

TEACHING AND EXAMINATION SCHEME

Sl. No.	Course Code	Course Name	Teaching Scheme					Examination Scheme						
			Instruction periods per week			Semester Total Periods	Credits	Continuous internal evaluation			Semester end examination			
			L	T	P			Mid sem. I	Mid sem. II	Internal evaluation	Max. Marks	Min. Marks	Total marks	Min. marks for pass
1	CH-401F	Advanced Engg Mathematics	3	1	0	60	3	20	20	20	40	14	100	35
2	CH- 402C	Mechanical Operations	3	1	0	60	3	20	20	20	40	14	100	35
3	CH- 403C	Inorganic Chemical Technology	3	1	0	60	3	20	20	20	40	14	100	35
4	CH- 404C	Organic Chemical Technology	3	1	0	60	3	20	20	20	40	14	100	35
5	CH-405C	Heat Transfer	3	1	0	60	3	20	20	20	40	14	100	35
6	CH-406P	Advanced Chemical Technology Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
7	CH-407P	Mechanical Operations Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
8	CH -408P	Heat Transfer Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
9	CH-409P	Chemical plant equipment drawing	1	0	2	45	1.5	20	20	20	40	20	100	50
10	CH-410P	Advanced Communications & Life skills Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
11	Skill up Gradation		0	0	7	105	2.5	0	0	Rubrics				
Total			20	5	17	690	25	220	220	220	420	170	1000	425
Activities: student performance is to be assessed through Rubrics														

Note: Pass criteria: The minimum marks required for passing in any of courses are given below

1. Cumulative 35% of marks (35 marks) in Mid Sem -1 + Mid Sem -2+ Internal Evaluation +SEE
2. Minimum marks in SEE is 35% (i.e.14marks).
3. If the cumulative of CIE is less than 35% (i.e.21 marks out of 60) then more than 35% of SEE is required to get overall 35%.

ADVANCED ENGINEERING MATHEMATICS

Course Title	: Advanced Engineering Mathematics	Course Code	: 18CH-401F
Semester	: IV	Course Group	: Foundation
Teaching Scheme in periods (L : T :P)	: 45 : 15 : 0	Credits	: 3
Methodology	: Lecture + Tutorial	Total Contact Periods	: 60
CIE	: 60 Marks	SEE	: 40 Marks

Pre requisites

This course requires the knowledge of Engg. Mathematics at Diploma first year level and Applied Engg. Mathematics at Diploma 3rd Semester level.

Course Outcomes :

At the end of the course, the student will have the ability to:

CO 1	Solve simple Homogeneous Linear Differential Equations
CO 2	Solve simple Non-Homogeneous Linear Differential Equations
CO 3	Express $f(x)$ as a Fourier series in the given interval
CO 4	Express $f(x)$ as a Fourier Half-Range Cosine series and Sine series
CO 5	Find Laplace transforms of simple functions
CO 6	Find Inverse Laplace transforms of simple functions and solve Linear Differential Equations using Laplace Transformations.

Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
1	Homogeneous Linear Differential equations with constant coefficients	05	Q4	Q1	Q9(a)	Q13(a)
2	Non-Homogeneous Linear Differential equations with constant coefficients	15				
3	Fourier series	10		Q2	Q10(a)	Q14(a)
4	Fourier Half-range series	05				
5	Laplace Transforms	10	Q3	Q5,Q 6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
6	Inverse Laplace transforms	15		Q7,Q 8	Q10(b), Q12(a), Q12(b)	Q14(b), Q16(a), Q16(b)

Total	60	8	8	8
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Course Contents:

Unit – I

Duration: 05 Periods (L:3.0 – T:2.0)

Homogeneous Linear Differential equations with constant coefficients

Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.

Unit – II

Duration: 15 Periods (L:12.0 – T:3.0)

Non-Homogeneous Linear Differential equations with constant coefficients

Non-homogenous linear differential equations with constant coefficients of the form $f(D)y = X$, where X is in the form $k(\text{a constant})$, e^{ax} , $\sin ax$, $\cos ax$, x^n , ($n = 1, 2, 3$) Complimentary Function (CF), Particular Integral (PI) and General Solution (GS).

Unit-III

Duration: 10 Periods (L: 8.0 – T: 2.0)

Fourier series

Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c, c + 2\pi)$, Euler's formulae, sufficient conditions for existence of Fourier series for a function. Even, Odd functions and Fourier series over the Interval $(0, 2\pi)$ and $(-\pi, \pi)$

Unit – IV

Duration: 05 Periods (L: 3.0 – T: 2.0)

Fourier Half-range series

Representation of a function as Fourier Half-range Sine series and Cosine series over the interval $(0, \pi)$

Unit – V

Duration: 10Periods (L: 7.0 – T:3.0)

Laplace Transformations:

Definition, sufficient conditions for existence of Laplace Transform, Laplace Transform of elementary functions, linearity property, Change of scale property, First shifting theorem, multiplication by t^n , division by t , Laplace Transform of derivatives and integrals, unit step function, Laplace Transform of second shifting theorem

Unit – VI

Duration: 15 Periods (L: 12.0 – T: 3.0)

Inverse Laplace transforms:

Inverse Laplace transforms- shifting theorems and change of scale property, multiplication by s^n and division by s –Inverse Laplace Transform using partial fractions – convolution theorem (no proof) – application of Laplace Transformations to solve ordinary differential equations of second order with initial conditions.

Recommended Books:

1. Higher Engineering Mathematics, B.S.Grewal .
2. Laplace Transforms - Murray R. Spigel .
3. Ordinary Differential Equations – R. S. Aggarwal.
4. Fourier Series – A.R. Vasishtha and Gupta.

Suggested E-Learning references:

1. www.freebookcentre.net/mathematics/introductory-mathematics-books.html
2. E-books:www.mathebook.net

Suggested Learning Outcomes

Unit-I

1.0 Solve Homogeneous linear differential equations with constant coefficients in engineering situations

- 1.1 Solve Differential equations of the type $(aD^2 + bD + c)y = 0$ when the roots of the auxiliary equation are real and different, real and repeated, complex.
- 1.2 Solve the higher order homogeneous Linear differential equations with constant coefficients.

Unit-II

2.0 Solve Non Homogeneous linear differential equations with constant coefficients in engineering situations

- 2.1 Explain the concept of complementary function, particular Integral and general solution of a differential equation.

- 2.2 Solve n^{th} order differential equation of the type $f(D)y = X$ where $f(D)$ is a polynomial of second order and X is a function of the form $k, e^{ax}, \sin ax, \cos ax, x^n$.
- 2.3 Solve simple problems on the above types of 2.2

Unit-III

3.0 Understand the Fourier series expansion of functions

- 3.1 Define the orthogonality of functions in an interval.
- 3.2 Define Fourier series of a function on the interval $(C, C+2\pi)$ and write the Euler's formulae for determining the Fourier coefficients.
- 3.3 Write sufficient conditions for the existence of Fourier series for a function.
- 3.4 Write Fourier series of simple functions in the range $(0, 2\pi)$ and $(-\pi, \pi)$.
- 3.5 Write Fourier series for even and odd functions in the interval $(-\pi, \pi)$.
- 3.6 Solve simple problems on even and odd functions in the interval $(0, 2\pi) \wedge (-\pi, \pi)$.

Unit- I

4.0 Understand the Half – Range Fourier series expansion of functions

- 4.1 Write Half – Range Cosine series of a function in the range $(0, \pi)$.
- 4.2 Write Half – Range Sine series of a function in the range $(0, \pi)$.
- 4.3 Solve simple problems on Half – Range Cosine and Sine series over the interval $(0, \pi)$.

Unit-V

5.0 Understand Laplace transforms

- 5.1 Write the definition of Laplace Transform and Laplace transform of standard functions.
- 5.2 Explain the sufficient conditions of existence of Laplace Transform.

- 5.3 Write the properties of Laplace Transform – Linearity property, First shifting theorem, Change of Scale property.
- 5.4 Solve simple problems using the above properties.
- 5.5 Write formulae for Laplace transform of $t^n f(t)$, $\frac{f(t)}{t}$, $f^n(t)$, $\int_0^t f(u) du$ in terms of Laplace transform of $f(t)$.
- 5.6 Solve simple problems using the above formulae.
- 5.7 Define unit step function and write the Laplace Transform of unit step function.
- 5.8 Write Second shifting theorem.

Unit-VI

6.0 Use Laplace transforms and Inverse Laplace transforms to solve differential equation in engineering problems

- 6.1 Define inverse Laplace Transform and write inverse Laplace Transforms of standard functions.
- 6.2 Solve simple problems on Inverse Laplace Transforms.
- 6.2 Write Shifting theorems and Change of scale property of inverse Laplace Transform.
- 6.3 Solve simple problems on 6.2
- 6.4 Write inverse Laplace Transforms corresponding to Laplace Transform of the functions $t^n f(t)$, $\frac{f(t)}{t}$, $f^n(t)$, $\int_0^t f(u) du$
- 6.5 Solve simple problems on 6.4
- 6.6 Define convolution of two functions and state convolution theorem.
- 6.7 Solve simple problems on Convolution theorem.
- 6.8 Use Laplace and inverse Laplace Transforms to solve simple differential equations of

Second order.

Suggested Student Activities:

1. Student visits Library to refer Standard Books on Mathematics and collect related material.
2. Quiz
3. Group discussion
4. Surprise tests
5. Seminars
6. Home Assignments.

CO-PO Mapping Matrix

	Basic knowledge	Discipline Knowledge	Practice Experiments and	Engineering Tools	Engineer and society	Ability Environment &	Ethics	Team Individual and Team	Communication	Lifelong learning	Linked PO
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	
CO 1	3	2	2	1			1			3	1,2,3,4,7,10
CO 2	3	2	2	1			1			3	1,2,3,4,7,10
CO 3	3	2	2	1			1			3	1,2,3,4,7,10
CO 4	3	2	2	1			1			3	1,2,3,4,7,10
CO 5	3	2	2	1			1			3	1,2,3,4,7,10
CO 6	3	2	2	1			1			3	1,2,3,4,7,10

Internal Evaluation

Test	Units	Marks
Mid Sem 1	1 and 2	20
Mid Sem 2	3 and 4	20
Slip Test 1	1 and 2	5
Slip Test 2	3 and 4	5
Assignments	-	5
Seminars	-	5
	Total	60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	

			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed $\frac{1}{4}$ of a page, 1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE				
	R		U		A
I	Q4	Q1		Q9(a)	Q13(a)
II					
III		Q2		Q10(a)	Q14(a)
IV					
V		Q3	Q5,Q	Q9(b),	Q13(b),

			6	Q11(a), Q11(b)	Q15(a), Q15(b)
VI			Q7, Q8	Q10(b), Q12(a), Q12(b)	Q14(b), Q16(a), Q16(b)
Total Questions	8			8	8

Code: 18CH-401F

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA
BOARD DIPLOMA EXAMINATIONS
MID SEM –I, MODEL PAPER, IV SEMESTER
ADVANCED ENGINEERING MATHEMATICS**

TIME: 1: 00 Hours

Max. Marks: 20

PART-A

Instructions:

1. Answer **ALL** questions

04 X 01 = 04

2 Each question carries **ONE** mark

1. Write the General solution of $(aD^2+bD+c)y = 0$, whose roots of auxiliary equation are real and distinct.

2. Find the roots of auxiliary equation of the differential equation $(D^2 + 2D + 1)y = 0$

3. Find the Particular Integral of $(D^2 - 4D + 1)y = e^{3x}$

4. Find the P.I of $(D^2 - 16)y = \sin 4x$

PART-B

Instructions:

1. Answer any **TWO** questions

02 X 03 = 06

2. Each question carries **THREE** marks

5 a) Solve: $(D^2 + 3D - 54)y = 0$

Or

5 b) Solve : $(D^2 + 16)y = 0$

6 a) Solve : $(D^2 + 4D + 4)y = e^{2x}$

Or

6 b) Find P.I of $(D^3 + D)y = \sin 2x$

PART C

Instructions:

1. Answer **ALL** questions

02 X 05 = 10

2. Each question carries **FIVE** marks

7 a) Solve $:(D^3 - 2D^2 - 4D + 8)y = 0$

Or

7 b) Solve $:(D^3 - D^2 - D + 1)y = 0$

8 a) Solve $:(D^2 + 36)y = \sin^2 x$

Or

8 b). Solve $:(D^2 + 3D + 2)y = x^2$

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Code: 18CH-401F

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

BOARD DIPLOMA EXAMINATIONS

MID SEM -II, MODEL PAPER, IV SEMESTER

ADVANCED ENGINEERING MATHEMATICS

TIME: 1: 00 Hours

Max. Marks: 20

PART-A

Instructions:

1. Answer **ALL** questions

04 X 01 = 04

2 Each question carries **ONE** mark

1. Define periodic function and give one example
2. Define Fourier series of the function $f(x)$ in the interval $(0, 2\pi)$
3. Write Half-range sine series of $f(x)$ in the interval $(0, \pi)$
4. Find a_0 for $f(x) = e^x$ in $0 < x < \pi$

PART-B

Instructions:

1. Answer any **TWO** questions

02 X 03 = 06

2. Each question carries **THREE** marks

5 a). If $f(x) = x^2$ in $(0, 2\pi)$, then find the value of a_n in Fourier series of $f(x)$

Or

5 b) If $f(x) = |x|$ in $(-\pi, \pi)$, then find the value of a_1 in Fourier series of $f(x)$

6 a). Find the value of a_n in half-range Cosine series for the function $f(x) = e^x$ in $(0, \pi)$

Or

6 b). Obtain the Fourier Half – Range Sine series for $f(x) = (\pi - x)$ in the interval $(0, \pi)$

PART C

Instructions: 1. Answer any **TWO** questions 02 X 05 = 10

2. Each question carries **FIVE** marks

7 a). Obtain the Fourier series for $f(x) = x$ in the interval $0 < x < 2\pi$

Or

7 b). Find the Fourier series for $f(x) = (x - x^2)$ in the interval $(-\pi, \pi)$. Hence show that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$$

8 a) Express $f(x) = \pi x - x^2$ as a half-range Sine series in $(0, \pi)$

Or

8 b). Find the half –range cosine series for the function $f(x) = x^2$ in the interval $(0, \pi)$

18CH-401F

BOARD DIPLOMA EXAMINATION, (C-18)
SEMESTER END EXAM MODEL PAPER
IV SEMESTER EXAMINATION
ADVANCED ENGINEERING MATHEMATICS

Time: 2 hours

[Total Marks: 40]

PART-A

Instructions: 1. Answer **ALL** questions

08 X 01 = 08

2 Each question carries **ONE** mark

1. Find the roots of auxiliary equation of the differential equation $(D^2 + 4D)y = 0$.
2. Define Fourier Series for the function $f(x)$ in the interval $(c, c+2\pi)$
3. Find the Particular Integral of $(D^2 - 4D + 1)y = e^x$
4. Find $L(e^{2t} + \cos 3t)$
5. Find $L(t + 5 \cosh t)$
6. State the First Shifting theorem of Laplace Transforms.
7. Find $L^{-1}\left(\frac{1}{s-3} + \frac{s}{s^2+4}\right)$
8. Find $L^{-1}\left(\frac{1}{2s+5}\right)$

PART-B

Instructions: 1. Answer any **FOUR** questions 04 X 03 = 12

2. Each question carries **THREE** marks

9. a) Solve: $(D^2 + D + 1)y = 4e^{3x}$

Or

- 9 b) Find $L(t \cos 3t)$

- 10 a) Find Half Range Sine Series of $f(x) = x$ in $(0, \pi)$

Or

- 10 b) Find $L^{-1}\left(\frac{s+1}{s^2+6s-7}\right)$

- 11 a) If $L\{f(t)\} = \frac{20-4s}{s^2-4s+20}$, find $L\{f(3t)\}$

Or

- 11 b) Find $\int_0^\infty t \cdot e^{-2t} \sin 3t dt$ using Laplace Transform Technique

12 a) Show that
$$\mathcal{L}^{-1}\left\{\frac{s}{s^2+a^2}\right\} = \frac{1-\cos at}{a^2}$$

12 b) Find
$$\mathcal{L}^{-1}\left(\frac{s}{(s+2)^2+4}\right)$$

PART C

Instructions: 1. Answer any **FOUR** questions

04 X 05 = 20

2. Each question carries **FIVE** marks

13. a) Solve : Solve: $(D^2 + D - 2) y = x + \sin x$

Or

13 b) Find $\mathcal{L} [te^t \sin 3t]$

14 a) Expand $f(x) = x^2$ as a Fourier series in the interval $(-\pi, \pi)$

Or

14 b) Find
$$\mathcal{L}^{-1}\left(\frac{s}{(s+1)^2(s^2+1)}\right)$$

15 a) Find
$$\mathcal{L}\left(\frac{\sin 3t \cdot \cos t}{t}\right)$$

Or

$$\mathcal{L}\left\{\int_0^t \frac{\sin t}{t} dt\right\}$$

15 b) Evaluate

16 a) Find
$$\mathcal{L}^{-1}\left(\frac{1}{(s+1)(s+2)}\right)$$
 using Convolution theorem .

