of applications. [6]

b) Explain Friedal - craft reactions w.r.t. [5]

   i) Alkylating agent

   ii) Acylating agent

   iii) Catalysts

c) What is soap? Explain cleansing action of soap. [5]

Q8) Write note on (any four): [18]

   a) Malachite green.

   b) Aldol condensation.

   c) Carbocations.

   d) Types of detergents.

   e) Oxidation Reduction reactions.

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