Or

16 b). Solve the differential equation $y'' - 2y' - 8y = \sin t$, when $y(0) = 3$, $y'(0) = 6$ by

Laplace Transform method.

Mechanical Operations

Course Title :	Mechanical Operations	Course Code	18CH-402C
Semester	IV	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	3:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours :	60Pds
CIE	60 Marks	SEE	40 Marks

Pre-requisites: This course requires the knowledge of fundamentals of Physical science, and fluid mechanics.

Course Outcomes

CO1	Analyse particle shape and size, mixed particle sizes and apply the principles of screen analysis
CO2	State the importance and principles of storage and handling of materials and identify suitable conveyors for specific applications. Demonstrate and operate the different types of conveyors
CO3	State the importance of mixing and agitation in process industries and sketch and summarize the working principles of various types of mixers.
CO4	State the principles, and apply the laws of size reduction, and illustrate the operation of various size reduction equipments and evaluate the power required in size reduction.
CO5	Interpret and analyse various size separation methods, Fluid-solid separation methods and illustrate the operation of various size separation equipments, and classify, demonstrate and operate different types of fluid-solid separation equipments. Select the appropriate devices
CO6	Classify filtration equipments, apply the principle of working of various types of filters, Demonstrate and operate the different types of filters

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
1	Properties of Particulate solids	10	Q4	Q1	Q9(a)	Q13(a)
2	Storage and conveyance of solids	07				
3	Mixing	08		Q2	Q10(a)	Q14(a)
4	Size Reduction	14				
5	Mechanical Separations	12	Q3	Q5,Q6	Q9(b),Q11(a), Q11(b)	Q13(b),Q15(a), Q15(b)
6	Filtration	09		Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a), Q16(b)

Course Content

UNIT 1 - Properties of Particulate solids

Duration: 10 Periods (L:7- T:3)

Particle size, shape, density and sphericity- mixed particle sizes and size analysis- specific surface, average particle size and particle population- Standard screening sieves viz Taylor standard series & Indian standard series- differential & cumulative screen analysis- actual & Ideal screens- Screen effectiveness- screen capacity.

UNIT 2 - Storage and conveyance of solids:

Duration: 07 Periods (L: 5.5- T:1.5)

Various types of storage methods of solids- Bin storage- flat bottomed bin, sloped bottomed bin, silos, hoppers and bulk storage- Conveying- types of conveyers –Working principles – Belt conveyor, screw conveyor, pneumatic conveyor and bucket elevator.

UNIT 3 -Mixing:

Duration: 08 Periods (L:6 -T:2)

Objectives of mixing, Liquid-liquid mixers- paddles, turbines, propellers, agitators-
Solid-liquid mixers, mixer for viscous masses- Banbury mixer, ribbon blenders, tumbling mixers.

UNIT 4 - Size Reduction:

Duration: 14 Periods(L:10- T:4)

Principles of comminution- Size Reduction laws- Efficiencies in size reduction- Size reduction equipments- Description and working of jaw crusher, gyratory crusher, roll crusher, hammer mill, ball mill, ultrafine grinder- Evaluation of angle of nip- critical speed of ball mill - Closed circuit grinding and open circuit grinding- simple problems on size reduction laws, critical speed and angle of nip.

UNIT 5 - Mechanical Separations:

Duration: 12 Periods(L:9-T:3)

Industrial screens -their applications- Grizzlies, Trommels, Shaking, vibrating screens, classifiers- hydraulic classifiers, jigging, tabling, froth flotation- Magnetic separation and electrostatic separation- Air separation- cyclone separator, bag filters, electrostatic separator.
Motion of particles through fluid, terminal velocity, Stoke's law, Batch sedimentation, Industrial thickener.

UNIT 6 - Filtration:

Duration: 09 Periods (L:7-T:2)

Application of filters- Classification of filters- Selection of filters- Plate and frame filter press, Leaf filters, continuous rotary filters- Filter aids- Constant pressure and constant rate filtration- Centrifugal filtration- Batch, semi continuous and continuous centrifuges

SPECIFIC LEARNING OUTCOMES

1.0 Properties of particulate solids

- 1.1 State the importance of size, shape, density and sphericity of particle.
- 1.2 Analyse the mixed particle sizes and size analysis.
- 1.3 State the importance of screen analysis and evaluate the specific surface, average particle size and particle population by differential and cumulative screen analysis.
- 1.4 Specify various standard screening sieves viz. Taylor standard series & Indian standard series.
- 1.5 Distinguish between differential and cumulative screen analysis
- 1.6 Compare actual & ideal screens
- 1.7 Derive equation for screen effectiveness
- 1.8 Distinguish between screen effectiveness and screen capacity.
- 1.9 Solve problems to calculate screen effectiveness and to evaluate specific surface, average particle size and particle population

2.0 Storage and conveyance of solids:

- 2.1 Select appropriate methods for storage of solids.
- 2.2 Summarize bulk storage and bin storage-
- 2.3 List out various conveyors.
- 2.4 Demonstrate the working principles of different types of conveyors
(a) Belt conveyor (b).Screw conveyor (c). Bucket elevator (d). Pneumatic conveyor
- 2.5 Select suitable conveyors for specific applications

3.0 Mixing:

- 3.1 State the importance of mixing and agitation
- 3.2 List various mixing equipments.
- 3.3 Explain the mixing of various systems like liquid-liquid, solid-liquid, solid-solids.
- 3.4 Sketch and summarize the working principles of various types of mixing equipments used
for (a). Liquid-liquid mixing- propellers, paddles and turbines.
(b). Solid- solid mixing - Ribbon blenders, tumbling mixers.

- (c). Viscous masses- Banbury mixer, kneading machine, pug mill.
- 3.5 Differentiate between mixing, agitation and blending.
- 3.6 Identify the methods to prevent Swirling and vortex formation

4.0 Size Reduction

- 4.1 Explain the principle involved in Size Reduction.
- 4.2 Calculate the mechanical efficiency and crushing efficiency.
- 4.3 State and explain (a) Rittinger's Law (b) Kick's Law (c) Bond's crushing law and work index.
- 4.4 Evaluate the power requirement for crushing and grinding.
- 4.5 Classify the size reduction equipment.
- 4.6 Distinguish the crushing and grinding
- 4.7 Sketch and demonstrate the working principles of following crushing equipment: Jaw crusher, Gyratory crusher, Roll crusher.
- 4.8 Demonstrate the working principles of grinding equipment: Rod mill, Ball mill and ultrafine grinder.
- 4.9 Evaluate angle of nip in crushing rolls.
- 4.10 Evaluate the critical speed of Ball mill.
- 4.11 Select suitable crushers and grinders for various applications
- 4.12 Distinguish between closed circuit grinding and open circuit grinding.
- 4.13 Solve simple problems to evaluate power required based on Rittinger's Law, Kick's Law and Bond's crushing law.
- 4.14 Solve problems on evaluating critical speed and angle of nip.

5.0 Mechanical Separations

- 5.1 List out the industrial screens and mention their applications.
- 5.2 Illustrate the operation of Grizzlies, Trommels, Shaking and vibrating screens.
- 5.3 Demonstrate the working of hydraulic classifiers-Mineral jig, Wilfley table
- 5.4 State the principle of froth flotation.
- 5.5 State the principle of magnetic separation and electrostatic separation.
- 5.6 Demonstrate the working principles of Air separator, Cyclone separator, Bag filter, Electrostatic Precipitator and Scrubber.
- 5.7 Elaborate the process of batch sedimentation and identify various zones.
- 5.8 State Stokes and Newton's laws in motion of particles through fluids.
- 5.9 Differentiate between free settling and hindered settling
- 5.10 Define terminal velocity.
- 5.11 Sketch and illustrate the working of industrial thickener
- 5.12 Solve problems to calculate the terminal velocity.

6.0 Filtration

- 6.1 State the principles of cake filtration.
- 6.2 State the principles of constant rate filtration and constant pressure filtration.
- 6.3 Sketch and illustrate the working principle of Plate and frame filter press, leaf filter and Continuous rotary drum filter.
- 6.4 List types of filter medium and its requirements.
- 6.5 State the function of filter aid
- 6.6 State the principles of centrifugal filtration.
- 6.7 Select various filters for specific applications
- 6.8 Demonstrate the working principle of Batch and Continuous centrifugal filters

SUGGESTED LIST OF STUDENT ACTIVITIES

Each student should do any one of the following type activity or any other similar activity

related to the course and before conduction, get it approved from concerned Teacher and HOD.

1. Prepare a model of Size reduction equipments and size separation equipment and write a report.
2. Write a report about filters and conveyors other than mentioned in the syllabus.
3. Write a report on different Standard sieves available in the market with their size ranges.
4. Prepare a study report on Separation of fine Particles from fluids by methods other than that mentioned in the syllabus content
5. Each student should visit library to refer to manual/Journals of Chemical Engineering
6. Each student should visit the Lab to know the equipments used for size separation and size reduction.
7. Quiz and Group discussion
8. Surprise test

Recommended Books

1. Unit operations of chemical Engg by Wareen L.Mc Cabe, Julian C.Smith and Peter Harriott, Fifth edition, Mc Graw Hill Publication.
2. Introduction to Chemical Engg by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
3. Particle Technology and Separation Processes, Coulson J.M. and Richardson J.F., 4thEdition.
4. Perry's Chemical Engineers' Handbook, McGrawHill.
5. Unit Operations – I by K.A. Gahvane.

e-Learning links:

- 1 <http://nptel.ac.in>

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	Analyse particle shape and size, mixed particle sizes and apply the principles of screen analysis	R/U/ A	1,2,3,4,10	09
CO2	State the importance and principles of sampling, storage and handling of materials and identify suitable conveyors for specific applications. Demonstrate and operate the different types of conveyors	R/U/ A	1,2,3,4,6,10	07
CO3	State the importance of mixing and agitation in process industries and sketch and summarize the working principles of various types of mixers.	R/U/ A	1,2,3,4,10	08
CO4	State the principles, and apply the laws of size reduction, and illustrate the operation of various size reduction equipments and Evaluate the power required in size reduction.	R/U/ A	1,2,3,4,10	14
CO5	Interpret and analyse various size separation methods, Fluid-solid separation methods and illustrate the operation of various size separation equipments, and classify, demonstrate and operate different types of fluid-solid separation equipments. Select the appropriate devices in minimizing air pollution in industries such as cement, metallurgy etc.	R/U/ A	1,2,3,4,6,8,9, 10	12
CO6	Classify filtration equipments, apply the principle of working of various types of filters, Demonstrate and operate the different types of filters.	R/U/ A	1,2,3,4,5,6,10	10
				60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed ¼ of a page,1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE				
		R		U	A
I	Q4	Q1		Q9(a)	Q13(a)
II					
III		Q2		Q10(a)	Q14(a)
IV					
V		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
VI					
Total Questions	8		8	8	

Model Question paper
DCHE IV Semester Mid Semester-I Examination

Course Code: 18CH-402C
Course Name: Mechanical Operations

Duration: 1 hour
Max.Marks : 20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

1. Write about the importance of mechanical unit operations in chemical industries?
2. What is an Ideal Screen?
3. List out various conveyors used in Chemical Industry
4. What is bulk storage?

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

- 5(a) Differentiate between Indian and Taylor standard screens?

(or)

- 5(b) Distinguish between screen effectiveness and capacity.

- 6(a) Explain the working of bucket elevator.

(or)

- 6(b) How do you perform screen analysis? Explain.

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

- 7(a) (i). Explain material balance over screen.

- (ii). A quartz mixture having a certain screen analysis is screened through a standard 10 mesh screen. Calculate (a). The mass ratio of overflow and underflow to feed and (b). The effectiveness of Screen.

Data : $D_p = D_{pc} = 1.651 \text{ mm}$, $x_F = 0.47$, $x_D = 0.85$, $x_B = 0.195$ (cumulative mass fractions)

(or)

- 7(b) How do you evaluate specific surface, average particle size and particle population by differential screen analysis.

- 8 (a) With a neat sketch explain the construction and working principle of Belt conveyor

(or)

- 8(b). Discuss about Bin Storage of solids with neat sketches.

DCHE IV semester Mid Semester-II Examination

Course Code: 18CH-402C
Course Name: Mechanical Operations

Duration: 1 hour
Max.Marks : 20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

1. What is the objective of mixing?
2. List out mixing equipments used for mixing viscous masses.
3. List the different types of crushers.
4. Define angle of nip in crushing rolls.

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Explain the working principle of Pug mill.
(or)

5(b) Explain the working of Banbury mixer.

6(a) State Bond's law and define work index.
(or)

6(b) Calculate the critical speed of ball mill using following data:

Diameter of ball = 40 mm , Diameter of ball mill = 450 mm

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Evaluate the critical speed of Ball mill.
(or)

7(b) Sketch and illustrate the working of Ribbon blender. Give its applications.

8(a) Explain with a neat sketch the construction and working of Jaw crusher and mention its applications.
(or)

8(b) A material is crushed in a Jaw crusher and the average size of particle is reduced from 8 cm to 2 cm with consumption of energy at the rate of 12 kW/(kg/sec). What will be the consumption of energy required to crush the same material of average size 6 cm to an average size of 1.5 cm?

Assuming i) Rittinger's law ii) Kick's law.

State Board of Technical Education and Training, Telangana

Model Question paper
DCHE IV Semester
Semester End Examination

PART-A

Answer **all** questions

8x1 = 8 Marks

- 1 Define Mesh number.
- 2 Define critical speed of Ball mill.
- 3 Based on which property the solid particles are separated in jigging?
- 4 What is the objective of mixing?
- 5 Name important dust collecting equipments.
- 6 Define free settling.
- 7 Classify different types of filters.
- 8 What is a filter aid?

PART-B

Answer **four** questions

4 x 3 = 12 Marks

- 9(a). Distinguish between screen effectiveness and capacity.
(or)
- 9(b). Explain the working principle of electrostatic separator.
- 10(a). Classify size reduction equipment.
(or)
- 10(b) What are the requirements of filter medium? Give examples.
- 11(a) Explain the working principle of Fabric filter.
(or)
- 11(b) Explain the working of Grizzly with a neat sketch.
- 12(a) Discuss the principle of Centrifugal filtration with neat sketches.
(or)
- 12(b) State the principles of constant rate and constant pressure filtration.

PART-C

Answer **four** questions

4 x 5 = 20 Marks

- 13(a). Derive the equation for Screen effectiveness.
(or)
- 13(b) (i). Define terminal velocity.
(ii). Calculate the settling velocity of a spherical steel ball of diameter 1.8 mm settling in water of specific gravity 0.98 and viscosity μ is 10 N-S/m² ? Specific gravity of steel ball is 7.87
- 14(a) Evaluate the critical speed of Ball mill.
(or)
- 14(b) Demonstrate the working of Suspended Basket centrifuge
- 15(a) Illustrate briefly the flotation operation and working of flotation cell with a neat sketch
(or)
- 15(b) Demonstrate the working of Industrial thickener with a neat sketch.
- 16(a) Explain the working of Plate and frame filter press with a neat sketch.
(or)
- 16(b) Describe the construction and working of Rotary drum filter with neat sketch.

MODEL QUESTION BANK

IV- Semester Diploma Examination

MECHANICAL OPERATIONS

UNIT-I. Properties of Particulate solids

Remembrance:

- 1 Define an Ideal screen.
- 2 Define 'Average particle size'

- 3 Define Mesh number.
- 4 What do you mean by Screen effectiveness or screen efficiency?
- 5 List the factors which affect Screen efficiency.
- 6 Compare ideal and actual screens
- 7 What are various standard screens available?

Understanding:

- 1 Define (a). Cumulative screen analysis (b). Differential screen analysis
- 2 Discuss about regular and irregular particle size and average particles
- 3 Explain the methods of particle size measurement
- 4 Distinguish between differential and cumulative screen analysis
- 5 Differentiate between screen effectiveness and capacity.
- 6 Differentiate between Indian and Taylor standard screens

Applications:

- 1 How do you evaluate specific surface, average particle size and particle population by differential and cumulative screen analysis.
- 2 (a). Derive the equation for screen effectiveness
(b). A quartz mixture having a certain screen analysis is screened through a standard 10 mesh screen. Calculate (a). The mass ratio of overflow and underflow to feed and (b). The effectiveness of screen
Data : $D_p = D_{pc} = 1.651 \text{ mm}$, $x_F = 0.47$, $x_D = 0.85$,
 $x_B = 0.195$ (cumulative mass fractions)
3. Distinguish between differential and cumulative screen analysis

UNIT-II. Storage and Conveyance

Remembrance:

- 1 State the fields of applications of different conveyors
- 2 List the properties of solids to be conveyed
- 3 List the specific applications of Belt conveyor, chain conveyor, bucket elevator, screw conveyor.
- 4 Select appropriate methods of storage of solids, liquids & gases in industries.
- 5 Name a suitable conveyor for
 - i Abrasive materials
 - ii Lumpy solids
 - iii Pasty material
 - iv Dry powders
- 6 List out various conveyors used in Chemical Industry
- 7 Write about bulk storage

Understanding:

- 1 Discuss the principles of Conveying and Classify the Conveyors
- 2 Illustrate Procedure of open and closed storage of solids
- 3 Identify suitable conveyor for specific applications.
- 4 Explain about bin storage of solids
- 5 Explain with a neat sketch the working of bucket elevator.

Application:

- 1 Sketch the different types of conveyors like belt conveyor, chain conveyor, bucket elevator, screw conveyor, pneumatic conveyer and report their operations
- 2 Explain bulk storage and bin storage of solids with examples.

UNIT-III: Mixing

Remembrance:

- 1 State the purposes of agitation
- 2 List the industrial applications of Mixing equipments.
- 3 List the applications of different types of impellers.
- 4 List out mixing equipments used for mixing viscous masses and dry powders
- 5 Draw a neat sketch of Ribbon blender
- 6 What is swirling?
- 7 What is the objective of mixing?
- 8 What is mixing?

Understanding:

- 1 Discuss the principles of mixing and agitations
- 2 Describe the operational characteristics and applications of Impellers, Propellers, paddles
- 3 Discuss Swirling and vortex formation
- 4 Differentiate between mixing and agitation
- 5 Identify the methods to prevent Swirling and vortex formation
- 6 Explain the working principle of Ribbon blender with a neat sketch
- 7 Explain the working principle of Tumbling mixer with a neat sketch
- 8 Explain the working principle of pug mill.

Application:

- 1 Sketch and explain Impellers, Propellers, paddles and turbines
- 2 Sketch and explain the working principles of mixing equipments used for mixing of dry powders and mention their applications
- 3 Sketch and illustrate the working of Banbury mixer
- 4 Sketch and explain Muller mixer
- 5 Demonstrate the working of tumbler mixer with diagram
- 6 Demonstrate the working of Ribbon blender with diagram

UNIT-IV Size Reduction**Remembrance:**

- 1 State the laws of crushing.
- 2 Name four common ways of breaking Solids.
- 3 State dry grinding and wet grinding?
- 4 State Rittinger's law and Kick's law.
- 5 Classify the size reduction equipment
- 6 Define critical speed of Ball mill
- 7 Define angle of nip in crushing rolls
- 8 What is closed circuit grinding?
- 9 State bond's law and work index
- 10 State Rittinger's law and write equation
- 11 Draw a neat sketch of ball mill

Understanding:

- 1 Classify the methods of size reduction and give examples
- 2 Distinguish the open circuit and closed circuit grinding
- 3 Classify the size reduction equipments
- 4 Distinguish between crushers and fine grinders
- 5 Differentiate between crushing and grinding operations
- 6 Differentiate between Jaw Crusher and Gyratory crusher
- 7 Identify the applications of the Crushing and grinding equipments
- 8 What is centrifuging and define critical speed of Ball mill.
- 9 Explain the working principle of ultrafine grinder.
- 10 State Rittinger's law and Kick's law.

Application:

- 1 Sketch the any one of the Crushing equipments label the parts
- 2 Outline the Working principles of the Crushing and grinding equipments
- 3 Draw a neat sketch of Conical ball mill and name its parts
- 4 Solve simple problems on energy requirement for Size reduction
- 5 A material is crushed in a Jaw crusher and the average size of particle is reduced from 10 cm to 2 cm with consumption of energy at the rate of 12 kW/(kg/sec). What will be the consumption of energy required to crush the same material of average size 6 cm to an average size of 1.5 cm? Assuming i) Rittinger's law ii) Kick's law.
- 6 Explain the working principle of Ball mill with a neat sketch and evaluate the critical speed of ball mill.
- 7 State and explain (a) Rittinger's Law (b) Bond's crushing law and work index (c) Kick's law
- 8 Discuss the working principle of Roll crusher and evaluate the angle of nip in Roll crusher.
- 9 a). Explain the working principle of Ball mill with a neat sketch.
b). Calculate the critical speed of ball mill using following data:
Diameter of ball = 40 mm , Diameter of ball mill = 450 mm
- 10 Explain with a neat sketch the construction and working of Jaw Crusher.

UNIT-V: Mechanical Separations

Remembrance:

- 1 Identify and list the Industrial screens.
- 2 Discuss Magnetic separation
- 3 Define Sedimentation.
- 4 Name important dust collecting equipments.
- 5 Define Jigging, Froth flotation.
- 6 Define terminal velocity and write equation.
- 7 State stoke's law and write equation
- 8 List some mechanical operations used for solid-solid and solid- fluid separations
- 9 Define free settling and hindered settling
- 10 List air separation equipment
- 11 Explain the principle of flotation, magnetic separation, tabling, classification, jigging

Understanding:

- 1 Discuss operations of thickener and mention the fields of applications
- 2 Explain the working principles of dust collectors, gravity settlers, Cyclone separators and mention their fields of applications
- 3 Explain the working principles of fabric filters and electrostatic precipitators and write the Industrial applications.
- 4 Illustrate the principles of sedimentation
- 5 Explain the working of Vibrating screen, Trommel

Application:

- 1 Demonstrate the working principles of screening equipment (Gyratory screen/ oscillating screen/ vibrating screen etc.)
- 2 Sketch the Jig and explain its construction
- 3 Illustrate briefly the flotation operation and working of flotation cell
- 4 Sketch and explain classification process and working of hydraulic classifier
- 5 Show how tabling is carried out
- 6 Demonstrate the working of Industrial thickener with a neat sketch.
- 7 Sketch and illustrate the working of Cyclone separator.
- 8 Sketch and illustrate the working of Fabric filter.
- 9 Sketch and illustrate the working of Electrostatic precipitator

UNIT-VI: FILTRATION

Remembrance:

- 1 Define filtration.
- 2 What are the requirements of filter medium?
- 3 Define filter aid and give examples.
- 4 List the advantages and disadvantages of Plate and frame filter press
- 5 List the types of filtration.
- 6 List the applications of Filters
- 7 Explain the function of filter aid and how it is used?
- 8 Write the principle of Centrifugal filtration.
- 9 Draw a neat sketch of Rotary drum filter and indicate the parts
- 10 Differentiate filtration and sedimentation
- 11 State the principles of cake filtration

Understanding:

- 1 List the characteristics of filter medium and give examples.
- 2 What is filter aid? How is it applied?
- 3 Classify Filtration equipments.
- 4 State the principles of constant rate and constant pressure filtration
- 5 Explain the working of a Leaf filter with figure
- 6 Discuss filter aid and filter medium
- 7 Explain the constant rate filtration and constant pressure filtration
- 8 Identify the factors affecting the rate Filtration
- 9 Explain its construction and operations of Rotary drum filter
- 10 Discuss the principle of centrifugal filtration with a neat sketch.
- 11 Sketch the neat figure of filter press and name the parts
- 12 Briefly explain the working of various filters

Application:

- 1 Demonstrate the working of suspended Basket centrifuge
- 2 Sketch and illustrate the operations of Batch and continuous centrifuges
- 3 Demonstrate the working principles of Plate and frame filter press
- 4 Sketch the Rotary drum filter and explain its working
- 5 Illustrate the principles of Filtration and Outline requirements of a filter medium
- 6 Write the advantages disadvantages of Rotary drum filter over plate and frame filter
- 7 Illustrate filter cake resistance and filter medium resistance

INORGANIC CHEMICAL TECHNOLOGY

Course Title: INORGANIC CHEMICAL TECHNOLOGY	Course Code : 18CH-403C
Semester : IV	Course Group : Core
Teaching Scheme in Hrs(L:T:P) : 3:1:0	Credits : 3
Type of course : Lecture + Assignments	Total Contact Hours : 45Hrs/60Pds
CIE : 60 Marks	SEE : 40 Marks

Prerequisites: Knowledge of basic science, physical, and organic Chemistry and unit operations of Chemical Engineering.

Course Outcomes (CO):

On successful completion of the course, the students will be able to attain below Course outcomes

CO1 :	Analyse the impurities in water, select raw materials, Discuss the methods of water treatment processes. manufacturing processes and sketch the flow sheets of various industrial chemicals
CO2 :	Identify the raw materials, chemical reactions, sketch the flow sheets and explain the manufacturing processes of various industrial acids.
CO3 :	Recall the properties & applications of different types of glass & cement, identify the constituents of paints and illustrate the different manufacturing methods of paints, pigments and varnishes.
CO4 :	Discuss the various manufacturing processes and sketch the flow sheets of hydrogen carbon dioxide and acetylene. Explain the separation of oxygen and nitrogen by liquefaction process of Linde cycle.
CO5 :	Discuss various feed stocks, Explain the various methods of manufacturing processes of ammonia, urea, ammonium sulphate, ammonium chloride, phosphoric acid, single super phosphate and triple super phosphate
CO6 :	Discuss the various manufacturing processes and sketch the flow sheets of Potassium chloride, NPK fertilizer, Graphite, Alum, Silicon carbide and calcium carbide

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE					
					R		U	A
1	Water and its treatment	6	Q4	Q1		Q9(a)	Q13(a)	
2	Industrial chemicals and industrial acids	12						
3	Industrial gases	8		Q2		Q10(a)	Q14(a)	
4	Nitrogenous fertilizers phosphate industries duration	13						
5	Miscellaneous inorganic chemicals	8		Q3	Q5,Q 6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)	
6	Silicate products. paints, pigments and varnishes	11			Q7,Q 8	Q10(b), Q12(a), Q12(b)	Q13(b), Q16(a), Q16(b)	
Total		60	8		8		8	

COURSE CONTENTS

UNIT-1: Water and its treatment

Duration: 7 Periods (L: 5– T:2)

Sources of water – causes of scale formation – removal – water softening methods – Municipal water treatment – Lime soda process – Zeolite process- ion exchange process -Osmosis.

UNIT-2: Industrial chemicals and Industrial acids: Duration: 12 Periods (L: 9 – T: 3)

Common salt :Solar evaporation and vacuum pan evaporation system –Soda ash: Solvay process – modified solvay process of soda ash, – Caustic soda and chlorine by electrolytic cell method – diaphragm cell – mercury cell and membrane cells .

Hydrochloric acid by synthesis process - Nitric acid by ammonia oxidation process –Extraction of sulphur - Sulphuric acid by Contact process & DCDA process.

UNIT -3: Industrial gases

Duration:8 Periods(L: 6– T:2)

Hydrogen – steam hydrocarbon reforming process, Oxygen and Nitrogen – liquefaction method – LindeFrankle cycle method – modified Linde Frankle cycle method-Carbon dioxide-manufacture by different methods.

UNIT 4: Nitrogenous fertilizers Phosphate industries Duration: 13 Periods(L: 9 – T:4)

Ammonia by steam reforming of hydrocarbons – Urea by partial and total recycle process – Ammonium chloride – direct neutralization – Dual salt process.

Phosphorous– Phosphoric acid – wet process, Super phosphate – single super phosphate – triple super phosphate

UNIT 5: Miscellaneous inorganic chemicals**Duration: 8 Periods (L:6 – T:2)**

Potassium permanganate -Potassium chloride, NPK fertilizers – Alum from Bauxite – silicon carbide by electric arc furnace – calcium carbide by quick lime process.

UNIT -6: Silicate products. Paints, pigments and varnishes**Duration: 12Periods (L: 8 – T:4)**

Cement by dry and wet process -types of cement and its applications –Glass- types of glasses and its applications – glass manufacture - silicate products

Paints –Constituents-manufacture by mixing method-pigments- Different coloured pigments-manufacture of Lithophone, TiO_2 and chromium oxide-Varnishes by oxidation and polymerization of drying oils- Rubber and plastic paints

Specific Learning outcomes:**UNIT-1 Water and its treatment**

- 1.1 Identify the different sources of water as rainwater, surface water and spring water.
- 1.2 Analyze the impurities in water such as dissolved solids, undissolved solids and dissolved minerals.
- 1.3 Define the term scale and study the causes of scale formation.
- 1.4 Explain the process of water treatment by municipal water treatment.
- 1.5 Explain the process of water treatment by lime soda process.
- 1.6 Explain the process of water treatment by zeolite process
- 1.7 Explain the process of water treatment by ion-exchange process
- 1.8 What is osmosis and reverse osmosis?

UNIT-2: Manufacture of Industrial chemicals and Industrial acids

- 2.1 List the various sources of common salt.
- 2.2 Explain the preparation of common salt from seawater by solar evaporation and vacuum pan evaporation
- 2.3 Explain the production of soda ash by modified Solvay processes.
- 2.4 Explain the manufacture of caustic soda and chlorine by electrolytic cell methods (mercury cells) from brines.
- 2.5 Explain the constructional details of mercury cell
- 2.6 Explain the production of hydrochloric acid by synthesis process.
- 2.7 Describe the ammonia oxidation process for nitric acid manufacture.
- 2.8 Explain the extraction method for sulphur from mines.
- 2.9 Explain the method of manufacture of sulfuric acid by contact & double contact double absorption process.

UNIT 3 Manufacture of Industrial gases.

- 3.1 Discuss the hydrogen production by steam reforming of hydrocarbon process.
- 3.2 Separation of oxygen and nitrogen by liquefaction process of Linde cycle and modified Linde Frankle cycle.
- 3.3 Production of carbon dioxide by molasses fermentation.
- 3.4 Recovery of CO₂ from various sources.
- 3.5 The production of acetylene from Calcium carbide.

UNIT-4 Manufacture of nitrogenous fertilizers and the phosphate industries

- 4.1 Discuss various feed stocks for ammonia production.
- 4.2 Explain the method of manufacture of ammonia by steam reforming process of hydro carbon feed.
- 4.3 Explain the manufacture of urea by partial recycle process.
- 4.4 Explain the manufacture of urea by total recycle process
- 4.5 Explain the production of ammonium sulphate by neutralization method.
- 4.6 Explain the production of ammonium sulphate from gypsum.
- 4.7 Explain the manufacture of ammonium chloride by direct neutralization method.
- 4.8 Explain the manufacture of ammonium chloride by dual salt process.
- 4.9 Outline the origin of Phosphate rock and dressing.
- 4.10 Explain the manufacture of phosphoric acid by wet process.
- 4.11 Explain the production of single super phosphate
- 4.12 Explain the production of triple super phosphate

UNIT 5 Miscellaneous Inorganic chemicals.

- 5.1 Explain the manufacture of potassium fertilizers i.e., potassium chloride.
- 5.2 Explain the manufacture of potassium fertilizers i.e., NPK fertilizers.
- 5.3 Explain the Production of Graphite by electric furnace.
- 5.4 Explain the Production of Alum from bauxite by reacting with H₂SO₄.
- 5.5 Explain the Production of Silicon carbide using electric arc furnace.

UNIT 6 Silicate products and Preparation of paints, pigments and varnishes.

- 6.1 Discuss different types of Portland cements.
- 6.2 Explain the production of Cement by wet process.
- 6.3 Explain the production of Cement by dry process.
- 6.4 Discuss various types of glass.
- 6.5 Explain the manufacture of Glass with various operations.
- 6.6 Discuss various silicate products.
- 6.7 Discuss various constituents of a paint.
- 6.8 Explain the manufacture of paint by mixing method.
- 6.9 Describe the production of pigments like lithopone, iron oxide and titanium dioxide.
- 6.10 Explain the preparation of varnishes by oxidation and polymerization of drying oils.

Suggested Student Activities:

1. Prepare a report with illustrations of the equipment on water treatment by visiting a nearby municipal water treatment plant.
2. Prepare a study report on recovery of CO₂ from various sources.
3. Write a report on the advantages and disadvantages of nitrogenous fertilizers and can they be replaced by organic fertilizers
4. Write a report about manufacture of paints, pigments and varnishes other than mentioned in the syllabus.
5. Prepare models / charts for any manufacturing process.
6. Group discussion/Quiz
7. Surprise test

Suggested Learning Resources / Reference books

1. CHEMTECH VOL-II Published by CH.E.E.D.C., I I T Madras
2. A textbook of Chemical Technology – Shukla and Pandey
3. Engineering Chemistry – Jain & Jain.
4. Chemical Process Industries – Shreve & Brink., McGraw –Hill Publications
5. Outline of Chemical Technology by Dryden.

Suggested Software / E-Learning references :e-links:

1. <http://www.essentialchemicalindustry.org/chemicals/sulfuric-acid.html>
2. <https://www.youtube.com/watch?v=mym1rRPX6F4>
3. <https://www.youtube.com/watch?v=FIxz7biiIG0>
4. <http://www.kemira.com/en/industries-applications/pages/hydrochloric-acid.aspx>
5. <https://www.youtube.com/watch?v=yLa5VkNaBqs>
6. <https://www.youtube.com/watch?v=vJ37sYrCt-8>
7. <https://www.youtube.com/watch?v=mBUWOPh11yU>
8. <https://www.youtube.com/watch?v=R9J7pOU5FSg>
9. https://www.youtube.com/watch?v=dyxL_BvkhJg

Course Outcome		CL	Linked PO	Teaching periods
CO1	Analyse the impurities in water, select raw materials, Discuss the methods of water treatment processes. manufacturing processes and sketch the flow sheets of various industrial chemicals	R/U/A	1,2,3,4,5,6,9,10	11
CO2	Identify the raw materials, chemical reactions, sketch the flow sheets and explain the manufacturing processes of various industrial acids.	R/U/A	1,2,3,4,5,6,9,10	9
CO3	Recall the properties & applications of different types of glass & cement, identify the constituents of paints and illustrate the different manufacturing methods of paints, pigments and varnishes.	R/U/A	1,2,3,4,5,6,9,10	10
CO4	Discuss the various manufacturing processes and sketch the flow sheets of hydrogen, carbon dioxide and acetylene. Explain the separation of oxygen and nitrogen by liquefaction process of Linde cycle	R/U/A	1,2,3,4,5,6,9,10	9
CO5	Discuss various feed stocks, Explain the various methods of manufacturing processes of ammonia, urea, ammonium sulphate, ammonium chloride, phosphoric acid, single super phosphate and triple super phosphate	R/U/A	1,2,3,4,5,6,8,9,10	11
CO6	Discuss the various manufacturing processes with flow sheets of Potassium chloride, NPK fertilizer, Graphite, Alum, Silicon carbide and calcium carbide	R/U/A	1,2,3,4,5,6,7,9,10	10
				60

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	
MID SEM -II EXAM					
S.No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	

Total Questions	4	4	4	
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Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Remarks
		R		U	A	
1	I	4	1	9(a)	13(a)	
2	II		2	10(a)	14(a)	
3	III					
4	IV		3	9(b)	13(b)	
5	V			11(a)	15(a)	
				11(b)	15(b)	
6	VI		7,8	10(b)	14(b)	
				12(a)	16(a)	
				12(b)	16(b)	
Total Questions		8		8	8	

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE IV semester Mid Semester-I Examination

Course Code: 18CH-403C

Duration: 1 hour

Course Name: INORGANIC CHEMICAL TECHNOLOGY

Max.Marks:20

PART-A

Answer **all** questions, Each Question carries one mark **4x1 = 4 Marks**

- 1) Name the different types of hardness.
- 2) What is osmosis?
- 3) What are the sources of common salt

4) What are the raw materials used in the production of sulphuric acid?

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a). What are the causes of scale formation?

(or)

5(b). What is lime soda process?

6(a) Write the industrial applications of caustic soda

(or)

6(b). What are the applications of HCL?

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Describe the process of Municipal water treatment with a neat sketch.

(or)

7(b) Explain briefly about ion exchange process.

8(a) Explain the method of production of soda ash by solvey process.

(or)

8(b). Explain the process of manufacture of sulphuric acid with a neat flow sheet.

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE IV semester Mid Semester-II Examination

Course Code: 18CH-403C

Duration: 1 hour

Course Name: INORGANIC CHEMICAL TECHNOLOGY

Max.Marks:20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

1) What are the raw materials used in the production of hydrogen

2) Name the different methods of manufacture of carbon dioxide .

- 3) What are the various feed stocks for ammonia production?
4) What is biuret ?

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Write the industrial applications of hydrogen.

(or)

5(b) Write the industrial applications of CO₂

6(a).Write the equations in manufacture of ammonium chloride by direct neutralization method.

(or)

6(b). Explain the process of production of single super phosphate.

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Write the production of hydrogen by steam reforming of hydrocarbon process.

(or)

7(b) Explain the production of acetylene from Calcium carbide.

8(a) Explain the manufacture of phosphoric acid by wet process.

(or)

8(b). Explain the production of ammonium sulphate from gypsum

**MODEL QUESTION PAPER
BOARD DIPLOMA SEMESTER END EXAMINATIONS (C-18)
D.CH.E - IV - SEMESTER EXAMINATION
18CH-403C - Inorganic Chemical**

Technology

TIME: 2 HOURS

MAXIMUM MARKS: 40

Marks

PART -A
8M

MARKS: 8 X 1 =

NOTE: Answer all questions.

1. What are the different types of hardness?

2. Name the different methods by which carbon dioxide is manufactured.
3. Write the Raw materials involved in the production of Silicon carbide.
4. Name the water softening methods.
5. Define a mixed fertilizer.
6. List out various silicate products.
7. What type of furnace used for glass manufacture?
8. Name some pigments used in paint.

PART –B

MARKS: 4 X3 = 12

Answer FOUR questions. Each question carries three marks.

9 (a) Write the industrial applications of HNO_3 .

(or)

9(b) Write the composition of NPK fertilizers.

10 (a). Write the industrial applications of acetylene.

(or)

10 (b). Write the different types of Portland cements

11(a) What is Alum? What are the methods of preparation of Alum?

(or)

11 (b). What are the raw materials involved in the production of Silicon Carbide?

12 (a) What are the various constituents of paint?

(or)

12 (b) Write briefly about lithopone.

PART –C

MARKS: 4 X5 =

20

Answer FOUR questions. Each question carries five marks.

13 (a). Write the method of manufacture of caustic soda using electrolyte cell process.

(or)

13(b). Discuss the production of Silicon Carbide by Electric Arc Furnace with a neat diagram

14 (a) Explain with a neat flow sheet the method of manufacture of Triple Super

Phosphate.

(or)

14 (b) With a neat sketch explain the production of Oxygen and nitrogen by Linde cycle.

15(a) Explain with a neat flow sheet the production of Alum from bauxite

(or)

15 (b) Explain briefly about the production of calcium carbide.

16(a) Describe the production Cement by wet process

(or)

16 (b) Explain the manufacture of paint by mixing method

State Board of Technical Education & Training (TS)
Department of Technical Education

Course Title :	ORGANIC CHEMICAL TECHNOLOGY	Course Code	18CH-404C
Semester	IV	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	30:15:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours :	45/60Pds
CIE	60 Marks	SEE	40 Marks

Prerequisites: Knowledge of basic science, physical, Organic and Inorganic Chemistry, knowledge of heat and mass transfer.

Course Objectives: Identify the applications, chemical reactions & raw materials, construct flowcharts & illustrate the manufacturing processes in chemical industries.

On completion of the course, the student will be able to:

Course Outcomes

CO1	Know the applications of different types of coal and distinction between low and high temperature carbonization of coal.
CO2	Identify the raw materials, reactions and illustrate the manufacturing process of oils, fats, soaps and detergents
CO3	Study the properties & applications of different types of Plastic, Synthetic fibers and Rubber , identify the raw materials and illustrate the various steps in their manufacturing processes.
CO4	Analyse the Pulping process and the principles of pulping and identify raw materials and chemical reactions & illustrate the manufacturing process in pulp and paper, industries
CO5	Learn the principles of fermentation, identify raw materials and chemical reactions & illustrate the manufacturing process in sugar and fermentation industries.
CO6	Outline the importance of petrochemicals, sketch the flow sheets and summarize the manufacturing process of various petrochemicals, and Petroleum refining.

Course Content

UNIT 1 - Introduction to chemical technology & Coal chemicals.

Duration: 8 Periods (L:6-T:2)

General requirements of a process plant.—compressed and instrument air, Principles of formation of coal.--List of chemicals obtained from coal.— Distinction between low and high temperature carbonizations of coal---General composition of coal tar.---Coal tar distillation.---Uses of coal.—

UNIT 2 Oils, fats and detergents

Duration: 12 Periods (L:8-T:4)

Physical and chemical properties of oils - Important vegetable oils and fats and animal fats
--Mechanical expeller process – solvent extraction process – overall processing of crude vegetable oil
– hydrogenation of oils. Soap and glycerin manufacture – uses of soap and glycerin- Manufacture linear alkyl Benzene & detergents

UNIT 3 Plastic Industries, Synthetic fibers and Rubber industries

Duration:14 Periods (L:10-T:4)

Esterification – Oxidation - Plastic Industries: Resins and plastics – classification – thermo setting and thermo plastics with example - Phenol – formaldehyde molding powder preparation - Production of polyethylene (HDPE) – PVC – Manufacturing process – uses of LDPE and HDPE and PVC - Production of phenol and formaldehyde.

Advantages of synthetic fibers – manufacture of nylon – 6, 6 and nylon – 6 – manufacture of Dacron polyester – importance of blended polyesters – uses of nylon – 6, 6 and nylon 6. Classification of rubbers – butadiene manufacturing process – styrene manufacturing process – specific uses of various rubbers .

UNIT 4 Pulp and Paper Industries:

Duration: 6 Periods (L:4-T:2)

Raw materials – wood chemistry – mechanical, chemicals and semi-chemical pulps – processing of sulphate pulp and ground wood pulp - manufacture of paper –additives in paper making- bleaching techniques of pulp

UNIT 5 Sugar and Fermentation industries: :

Duration: 8 Periods(L:6-T:2)

Properties and uses of sugar – raw sugar manufacturing process – cane sugar refining – inversion of sugar, byproducts from sugar industries, grading of sugar crystals and uses-neat sketches of centrifuges in sugar industries. Fermentation industries: Properties and uses of ethyl alcohol – fermentation – aerobic and anaerobic fermentation – ethyl alcohol (industrial) manufacturing process – denaturing – potable spirits – anhydrous alcohol manufacturing process.

UNIT 6 Petroleum refining and Petro-chemicals.

Duration: 12 Periods (L:8-T:4)

Origin of crude petroleum.--Petroleum products – uses – properties. Atmospheric distillation and vacuum distillation of crude.-Cracking – thermal and catalytic cracking. --Reforming process --Other unit processes: Polymerization, isomerization, alkylation and hydro alkylation.-Purification of crude and petroleum end products. Various raw materials for petrochemicals-Petrochemicals from methane – formaldehyde – methanol – Petrochemicals from ethylene – vinyl chloride –ethylene oxide –unit operations in petroleum refining..

REFERENCE BOOKS:

1. A textbook of Chemical Technology Volume II by Shukla and Pandey.
2. Chemtech – II (Second volume of Manual of Chemical Technology, I.I.T, Madras.)
3. Chemical Process Industries by Shreve
4. Outline of Chemical Technology by Dryden.

SPECIFIC LEARNING OUTCOMES

1.0 Introduction to Chemical technology and Coal Chemicals

- 1.1 The general requirement of a process plant.
- 1.2 Steps in the process development.
- 1.3 Principles of formation of coal.
- 1.4 Distinguish between low and high temperature carbonization process.
- 1.5 Flow diagram containing coking of coal and how the coal chemicals recovered.
- 1.6 Describe the HTC and explain the recovery of coal chemicals.
- 1.7 Describe the LTC with a neat sketch.
- 1.8 Describe the coal tar distillation process with a flow diagram.
- 1.9 Uses of coal.

2.0 Physical and chemical properties of oil.

- 2.1 List the important vegetable and animal oils and fats.
- 2.2 Describe the mechanical expeller process and solvent extraction process.
- 2.3 Explain the hydrogenation of oils and explain the steps in the vanaspati process.
- 2.4 Describe the continuous soap manufacturing process.
- 2.5 List the detergent builders.
- 2.6 Explain the glycerin recovery process.
- 2.7 Explain manufacture of linear alkyl Benzene and detergents

3.0 Distinguish between a resin and plastic with examples.

- 3.1 Describe esterification and oxidation as unit processes.
- 3.2 Explain addition polymerization & condensation polymerization, suspension & co polymerization
- 3.3 Differentiate between thermosetting and thermoplastic resins with examples.
- 3.4 Explain HDPE and LDPE.
- 3.6 Explain the production of HDPE.
- 3.7 Describe the manufacture of PVC.
- 3.8 Illustrate the various steps in manufacturing process of phenol.
- 3.9 Illustrate the various steps in manufacturing process of formaldehyde.

3.10 Importance of synthetic fibres.

- 3.11 Describe the manufacture of Nylon 6, 6.
- 3.12 Describe the manufacturing process of Nylon – 6 from caprolactum.
- 3.13 Describe the manufacture of Dacron polyester.
- 3.14 Uses of nylon 6, 6 and nylon – 6.
- 3.15 Importance of blended polyesters.
- 3.16 **Importance of rubber industries.**
- 3.17 List the specific uses of various rubbers.
- 3.18 Explain the butadiene manufacturing process.
- 3.19 Explain the styrene manufacturing process.
- 3.20 Describe the additional processing used in rubber industry

4.0 List the raw materials for pulp and paper industry.

- 4.1 Learn the chemistry of wood.
- 4.2 Classify mechanical, chemical and semi chemical pulps.
- 4.3 Explain the process details of mechanical pulp.
- 4.4 Describe the Kraft process for the manufacture of sulfate pulp.

- 4.5 Define paper and know about the paper processing.
- 4.6 Describe the additives used in paper making.
- 4.7 Describe bleaching techniques of pulp in the paper industry.

5.0 Explain the properties and uses of sugar & ethyl alcohol.

- 5.1 Describe the sugar (raw) manufacturing process.
- 5.2 List the by-products obtained from sugar industries.
- 5.3 Explain the steps involved in cane sugar refining.
- 5.4 Explain the grading of sugar crystals.
- 5.5 Describe the “Inversion of sugar” and methods to eliminate it.
- 5.6 Differentiate between aerobic and anaerobic fermentation processes.
- 5.7 Illustrate the various steps in industrial alcohol manufacturing process from molasses.
- 5.8 Define the term denaturing.
- 5.9 Explain potable spirits.
- 5.10 Explain the anhydrous alcohol manufacturing process.

6.0 Petroleum Refining and Petrochemicals

- 6.1 List the usual raw materials used in petrochemicals manufacturing.
- 6.2 Classify of crude petroleum, product boiling ranges
- 6.3 Write the uses and properties of products of refining.
- 6.4 Describe the atmospheric and vacuum distillation of crude petroleum.
- 6.5 Explain the Cracking process.
- 6.6 Differentiate between thermal and fluid catalytic cracking
- 6.7 Describe the thermal cracking process with a neat sketch.
- 6.8 Describe the fluid catalytic cracking process with a neat sketch
- 6.9 Describe catalytic reforming of crude.
- 6.10 Explain the refining processes
- 6.11 Comprehend other unit processes used in petroleum refining.
 - a) Polymerization
 - b) Isomerization
 - c) Alkylation
- 6.11 Illustrate the various purification steps used in petroleum refining.
- 6.12 Describe the following unit operations used in petroleum refining.
 - a) Distillation b) Absorption c) Extraction
- 6.13 Describe the processing methods of the following petrochemicals.
 - a) Formaldehyde b) Methanol

6.14 Describe the processing methods of the following petrochemicals.

a) Vinyl chloride

b) Ethylene oxide

Suggested Student Activities

1. Each student should visit library to refer to manual/Journals of Chemical Engineering related to Chemical Technology.
2. Write a report on extraction of vegetable oils or synthetic detergents.
3. Prepare a study report on pulping, sugar, production of fermentation products, petrochemicals and polymers other than that mentioned in the syllabus content.
4. Quiz and Group discussion
5. Surprise test

e-Learning links:

1. <http://nptel.ac.in>
 - a. <https://www.youtube.com/watch?v=yLa5VkNaBqs>
 - b. <https://www.youtube.com/watch?v=vJ37sYrCt-8>

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
1	Introduction to chemical technology & Coal chemicals	8	Q4	Q1	Q9(a)	Q13(a)
2	Oils, fats and detergents	12				
3	Plastic Industries. Synthetic fibers and Rubber industries	14		Q2	Q10(a)	Q14(a)
4	Pulp and Paper Industries	6				
5	Sugar and Fermentation industries	10	Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)
6	Petroleum refining and Petrochemicals	10		Q7,Q8	Q10(b), Q12(a), Q12(b)	Q13(b), Q16(a), Q16(b)
DISTRIBUTION OF QUESTIONS/MARKS FOR SEMESTER MID/END EXAMINATION						

Course Outcome		CL	Linked PO	Teaching periods
CO1	Know the applications of different types of coal and distinguish between low and high temperature carbonizations of coal.	R/U/A	1,2,9	6
CO2	Identify the raw materials, reactions and illustrate the manufacturing process of oils, fats, soaps and detergents	R/U/A	1,2,9,10	8
CO3	Study the properties & applications of different types of Plastic, Synthetic fibers and Rubber, identify the raw	R/U/A	1,2,6,9,10	14

	materials and illustrate the various steps in their manufacturing processes.			
CO4	Analyse the Pulping process and the principles of pulping and identify raw materials and chemical reactions & illustrate the manufacturing process in pulp and paper, industries	R/U	1,2,3,9,10	10
CO5	Learn the principles of fermentation, identify raw materials and chemical reactions & illustrate the manufacturing process in sugar and fermentation industries.	R/U/A	1,2,5,8,9,10	10
CO6	Outline the importance of petrochemicals, sketch the flow sheets and summarize the manufacturing process of various petrochemicals and Petroleum refining	R/U/A	1,2,3,8,9,10	12
Mid term Examination marks distribution				
				60

Test	Units	Marks
Mid Sem 1	1 and 2	20
Mid Sem 2	3 and 4	20
Slip Test 1	1 and 2	5
Slip Test 2	3 and 4	5
Assignment	1	5
Seminars	1	5
	Total	60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
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1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed ¼ of a page, 1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE			
	R		U	A
I	Q4	Q1	Q9(a)	Q9(a)

II					
III		Q2		Q10(a)	Q10(a)
IV					
V		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q9(b), Q11(a), Q11(b)
VI			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q10(b), Q12(a), Q12(b)
Total Questions		8		8	8

Model Question papers

MODEL QUESTION PAPER

BOARD OF TECHNICAL EDUCATION (C18) DCHE- IV SEMSTER, MIDSEM-I EXAMINATION

18CH-404C - ORGANIC CHEMICAL TECHNOLOGY

Duration:1 hour

MARKS:20

PART-A

4 X 1=4M

1. What are the basic needs of process plant?
2. List the chemicals obtained from coal.
3. Compare soap with detergents.
4. List the detergent builders

PART-B

Marks: 2x3=6M

- 5(a) Distinguish between low and high temperature carbonization process .

(Or)

- (b) Describe the low temperature carbonization process with a neat sketch.

- 6 (a) Explain the hydrogenation of oils

(Or)

(b) Describe briefly the continuous soap manufacturing process?

PART-C

Marks: 2X5=10

7.(a) Describe the coking of coal with a flow diagram.

(Or)

(b) Describe the coal tar distillation process with a flow diagram

8.(a) Describe the solvent extraction process

(Or)

(b) Explain the glycerine recovery process.

C18-DCHE

BOARD OF TECHNICAL EDUCATION (C18)

DCHE- IV SEMSTER MIDSEM-II EXAMINATION

18CH-404C - ORGANIC CHEMICAL TECHNOLOGY

Duration:1 hour

MARKS:20

PART-A

Marks: 4 X 1=4M

1. Distinguish between a resin and plastic with examples.
2. Describe esterification as unit processes.
3. What are the additives used in paper making?
4. What are the different types of pulp?

PART-B

Marks: 2x3=6M

5 (a). Explain addition polymerization & condensation polymerization.

(Or)

(b) Explain the production of HDPE.

6 (a) Explain the process details of mechanical pulp.

(Or)

(b) Define paper and write about the paper processing.

PART-C

Marks: 2X5=10

7(a) Illustrate the various steps in manufacturing process of phenol.

(Or)

(b) Explain the styrene manufacturing process.

8 (a). Describe the Kraft process for the manufacture of sulfate pulp.

(Or)

(b) Describe bleaching techniques of pulp in the paper industry.

18-CH-404

BOARD OF TECHNICAL EDUCATION (C18)

DCHE- IV SEMSTER END EXAMINATION

18CH-404C - ORGANIC CHEMICAL TECHNOLOGY

Duration: 2 hours

MARKS:40

PART-A

Marks: 8 X 1=8M

1. What are the uses of coal.
2. List the specific uses of various rubbers.
3. List the by-products obtained from sugar industries.
4. What are the different types of pulp?
5. Describe the "Inversion of sugar".
6. Explain the grading of sugar crystals.
7. Name any three petroleum end products and their uses
8. Explain the Cracking process.

PART-B

Marks: 4X3=12M

9.(a) Discuss about the coking of coal .

(Or)

(b Explain the steps involved in cane sugar refining..

10. (a) Describe the manufacture of PVC.

(Or)

(b) Describe the vacuum distillation of crude petroleum.

11 (a) Define the term denaturing

(Or)

(b) Differentiate between aerobic and anaerobic fermentation processes

12(a) Explain about the fluid catalytic cracking process.

(Or)

(b) Illustrate the various purification steps used in petroleum refining.

PART-C

Marks: 4X5=20M

13(a) Describe the continuous soap manufacturing process

(Or)

(b) Describe the various steps in industrial alcohol manufacturing process from molasses.

14 a) Describe the manufacture of Nylon 6, 6.

(Or)

(b) Describe the processing methods of the petrochemical Formaldehyde

15 (a) Describe the the sugar (raw) manufacturing process.

(Or)

(b) Explain the anhydrous alcohol manufacturing process.

16(a) Describe about the manufacturing of Methanol as Petrochemical

(Or)

(b) Describe the Process of Distillation used in petroleum refining.

QUESTION BANK

18CH-404C - ORGANIC CHEMICAL TECHNOLOGY

PART –A

1. Draw the flow diagram containing coking of coal.
2. What are the the uses of coal.
3. Define oils and fats.
4. What are the properties of oils and fats.
5. List the sources of oils and fats
6. List the industrial uses of oils, fats.
7. Define surfactant.
8. What are the the physical and chemical properties of oil.
9. List the important vegetable and animal oils and fats.
10. Explain the hydrogenation of oils .
11. List the detergent builders.
12. Write differences between HDPE and LDPE
13. Describe the manufacturing process of Nylon – 6 from caprolactum
14. Distinguish between a resin and plastic with examples.
15. Write notes on esterification and oxidation as unit processes.
16. Write notes on addition polymerization.
17. Write notes on condensation polymerization.
18. Explain about suspension and co polymerization.
19. Differentiate between thermosetting and thermoplastic resins with examples
20. Write about HDPE and LDPE
21. What are the end uses of nylon 6, 6 and nylon – 6.
22. Explain the importance of blended polyesters.

23. List the specific uses of various rubbers.
24. Write the properties and applications of various rubbers.
25. What are the secondary Raw materials used for paper making ?
26. What are the chemical pulping methods explain briefly.
27. What are the Raw materials used for paper making ?
28. What are the raw materials for pulp .
29. List the methods of pulping.
30. Define paper.
31. List fibrous and non-fibrous materials for paper production
32. Why SO₂ is bubbled through cane juice give reasons
33. List the applications of starch.
34. Write about the process of fermentation.
35. Write about the sulphite process.
36. Define Bagasse, Molasses, Masecuite.
37. Write about the additives used in paper making.
38. What are the bleaching techniques of pulp in the paper industry.
39. What are the physical properties of wood ?
40. What are the applications of natural Fibres ?
41. What are the raw materials used in petrochemicals manufacturing.
42. What is the classification of crude petroleum, and the product boiling ranges
43. Write the uses and properties of products of refining.
44. Write about esterification and oxidation as unit processes.
45. Define Bagasse, Molasses, Masecuite
46. List the methods of pulping.
47. Write about about the grading of sugar crystals.

PART –B

1. Distinguish between low and high temperature carbonization process.
2. Describe the HTC and explain the recovery of coal chemicals.
3. Describe the LTC with a neat sketch.
4. Describe the coal tar distillation process with a flow diagram.
5. Explain the glycerin recovery process.
6. Explain cleaning action of soap and detergent
7. Interpret thermosetting and thermoplastic materials.
8. Explain production of natural rubber.
9. Write about rubber industries

10. Explain the butadiene manufacturing process.
11. Explain the styrene manufacturing process.
12. Write about the additional processes used in rubber industry
13. Explain the manufacture of PVC.
14. Illustrate polymerization process for vinyl chloride.
15. Explain the production of Phenol formaldehyde.
16. Explain the production of synthetic rubber.
17. Illustrate the production of different petrochemicals indicating various stages.
18. Illustrate the production of Crystalline sugar.
19. Summarize refining of cane sugar.
20. Explain production of Starch.
21. Explain industrial alcohol, absolute alcohol, rectified spirit.
22. Summarize the production of gelatin.
23. Explain bleaching of pulp.
24. Explain preparation of fiber suspension for paper production.
25. Explain the process details of mechanical pulp.
26. Describe the Kraft process for the manufacture of sulfate pulp
27. Explain the manufacturing process of Paper with the help of neat sketch.
28. Explain about chemical pulping methods.
29. Explain about continuous and batch digesters, explain with the help of neat sketch.
30. Explain cleaning action of soap and detergent
31. Interpret thermosetting and thermoplastic materials.
32. Explain production of natural rubber.
33. Construct the flow diagram and explain production of polyethylene. 10
34. Describe the atmospheric distillation and vacuum distillation of crude petroleum.
35. Explain the Cracking process.
36. Differentiate between thermal and fluid catalytic cracking
37. Describe the thermal cracking process with a neat sketch.
38. Write notes on the unit processes used in petroleum refining.
39. a) Polymerization b) Isomerization c) Alkylation
40. Describe the fluid catalytic cracking process with a neat sketch
41. Describe the fluid catalytic cracking process with a neat sketch

PART –C

1. Describe the mechanical expeller process and solvent extraction process.
2. Describe the continuous soap manufacturing process.
3. Explain manufacture of linear alkyl Benzene & detergents.

4. Construct the flow diagram of pulping by kraft process and explain its process
5. Illustrate the manufacture of sugar with flow sheet.
6. Explain the manufacture of ethyl alcohol .Give flow diagram.
7. Illustrate the production of methanol by synthesis gas route.
8. Construct the flow diagram of pulping by kraft process and explain its process.
9. Illustrate the manufacture of sugar with flow sheet.
10. Explain the manufacture of ethyl alcohol .Give flow diagram.
11. Illustrate the production of methanol by synthesis gas route.
12. Construct the flow diagram and explain production of polyethylene.
13. Explain the manufacturing process of Paper with the help of neat sketch.
14. What are the different pulping processes and explain them.
15. Explain the manufacture of ethyl alcohol by fermentation of molasses.
16. Describe the processing methods of the following petrochemicals.
 - a) Formaldehyde b) Methanol
17. Describe the processing methods of the following petrochemicals.
 - a) Vinyl chloride b) Ethylene oxide
18. Explain the steps involved in cane sugar refining.

HEAT TRANSFER

Course Title :	HEAT TRANSFER	Course Code	18CH-405C
Semester	IV	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	3:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours :	60Pds
CIE	60 Marks	SEE	40 Marks

Pre-requisites: This course requires the Knowledge of fundamentals of science and maths, Chemical Process calculations and fluid mechanics.

Course Outcomes

CO1	Apply the principles of heat transfer, apply the principles of conduction to estimate rate of heat transfer in different applications
CO2	Apply the principles of convective heat transfer in calculations involving determination of heat transfer co-efficient
CO3	State laws of black body radiation and apply the principles of heat transfer by radiation
CO4	Interpret the principles of working of various types of heat transfer equipments, identify type of heat exchangers for specific duty.
CO5	Explain working principle of various types of evaporators, identify the type of evaporator for specific duty, Calculate heat transfer area and steam requirement using material and energy balance.
CO6	Analyse the performance of an evaporator- identify the methods for enhancing steam economy of an evaporator,

UNIT 1 - Heat transfer by conduction

Duration: 10 Periods (L:7-T:3)

Heat transfer and its applications- Mechanisms of heat flow- Fourier's law-Thermal conductivity- Steady state conduction-conduction through a single plane wall- Compound resistances in series-composite wall- Heat flow through a Cylinder- lagging-insulating materials- Problems.

UNIT 2 - Principles of heat flow in fluids:

Duration: 11 Periods(L:7-T:4)

Typical heat exchange equipment – approach, range- Counter current and parallel-current flows – Energy balances – Average temperature of fluid stream– LMTD – film concept in heat transfer- Individual heat transfer coefficients – Calculation of Overall heat transfer coefficients from Individual

Course Content

UNIT 3 - Heat transfer to Fluids without and with phase change

Duration: 10 Periods (L:7-T:3)

Regimes of heat transfer in fluids – Thermal boundary layer – Heat transfer by forced convection in laminar flow – Graetz and Peclet numbers – Heat transfer by forced convection in Turbulent flow – Empirical equations – Heat transfer from condensing vapors – Drop wise and film wise condensation – Heat transfer to boiling liquids-pool boiling, nucleate boiling and film boiling- problems on calculation of heat transfer coefficient

UNIT 4 - Radiation Heat transfer:

Duration: 07 Periods (L:5-T:2)

Fundamentals - Emission of Radiation- wave length of radiation- Emissive power – Black body radiation – Laws of Black body radiation – Absorption of radiation by opaque solids – Reflectivity and absorptivity – Kirchoff's law – Radiation between surfaces – Angle of vision – view factor – combined Heat transfer by conduction – convection and radiation.

UNIT 5 - Heat Exchange equipment:

Duration: 10 Periods(L:7-T:3)

Types of heat exchangers- principles and operation of Double pipe heat exchangers – Shell and tube Heat exchanger- single, multipass, floating head heat exchanger – Temperature patterns in multipass

exchangers – extended surface heat exchangers – Fin type and plate type Heat exchangers - Kettle type reboilers- condensers

UNIT 6 - Evaporation.

Duration: 12 Periods (L:8-T:4)

Liquid characteristics – Types of evaporators – Standard vertical tube, Long tube, Climbing film, falling film – forced circulation evaporators – evaporator accessories – steam traps – condensers – Entrainment separators – Barometric leg – Ejectors – Performance of tubular evaporators – Evaporator capacity – Economy – Boiling point elevation and Duhring's rule - Enthalpy balances for single effect evaporator – Simple problems – Multiple effect evaporators- Methods of feeding.

SPECIFIC LEARNING OUTCOMES:

1.0 Heat transfer by conduction

- 1.1 Demonstrate various mechanisms of heat flow such as conduction, convection and Radiation.
- 1.2 Define conduction, convection and Radiation.
- 1.3 Contrast steady state and unsteady state heat flow
- 1.4 Explain Fourier's law of heat flow by conduction
- 1.5 Define and explain thermal conductivity of a substance.
- 1.6 Derive an equation for conduction through a single Plane wall, Composite wall.
- 1.7 Derive equation for conduction through cylindrical wall
- 1.8 Appraise the necessity of lagging and economy of lagging thickness
- 1.9 List different heat insulating materials
- 1.10 Calculate the rate of heat transfer by conduction through a single plane wall, cylindrical and composite wall

2.0 Principles of heat flow in fluids:

- 2.1 Differentiate between natural and forced convection
- 2.2 Explain the working of heat exchanger.
- 2.3 Compare counter current and parallel current flows in heat exchanger.
- 2.4 Apply energy balance to heat exchangers and condensers.
- 2.5 Explain the need of using log mean temperature difference.
- 2.6 Explain film concept in heat transfer by convection.
- 2.7 Compare film coefficient with thermal conductivity.
- 2.8 Define Nusselt number and Prandtl number
- 2.9 Derive an equation for determination of overall coefficients from individual coefficients.
- 2.10 Solve problems to calculate LMTD and overall coefficients.

3 Heat transfer to fluids without and with phase change

- 3.1 Explain about thermal boundary layer and compare with hydrodynamic boundary layer
- 3.2 Analyse the heat transfer by forced convection in laminar flow and turbulent flow.
- 3.3 Define Graetz and Peclet numbers.
- 3.4 Apply various empirical equations used to calculate heat transfer coefficient, h_i such as
 - 1. Dittus – Boelter Equation
 - 2. Sieder – Tate Equation.
- 3.5 Analyse the mechanism of heat transfer from condensing vapors.
- 3.6 Analyse the heat transfer mechanism to boiling liquids.
- 3.7 Summarize the significance of heat transfer coefficient in boiling liquid and condensing vapours.
- 3.8 Solve problems to calculate various numbers and heat transfer coefficient using various equations.

4.0 Radiation Heat transfer

- 4.1 Define absorptivity, reflectivity and transmittivity.
- 4.2 Define black body emissivity.
- 4.3 State and Explain Stefan Boltzmann Law, Planck's law and Wien's displacement law.
- 4.4 State and Explain Kirchhoff's law.
- 4.5 Analyse the process of radiation between surfaces.
- 4.6 State angle of vision and view factor.
- 4.7 Describe the combined heat transfer by conduction, convection and Radiation and write equation
- 4.8. Solve problems to determine rate of heat transfer by radiation.

5.0 Heat Exchange equipment

5.1 Classify heat exchangers.

- 5.2 Interpret the principle of working of Double pipe heat exchanger.
- 5.3 Describe the working principle of a shell and tube heat exchanger in detail with a neat diagram
- 5.4 Explain the working principle of a floating head heat exchanger with a neat sketch
- 5.5 Explain the working principle of a multipass heat exchanger.
- 5.6 Analyse temperature patterns in multipass exchanges with sketches.
- 5.7 Demonstrate with a diagram the extended surface heat exchangers i.e., i) Fin Type and ii) Plate type
- 5.8 Outline the functions of a condenser and reboiler
- 5.9 Select the heat exchanger for specific duty

6.0 Evaporation.

- 6.1 Differentiate evaporation with other unit operations
- 6.2 Analyze different liquid properties considered in evaporation.
- 6.3 Classify different types of evaporators
- 6.4 Describe with neat sketches the construction and working of following type of evaporators.
 - a) Standard vertical tube evaporator.
 - b) Falling film and climbing film evaporators.
 - c) Forced circulation evaporators.
- 6.5 Distinguish between various types of evaporators
- 6.6 Identify various types of evaporator accessories
 - a. Condensers
 - b. Vacuum pump and ejectors
 - c. Steam traps
 - d. Entrainment separators
- 6.7 Evaluate the performance of an evaporator
- 6.8 Define economy and capacity of an evaporator.
- 6.9 State boiling point elevation, Duhring's rule and effect of hydrostatic head
- 6.10 Write enthalpy balances for single effect evaporator.
- 6.12 Construct enthalpy concentration diagram.
- 6.13 Calculate heat transfer area and steam requirement using material and energy balance.
- 6.14 Identify the methods to enhance economy of evaporator
- 6.15 Explain the working principle of the multiple effect evaporator system with a sketch.

- 6.16 State and explain the methods of feeding the Multiple effect evaporator system with relative advantages and disadvantages

SUGGESTED LIST OF STUDENT ACTIVITIES

Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.

1	Each student will give an activity to prepare a tabulated summary for types of evaporators which is available in the market. (Summary includes types of evaporators other than indicated in chapter-6)
2	List out any five heat exchangers devices available in market with its specifications and current market price.
3	Each student will be given an activity to prepare a tabulated summary for types of heat insulating materials available in market. (Summary includes type, specification, size range, material, rate and applications).
4	Each student should visit library to refer to manuals/Journals of Chemical Engineering
5	Group Discussion, Quiz and Seminars

Recommended Books

1. Unit operations of chemical Engg by Wareen L.Mc Cabe, Julian C.Smith and Peter Harriott, Fifth edition, Mc Graw Hill Publication.
2. Introduction to Chemical Engg by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
3. Process Heat Transfer by Donald Q. Kern, Mc GRAW Hill Publication.
4. Perry's Chemical Engineers' Handbook, McGrawHill .
5. Unit Operations – II by K.V Gahvane.

e-Learning links:

- 1 <http://nptel.ac.in>
- 2 <https://www.youtube.com/watch?v=w7MoS2C70zU>
<https://www.youtube.com/watch?v=n9Riw8gp2JI>
<https://www.youtube.com/watch?v=GzH1Z2IpnMY>
<https://www.youtube.com/watch?v=jdsNoRgt7zY>
<https://www.youtube.com/watch?v=iIRbhZY8MpE>
<https://www.youtube.com/watch?v=22W753joAnA>
<https://www.youtube.com/watch?v=x4c6UN8IqOc>
<https://www.youtube.com/watch?v=-42JmVBdlM4>
<https://www.youtube.com/watch?v=ftnLJ6VDwS8>
<https://www.youtube.com/watch?v=Gn0E7BSaVZ8>
<https://www.youtube.com/watch?v=3T8Km9BYHeg&list=PL4ECF5DA8511498E6>

CO-PO MAPPING MATRIX

Course Outcome		CL	Linked PO	Teaching periods
CO1	Apply the principles of heat transfer, apply the principles of conduction to estimate rate of heat transfer in different applications	R/U/A	1,2,3,9,10	11
CO2	Apply the principles of convective heat transfer in calculations involving determination of heat transfer co-efficient	R/U/A	1,2,3,4,10	10
CO3	State laws of black body radiation and apply the principles of heat transfer by radiation	R/U/A	1,2,6,9,10	12
CO4	Interpret the principles of working of various types of heat transfer equipments, identify type of heat exchangers for specific duty.	R/U/A	1,2,3,4,5,10	07
CO5	Explain working principle of various types of evaporators, identify the type of evaporator for specific duty, Calculate heat transfer area and steam requirement using material and energy balance.	R/U/A	1,2,3,4,8,10	8
CO6	Analyse the performance of an evaporator- identify the methods for enhancing steam economy of an evaporator	R/U/A	1,2,3,4,10	12
				60

Internal Evaluation

Test	Units	Marks
Mid Sem 1	1 and 2	20
Mid Sem 2	3 and 4	20
Slip Test 1	1 and 2	5
Slip Test 2	3 and 4	5
Assignment	1	5
Seminars	1	5
	Total	60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.N	Description	Level	No of	Marks for	Choice	Total
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o			Questions	each question		Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed ¼ of a page,1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE				
	R		U		A
I	Q4	Q1		Q9(a)	Q13(a)
II					
III		Q2		Q10(a)	Q14(a)
IV					
V		Q3	Q5,Q 6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
VI			Q7,Q 8	Q10(b), Q12(a), Q12(b)	Q14(b), Q16(a), Q16(b)
Total Questions	8		8		8

State Board of Technical Education and Training, Telangana

Model Question paper
DCHE IV semester
Mid Semester-I Examination

Course Code: 18CH-405C
Course Name: Heat Transfer

Duration: 1 hours
Max.Marks:20

PART-A

Answer **all** questions, Each Question carries 01 marks

4x1 = 04 Marks

- 1) What are the different modes of heat transfer?
- 2) What is lagging?
- 3) Define Nusselt number.
- 4) Define natural convection. Give example.

PART-B

Answer **all** questions, Each Question carries 03 marks

2x3 = 06 Marks

5(a) Derive an equation for conduction through a single plane wall.

(or)

5(b) Explain Fourier's Law of heat conduction. Define thermal conductivity.

6(a) Explain in brief about LMTD.

(or)

6(b) Define heat transfer coefficient. Write relationships between individual and overall heat transfer coefficients.

PART-C

Answer **all** questions, Each Question carries 05 marks

2x5 = 10 Marks

7(a) Derive an equation for conduction through a composite wall made of three materials.
(or)

7(b) A furnace is constructed with 220 mm thick of silica brick, 120 mm thick of insulating brick and 220 mm of thick of building brick. The temperature of the inner surface of the wall is 925°C and that at outer surface is 40°C. Find the heat loss per unit area ?

Data: Thermal conductivity of silica brick = 1.75 W/(m K)

Thermal conductivity of insulating brick = 0.124 W/(m K)

Thermal conductivity of building brick = 0.744 W/(m K)

8(a) Explain about co current, counter current flows in heat exchangers and compare them with temperature patterns.

(or)

8(b) A hot fluid enters a double pipe heat exchanger at a temperature of 423 K and is to be cooled to 367 K by a cold fluid entering at 311 K and heated to 339 K. Calculate the value of log mean temperature difference for co-current and counter current flow.

State Board of Technical Education and Training, Telangana

Model Question paper
DCHE IV semester
Mid Semester-II Examination

Course Code: 18CH-405C
Course Name: Heat Transfer

Duration: 1 hour
Max.Marks:20

PART-A

Answer **all** questions, Each Question carries 01 marks

4x1 = 04 Marks

- 1). Write Sieder Tate equation for laminar flow.
- 2). Define Greatz number.
- 3). Define emissivity.
- 4). What is a black body?

PART-B

Answer **all** questions, Each Question carries 03 marks

2x3 = 06 Marks

5(a) Explain briefly about thermal boundary layer.

(or)

5(b) Discuss briefly about dropwise and filmwise condensation.

6(a) Explain about reflectivity and absorptivity of opaque solids.

(or)

6(b) Define angle of vision and view factor.

PART-C

Answer **all** questions, Each Question carries 05 marks

2x5 = 10 Marks

7(a) Explain about the process of heat transfer to boiling of liquids with the help of heat flux vs temperature drop curve

(or)

7(b). Determine the heat transfer coefficient for water flowing in a tube of 16mm diameter at a velocity of 3m/s . The temperature of the tube is 297 K and the water enters at 353 K and leaves at 309K. Use (i) Dittus - Boelter equation (ii) Sieder -Tate equation.

Given Data: Properties of water at 331 K at arithmetic mean bulk temperature are:

Density = 984.1 kg/m^3 , Specific heat $C_p = 4187 \text{ J/(kg.K)}$,

Viscosity $\mu = 485 \times 10^{-6} \text{ Pa.s}$, Thermal conductivity $k = 0.657 \text{ W/(m.K)}$,

Viscosity of water at 297 K , $\mu_w = 920 \times 10^{-6} \text{ Pa.s}$

8(a) State and explain laws of black body radiation.

(or)

8(b) Describe the combined mechanism of heat transfer by conduction, convection and radiation.

State Board of Technical Education and Training, Telangana

**Model Question paper
DCHE IV semester
Semester End Examination**

Corse Code: 18CH-405C
Course Name: HEAT TRANSFER

Duration: 2 hours
Max.Marks:40

PART-A

Answer **all** questions, Each Question carries 01 marks

8x1 = 08 Marks

1. Define Conduction and give examples.
2. Define Nusselt number.
3. State the industrial applications of Evaporators
4. Write Dittus- Boelter equation.
5. Write the function of condenser.
6. What is the purpose of baffles in heat exchangers?
7. Define evaporation.
8. What is vapor recompression?

PART-B

Answer all questions. Each Question carries 03 marks

4 x 3 = 12 Marks

- 9(a). Define film coefficient and compare it with thermal conductivity.
(or)
9(b) Explain the working of Double pipe heat exchanger.
- 10(a) State and explain Kirchoff's law of black body radiation.
(or)
10(b) Define capacity and economy of an evaporator. How the economy of an evaporator can be increased?
- 11(a). Draw a neat sketch of Internal floating head heat exchanger and indicate the parts.
(or)
11(b) List the different types of shell and tube heat exchangers and write their specific applications.
- 12(a). Write energy balance over a single effect evaporator.
(or)
12(b) Discuss the boiling point elevation and effect of hydrostatic head.

PART- C

Answer all questions. Each Question carries 05 marks

4 x 5 = 20 Marks

- 13.(a) Derive an equation for conduction through a composite wall made of three materials..
(or)
13(b) Explain the principle of working of extended surface heat exchangers.
- 14(a) Differentiate between Filmwise and dropwise condensation.
(or)
14(b) Explain the principle of multiple effect evaporation.
- 15(a). Explain the working of shell and tube heat exchangers with neat sketch.
(or)
15(b). Explain about multipass heat exchanger with a neat sketch and draw temperature patterns.
- 16(a). Explain the construction and working of Forced circulation evaporator with a neat sketch

and give its relative advantages over other evaporators

(or)

16(b) A solution containing 10% solids is to be concentrated to a level of 50% solids, steam is available at a pressure of 0.20 MPa [saturation temperature of 393 K (120° C)]. Feed rate to the evaporator is 30000 kg/h. The overall heat transfer coefficient is 2.9 kW/ (m².K). Estimate steam economy and heat transfer surface for feed introduced at 293 K (20° C).

Data : Specific heat of feed = 3.98 kJ/(kg.K), Latent heat of condensation of steam at 0.20 MPa = 2202 kJ/ kg, Latent heat of vaporization of water at 323 K (i.e. at pressure in the vapour space = 2383 kJ/kg

IV- Semester Diploma Examination

HEAT TRANSFER

UNIT-I. Heat transfer and its applications-Heat transfer by conduction

Remembrance:

1. Define conduction. Indicate industrial examples.
2. Define thermal conductivity. Give S.I. unit.
3. State Fourier's law of heat transfer.
4. Define the terms : conduction, convection, radiation.
5. Define conductors and insulators. Give examples.

Understanding:

1. Discuss briefly the three modes of heat transfer
2. Explain briefly "Optimum insulation Thickness"
3. Discuss about conductors and insulators with examples
 4. Report the mathematical statement of Fourier's law and explain each term in the equation.
5. Discuss in brief about thermal conductivity.
6. Distinguish Steady state and unsteady state heat transfer.
 7. Explain the significance of log mean area in calculating conduction through a cylindrical wall.

Applications:

1. Derive an equation for conduction through a single plane wall, a cylindrical wall and composite wall by applying Fourier's law.
2. Appraise the necessity of lagging and economy of lagging thickness.
3. Solve simple problems using rate equations derived from Fourier's law statement.
4. Calculate the rate of heat transfer by conduction through a single cylindrical and composite wall given the necessary data.

UNIT-II. Principles of heat flow in fluids

Remembrance:

1. Define Convection.
2. Define film concept in heat transfer by convection.
3. Define the film coefficients
4. Define natural and forced convection.
5. Name the types of flow arrangements in heat exchangers

Understanding:

1. Compare film coefficients with thermal conductivity.
2. Explain the need of using log mean temperature difference.
3. Compare parallel current and counter current methods in heat transfer process.
4. Differentiate between natural and forced convection
5. Explain Re, Pr, Nu, Gr number in calculating the film coefficient.
6. Distinguish between parallel and counter current flow.

Application:

1. Derive an equation for overall heat transfer coefficient (from hot fluid to cold fluid through a solid wall).
2. Calculate the heat transfer area required given the necessary data.
3. Explain about co current, counter current flows in heat exchangers and compare them with temperature patterns
4. Derive equation for LMTD and solve problems on LMTD

UNIT-III: Heat transfer to Fluids without and with phase change

Remembrance:

1. Define Gratz number and Peclet number.
2. Define dropwise and filmwise condensation.
3. Write empirical equations to calculate heat transfer coefficient
4. Write Sieder Tate equation for laminar and turbulent flow
5. Define pool boiling of saturated liquid

Understanding:

1. Explain about the process of heat transfer to boiling of liquids with the help of heat flux vs temperature drop curve.
2. Discuss about Dropwise and Filmwise condensation
3. Explain about Thermal boundary layer
4. Define and explain nucleate boiling and film boiling

Application:

1. Calculate the heat transfer coefficient applying Dittus Boelter's equation.
2. Calculate the heat transfer coefficient applying Sieder Tate equation.
3. Summarize the significance of heat transfer coefficient in boiling liquid and condensing vapours.
4. Compare and analyse dropwise and film wise condensation

UNIT-IV Radiation Heat transfer

Remembrance:

1. Define the terms: radiation, absorptivity, reflectivity, transmittivity and emissivity.
2. State and illustrate Kirchoff's law and Stefan-Boltzmann law.
3. Define black body
4. Write equation for calculation of radiant heat transfer

Understanding:

1. Discuss the laws of radiation.
2. Discuss the concept of black body
3. Explain reflectivity and absorptivity of opaque solids
4. Define and explain angle of vision and view factor

Application:

1. Describe the combined mechanism of heat transfer by conduction, convection and radiation.
2. Solve simple problems on Radiation heat transfer.

UNIT-IV: Heat Exchange equipment

Remembrance:

1. List the various types of heat transfer equipments used in industries.
2. State the specific advantages of the shell and tube heat exchangers.
3. List the merits and demerits of Double pipe heat exchanger.
4. Define fins.
5. List the types of fins.
6. List the types of shell and tube heat exchangers.

Understanding:

1. Explain the working of shell and tube heat exchangers with neat sketch.
2. Describe with a sketch the working of multipass heat exchanger.
3. Explain the working of double pipe heat exchangers with neat sketch.
4. Explain the working of extended surface and plate type heat exchanger.
5. Compare merits and demerits of Double pipe heat exchanger.
6. Identify the specific applications of different types of heat exchange equipments.
7. Explain the need for providing baffles in the shell side of a heat exchanger.
8. Discuss maintenance procedure of heat exchangers.

UNIT-V: EVAPORATION

Remembrance:

1. State the industrial applications of Evaporators.
2. State the boiling point elevation and effect of hydrostatic head.
3. Define capacity of an evaporator
4. Describe the economy of an evaporator
5. Discuss the four methods of feeding in a multiple effect evaporator.
6. Explain the temperature distribution in a multiple effect evaporator
7. Describe the working of a multiple effect evaporator.
8. Understand the general properties, principles and practice of maintenance of Evaporator.

Understanding:

1. Compare evaporation, distillation and drying.
2. Describe with sketches the construction and working of the following type of evaporators : a. Standard vertical tube evaporator. b. Long tube evaporator
3. Describe with sketches the construction and working of the Falling and climbing film evaporators
4. Describe with sketches the construction and working of Agitated film type evaporators.
5. Distinguish the following by stating the difference in their construction details working principles and specific advantages:
 - a. Vertical and horizontal type evaporator
 - b. Vertical and long tube evaporator
6. Distinguish the following by stating the difference in their construction details working principles and specific advantages
 - a. Natural and forced circulation type
 - b. Forced circulation with internal and external heaters.
7. Identify the various types of evaporator accessories.

8. Discuss the boiling point elevation and effect of hydrostatic head.

Application:

1. Outline the important liquid characteristics in evaporators and select the suitable evaporator by giving reasons.
2. Sketch and summarize the following accessories by giving their sketches, functions and working principles:
 - e. Condensers
 - f. Vacuum pump and ejectors
 - g. Steam traps
 - h. Entrainment separators
3. Apply the basic principles of material and energy balance.
4. Sketch the multiple effect evaporator system.
5. Calculate heat transfer area and steam required using material balance and energy balance

ADVANCED CHEMICAL TECHNOLOGY LAB PRACTICE

Course Title:	ADVANCED CHEMICAL TECHNOLOGY LAB PRACTICE	Course Code	18CH406P
Semester	IV	Course Group	Core
Teaching Scheme in Periods(L: T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact Hours:	45Pds
CIE	60 Marks	SEE	40 Marks

PRE-REQUISITE

Basic Knowledge of inorganic chemistry and provide practical knowledge about the Basics of preparation of chemical solutions and qualitative and quantitative analysis of chemical compounds & instrumental methods of analysis.

COURSE OUTCOMES

Students who had completed the course will be able to

Course outcome		Linked Exercise	CL (R/U/A)	Linked PO	Teaching periods
CO 1	Analyse the acid value, saponification value and iodine value of vegetable oil	1,2,3,4,5,8 10	U,A	1,2,3,4,5,8,10	15
CO 2	Preparation of chemical products Like Phenol formaldehyde resin (Barkelite), soap	1,2,3,4,5,6	U,A	1,2,3,4,5,6,8,10	12
CO 3	Functioning and application of P ^H meter, Polarimeter, conductivity meter, Spectrophotometer and Colorimeter	1,2,3,4,5,6 8,9,10	U, A	1,2,3,6,7,8,10	18

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Determination of acid value of coconut oil / vegetable oil.	3
2	Estimation of Saponification value of the given sample.	6
3	Determination of iodine value of given vegetable oil.	6
4	Preparation of Phenol formaldehyde resin (Bakelite)	6
5	Preparation of soap by cold process.	6
6	Determination of pH of the given sample of solution by using pH meter.	6
7	Estimation of sugar content in a given sample by using Polari meter.	3
8	Determination of conductivity of the give sample of solution by conductivity meter.	3
9	Determination of absorbency/ transmittency of a given sample by spectrophotometer/Spectrometer.	3
10	Determination of the color of given sample by colorimeter.	3

Suggested Student Activities

1. Introduction to technical analysis practical's and its importance and safety precautions. Maintenance of cleanliness and orderliness of chemical reagents in the laboratory.
2. Maintenance of apparatus and equipments.
3. While being careful with acids, Following the Do's and Don'ts.
4. Maintenance of data recording in the record book.
5. Writing the procedure of the experiment before the commencement of each experiment.
6. Strict following of instructions given from time to time by the staff in charge.
7. Demonstration of each experiment by the staff in charge

Reference Books :

1. Vogel's Inorganic Qualitative and Quantitative Analysis.
2. Practical chemistry By O.P.Pande. & others.
3. Qualitative and quantitative analysis by Alex
4. Instrumental methods of analysis by Willard D & Merits

Evaluation Pattern:

I **Continuous Internal Examination:** **60 Marks**

Mid Sem - I - 20 marks **Mid Sem– II:** 20 Marks **Internal assessment:** 20 marks

II **Semester End Examination :** **40 Marks**

State Board of Technical Education and Training, Telangana

Semester End Examination Model Question paper

DCHE IV Semester practical Examination

Corse Code: 18CH-406P

Duration:3 hours

Course Name: Advanced Chemical Technology Lab Practice

Max.Marks:40

Instructions to the Candidate:

(i) Answer any One of the following Questions.

(ii)Record the results on a graph sheet if required , and conclude your observation of the experiment

(iii) Draw the diagram for illustration ,choose appropriate values when not mentioned in the question

1. Estimate Saponification value of the given sample.
2. Estimation of sugar content in a given sample by using Polari meter.
3. Determine Determination of acid value of coconut oil / vegetable oil.
4. Determine of iodine value of given vegetable oil.
5. Preparation of Phenol formaldehyde resin
6. Determine conductivity of the give sample of solution by conductivity meter.
7. Determine the color of given sample by colorimeter.
8. Verify Stoke's law by settling a particles in a liquid column
9. Determine absorbency/ transmittency of a given sample by spectrophotometer/Spectrometer .
10. Determine pH of the given sample of solution by using pH meter.

18CH-407P :: MECHANICAL OPERATIONS LAB PRACTICE

Course Title:	Mechanical Operations Lab Practice	Course Code	18CH 407P
Semester	IV	Course Group	Core
Teaching Scheme in Periods(L: T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact Hours:	45Pds
CIE	60 Marks	SEE	40 Marks

PRE-REQUISITE

Basic Knowledge of materials and mechanical operations

COURSE OUTCOMES

Students who had completed the course will be able to

Course outcome		Linked Exercise	CL (R/U/A)	Linked PO	Teaching periods
CO1	Calculate the power requirement in size reduction and to evaluate critical speed of ball mill and angle of nip in crushing rolls	1,2,3,4	U,A	2,3,4,5,8,10	6
CO2	Calculate average particle diameter by Screen analysis and evaluate the effectiveness of screening	5,6	U,A	1,2,3,4, 8,9,10	3
CO3	Analyse the fluid- solid and solid-solid separation processes	7,8	U, A	2,3,5,6,8,10	9
CO4	Calculate the area of thickener using Sedimentation principles.	9	U, A	1,2,3,8,10	18
CO5	Apply the principles of constant rate and const pressure filtration and calculate rate of filtration, cake resistance	10	U,A	1,2,3,8,10	9

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Verification of the various laws of crushing by using Jaw crusher.	6
2	Verification of various crushing laws using roll crusher.	3
3	Determination of angle of nip in roll crusher.	3
4	Determination of critical speed & energy consumed in size reduction using ball mill / rod mill.	6
5	Perform screen analysis for determination of average size, Specific surface area, Particle population for the given sample	6
6	Determination of effectiveness of screening in separating the given material by use of Vibrating screens.	3
7	Verification of Stoke's law by settling a particle in a liquid column	3
8	Perform froth flotation experiment to separate a mixture of coal into two fractions.	6
9	Perform batch Sedimentation experiment to calculate the thickener area required using Kynch formula	6
10	Determination of the resistance offered by filter cake & filter medium under constant pressure & Constant rate of filtration in filtration operation by plate & frame type of filter press.	3

Conduction of experiments: Lecture 1 period + Experiment 2 periods.

Student must conduct experiment individually under the supervision of the staff-in-charge.

Specific Learning Outcomes

Upon completion of the course, the student will have ability to

1. Demonstrate and operate the size reduction equipments
2. Identify the different solid- solid separation processes
3. Demonstrate and operate filters
4. Infer the crushing laws, stoke's law and batch sedimentation
5. Illustrate solid fluid separation techniques
6. Determine the average size of mixture of particles
7. Evaluate the energy requirement in size reduction

Suggested Student Activities

Carry out separation processes other than mentioned in lab and submit a report
Identify and list at least 10 equipments/devices which are used for size separation, and fluid – solid separation. Also state their principles
At least one visit to any chemical industry where various mechanical operations are carried out can be shown to students and prepare a report
Carry out sieve analysis using different standard screens
Group discussion & Quiz

Reference :

1. Unit Operations of Chemical Engineering, McCabe and W.L Smith V Edn., McGraw Hill.
2. Introduction to Chemical Engineering by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
3. Perry's Chemical Engineers' Handbook, McGraw Hill .
4. Unit Operations – I by K.A Gavhane.
5. Particle Technology and Separation Processes, Coulson J.M. and Richardson

Suggested E-Learning references

- 1 <http://nptel.ac.in>
- 2 www.flowmaster.com
- 3 www.vlab.co.in
- 4 Pipeflow.co.uk

Evaluation Pattern:

I	Continuous Internal Examination:	60 Marks
	Mid Sem - I - 20 marks	
	Mid Sem– II: 20 Marks	
	Internal assessment: 20 marks	
II	Semester End Examination :	40 Marks

Scheme of Valuation for MID I & II		
Sl. No.	Particulars	Marks
1	Identification of apparatus/equipment/chemical compounds/tools/etc.	2
2	Writing Procedure	5
3	Conducting of experiment	4
4	Observation and Results	6
5	Viva-voice	3
Total		20

Course Content and Blue Print of Marks for SEE

Unit No	Unit name	Hours/Periods	Questions for SEE			Marks weightage	%Weightage
			Handling	Manipulation	Precision		
1.	Verification of the various laws of crushing by using Jaw crusher.	6	15	10	15	40	100
2.	Verification of various crushing laws using roll crusher.	3	15	10	15	40	100
3.	Determination of angle of nip in roll crusher.	3	15	10	15	40	100
4.	Determination of critical speed & energy consumed in size reduction using ball / rod mill.	6	15	10	15	40	100
5.	Perform screen analysis for determination of average size, Specific surface area, Particle population for the given sample	6	15	10	15	40	100
6.	Determination of effectiveness of screening in separating the given material by use of Vibrating screens.	3	15	10	15	40	100
7.	Verification of Stoke's law by settling a particle in a liquid column	3	15	10	15	40	100
8.	Perform froth flotation experiment to separate a mixture of coal into two fractions.	6	15	10	15	40	100
9	Perform batch Sedimentation experiment to calculate the thickener area required using	6	15	10	15	40	100

	Kynch formula						
10	Determination of the resistance offered by filter cake & filter medium under constant pressure & Constant rate of filtration by plate & frame type of filter press.	3	15	10	15	40	100
	Total	45					

State Board of Technical Education and Training, Telangana

Semester End Examination Model Question paper

DCHE IV Semester practical Examination

Corse Code: 18CH-407P

Duration:3 hours

Course Name: Mechanical Operations Lab Practice

Max.Marks:40

Instructions to the Candidate:

(i) Answer any One of the following Questions.

(ii)Record the results on a graph sheet if required , and conclude your observation of the experiment

(iii) Draw the diagram for illustration ,choose appropriate values when not mentioned in the question

1. Verify the various laws of crushing by using Jaw crusher.
2. Verify the various crushing laws using roll crusher.
3. Determine the angle of nip in roll crusher.
4. Determine the critical speed & energy consumed in size reduction using ball mill / rod mill.
5. Perform screen analysis and determine average size, Specific surface area, Particle population for the given sample.
6. Determine the effectiveness of screening in separating the given material by use of vibrating screens.
7. Perform froth flotation experiment to separate a mixture of coal into two fractions.
8. Verification of Stoke's law by settling a particle in a liquid column
9. Perform batch Sedimentation experiment to calculate the thickener area required using Kynch formula.

10. Determine the resistance offered by filter cake & filter medium under constant pressure & constant rate of filtration by Plate & frame type of filter press.

HEAT TRANSFER LAB PRACTICE

Course Title:	Heat Transfer Lab Practice	Course Code	18CH 408P
Semester	IV	Course Group	Core
Teaching Scheme in Periods(L: T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact Hours:	45Pds
CIE	60 Marks	SEE	40 Marks

PRE-REQUISITE

Basic Knowledge of Physics and Heat transfer

COURSE OUTCOMES

Students who had completed the course will be able to

	Course outcome	Linked Exercise	CL (R/U/A)	Linked PO	Teaching periods
CO1	Evaluate the rate of heat flow in composite walls	1	U,A	2,3,8,9,10	6
CO2	Apply the principles of conduction to determine of thermal conductivity of material	2	U,A	1,2,3,8,9,10	3
CO3	Estimate heat transfer coefficient in natural and forced convections	3,4	U, A	2,3,8,9,10	9
CO4	Appreciate the mechanism of heat transfer in Double pipe heat exchanger and in Shell & tube heat exchanger.	5,6,7,8	U, A	1,2,3,4,6,8,10	18
CO5	Apply the principles of radiation to determine the emissivity of test plate and Steafan- Boltzmann's constant	9,10	U,A	1,2,3,8,9,10	9

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Verification of the fourier's law of heat conduction through composite walls.	6
2	Verification of the fourier's law of heat conduction and determination of thermal conductivity of metal bar.	3
3	Determination of the heat transfer co-efficient for natural convection of air.	6
4	Determination of the heat transfer co-efficient for forced convection of air.	3
5	Determination of the overall heat transfer co-efficient in a double pipe heat exchanger for parallel flow.	6
6	Determination of overall heat transfer co-efficient in a double pipe heat exchanger for Counter flow	3
7	Determination of the overall heat transfer co-efficient in a Shell and tube heat exchanger for Parallel flow	6
8	Determination of the overall heat transfer co-efficient in a Shell and tube heat exchanger for counter flow.	3
9	Determination of emmisivity of a test plate	6
10	Determination of Steafan- Boltzmann's constant	3

Specific Learning Outcomes

Upon completion of the course, the student will have ability to

1. Distinguish natural and forced convection
2. Identify different heat transfer equipments
3. Determine the heat transfer coefficient in double pipe heat exchanger and shell and tube heat exchanger
4. Apply the knowledge of principle for determination of emissivity
5. Analyse different flow patterns in heat exchangers
6. Demonstrate different types of heat exchangers

Suggested Student Activities

Collect/ download product catalogues with specification of various types of energy conservation equipment/ devices and heat exchanger of recent trends.
Identify and list at least 10 equipments/devices which require heat transfer and prevention of heat transfer. Also state mode of heat transfer and methods used to prevent heat transfer.
At least one visit of any power plant/ industry where various items like air compressor, heat exchanger, cooling tower, condenser etc. can be shown to students.
Group discussion & Quiz

Reference :

1. Unit Operations of Chemical Engineering, McCabe and W.L Smith V Edn., McGraw Hill.
2. Introduction to Chemical Engg by Walter L.Badger & Julius T.Banchero. Mc GRAW Hill Publication.
3. Process Heat Transfer by Donald Q. Kern, Mc GRAW Hill Publication.
4. Coulson and Richardson's Chemical Engineering.
5. Perry's Chemical Engineers' Handbook, McGrawHill .
6. Unit Operations – II by K.A Gahvane.

Suggested E-Learning references

- 1 <http://nptel.ac.in>
- 2 [www.flow master.com](http://www.flowmaster.com)
- 3 www.vlab.co.in

Course Content and Blue Print of Marks for SEE

Unit No	Unit name	Hours / Periods	Questions for SEE			Marks weightage	%Weightage
			Handling	Manipulation	Precision		
1.	Verification of fourier's law of heat conduction through composite walls.	6	15	10	15	40	100
2.	Verification of fourier's law of heat conduction and determination of thermal conductivity of metal bar.	3	15	10	15	40	100
3.	Determination of heat transfer coefficient for natural convection of air.	6	15	10	15	40	100
4.	Determination of heat transfer co-efficient for forced convection of air.	3	15	10	15	40	100
5.	Determination of overall heat transfer co-efficient in a double pipe heat exchanger for parallel flow.	6	15	10	15	40	100
6.	Determination of overall heat transfer co-efficient in a double pipe heat exchanger for Counter flow	3	15	10	15	40	100
7.	Determination of overall heat transfer co-efficient in a Shell and tube heat exchanger for Parallel flow	6	15	10	15	40	100
8.	Determination of overall heat transfer co-efficient in a Shell and tube heat exchanger for counter flow.	3	15	10	15	40	100
9	Determination of emmisivity of a test plate	6	15	10	15	40	100
10	Determination of Steafan- Boltzmann's constant	3	15	10	15	40	100
	Total	45					

Evaluation Pattern:

I. Continuous Internal Examination:

60 Marks

Mid Sem - I - 20 marks

Mid Sem– II: 20 Marks

Internal assessment: 20 marks

II. Semester End Examination :**40 Marks**

Scheme of Valuation for MID I & II		
Sl. No.	Particulars	Marks
1	Identification of apparatus/equipment/chemical compounds/tools/etc.	2
2	Writing Procedure	5
3	Conducting of experiment	4
4	Observation and Results	6
5	Viva-voice	3
Total		20

State Board of Technical Education and Training, Telangana**Semester End Examination Model Question paper****DCHE IV Semester practical Examination****Corse Code: 18CH-408P****Duration:3 hours****Course Name: Heat Transfer Lab Practice****Max.Marks:40**

Instructions to the Candidate:

(i) Answer any One of the following Questions.

(ii) Record the results on a graph sheet if required , and conclude your observation of the experiment

(iii) Draw the diagram for illustration ,choose appropriate values when not mentioned in the question

1. Verify the fourier's law of heat conduction through composite walls.
2. Determine the heat transfer co-efficient for natural convection of air.
3. Determine the heat transfer co-efficient for forced convection of air.
4. Determine the overall heat transfer co-efficient in a double pipe heat exchanger for counter flow.
5. Determine the overall heat transfer co-efficient in a double pipe heat exchanger for parallel flow.
6. Determine the overall heat transfer co-efficient in a Shell and tube heat exchanger for counter flow.
7. Determine the overall heat transfer co-efficient in a Shell and tube heat exchanger for Parallel flow.
8. Determine the emissivity of a test plate.
9. Verify the fourier's law of heat conduction and determination of thermal conductivity of metal bar
10. Determine Steafan- Boltzmann's constant

CHEMICAL PLANT EQUIPMENT DRAWING

Course Title:	Chemical Plant Equipment Drawing	Course Code	18CH-409P
Semester	IV	Course Group	Core
Teaching Scheme in Periods(L: T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Drawing	Total Contact Hours:	45Pds
CIE	60 Marks	SEE	40 Marks

PRE-REQUISITE

Basic Knowledge of Engineering drawing and chemical engineering subjects

COURSE OBJECTIVE

Sketch Chemical engineering equipments, Process flow sheets and instrument symbols and plant layouts.

COURSE OUTCOMES

Students who had completed the course will be able to

CO1	Draw symbols for important Chemical engineering equipments
CO2	Sketch and demonstrate equipments like heat exchangers, evaporators, jaw crusher, and filters.
CO3	Sketch and demonstrate process flow sheets for manufacture of different chemicals
CO4	Sketch, demonstrate and analyse Process instrumentation diagrams of equipments using different instrumentation symbols
CO5	Sketch and demonstrate equipment layouts and project layouts of different chemical engineering plants

COURSE CONTENTS

1.0 Drawing of symbols of Chemical Engineering equipment Duration :06 periods

Drawing of symbols for heat transfer equipment ; heat exchanger, water cooler, Steam Heater, Reboiler and Condenser; Drawing of symbols for pumps ,compressors and boiler; agitator, jacketed kettle, absorber, stripper, fractionating column, pipe lines and flow meters.

Drawing of symbols for instruments such as flow measurement, temperature, pressure and level.

2.0 Drawings of various Chemical Engineering equipment Duration : 12 periods

Draw neat sketches of 1-1 and 2-4 Shell & tube heat exchanger; Short tube vertical evaporator and Long tube forced circulation evaporator ; Rotary drum vacuum filter; Bubble cap plate; Jaw crusher; Plate & Frame filter press, Distillation column.

**3.0 Process block diagrams/utility diagrams / flow diagrams using process description
Duration : 09 periods**

Production of glacial acetic acid using acetaldehyde solution, Para-nitro aniline from Para- nitrochloro benzene, Production of acetylene from Iso- propanol, Conversion of ethanol to alcohol by Azeotropic distillation, Manufacture of a fertilizer/ a petrochemical product.

**4.0 Process instrumentation diagram of equipments using different instrumentation symbols
Duration : 12 periods**

Reactor temperature control; Hot fluid temperature control in heat exchanger; Spray drier temperature control; Forced circulation evaporator control with vertical heat exchanger; Control of mechanically agitated vessel used for gas absorption; Distillation column tower pressure control ; Distillation column control of level and reflux condenser with pumped reflux column ; Steam flow rate and level control of re-boiler and cooler temperature control

5.0 Process equipment layout and Project layout Duration : 06 periods

Equipment layout in Ammonia plant; water treatment plant; sugar manufacturing unit; Paper industry and cement plant
Drawing of project layout for phosphoric acid, urea plant in fertilizer Industry
Drawing of project layout of petroleum refinery consisting various units like CDU, FCCU, utilities etc.

Specific Learning Outcomes

1.0 Drawing of symbols:

Draw the symbols for heat transfer equipment ; heat exchanger, water cooler, Steam Heater, Reboiler and Condenser, pumps, compressors and boiler.

Draw symbols for agitator, jacketed kettle, absorbers, stripper, fractionating column, pipe lines and flow meters.

Draw symbols for instruments used for flow measurement, temperature, pressure and level

2.0 Drawings of various Chemical Engg equipment

Draw neat sketches of important chemical engineering equipment and demonstrate their working principles and construction.

3.0 Process block diagrams/ utility diagrams / flow diagrams using process description

Construct and explain the process flow sheet for Production of important chemicals and analyze the Process flow diagrams and utility diagrams

4.0 Process instrumentation diagram of equipments using different Instrumentation symbols

Demonstrate, draw and analyse the instrumentation diagrams with instrument symbols for Reactor temperature control, Cooler temperature control, Hot fluid temperature control in heat exchanger, Spray drier temperature control, Vaporizer temperature control, Forced circulation evaporator control with vertical heat exchanger, Distillation column tower pressure control Distillation column control of level and reflux condenser with pumped reflux, Steam flow rate and level control of re-boiler.

5.0 Process equipment layout and project layout

Draw, demonstrate and analyse the Equipment layouts in Ammonia plant, water treatment plant Sugar manufacturing unit, Paper industry and cement plant

Draw the diagram of project layout and identify location for the proposed plant and various factors to be considered.

Suggested Student Activities

- 1 Drawing of equipments other than prescribed in syllabus
- 2 Drawing and analysing the instrumentation diagrams
- 3 Group discussion & Quiz
- 4 Constructing process flow sheets for chemicals other than prescribed in syllabus

Course Outcome		Cognizant Level	Linked Program Objectives (PO)
CO1	Draw symbols for important chemical Engg equipments	R	1, 2, 4, 9
CO2	Sketch and demonstrate equipments like heat exchangers, evaporators, jaw crusher, and filters.	R / U	1, 2, 3, 4, 8, 9, 10
CO3	Sketch and demonstrate process flow sheets for manufacture of different chemicals	R / U/A	1, 2, 3, 4, 9, 10
CO4	Sketch, demonstrate and analyse Process instrumentation diagrams of equipments using different instrumentation symbols	R / U / A	1, 2, 3, 4,5, 9, 10
CO5	Sketch and demonstrate equipment layouts and project layouts of different chemical Engg plants	R / U / A	1, 2, 3, 4, 5,6, 10

Reference Books:

1. Unit Operations of Chemical Engineering, McCabe and W.L Smith V Edn., McGraw Hill.
2. Introduction to Chemical Engineering, Badger, W.L. and Banchero J.T, 3rd Edition, McGraw Hill
3. Plant design drawing by vibrant & Dryden, Mc Graw Hill publications
4. Chemical Engineering drawing by KA Ghavane, Nirali publications
5. Chemical Engineering drawing by R.S.Hiremath. Nirali Publications.
- 6 . Perry's Chemical Engineers' Handbook, McGraw Hill

Suggested E-Learning references

- 1 <http://nptel.ac.in>
- 2 [www.flow master.com](http://www.flowmaster.com)
- 3 www.vlab.co.in
- 4 Pipeflow.co.uk

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE IV semester, Mid Semester-I Examination

18CH-409P – Chemical Plant Equipment Drawing

TIME: 1 HOUR

MAXIMUM MARKS: 20

P A R T – A

2 x 4 = 8

Instructions : 1). Answer any two questions.

2). Each question carries *four* marks.

1. Draw the symbols for heat exchanger and water cooler.
2. Draw symbols for agitator and absorber.
3. Draw symbols for instruments for temperature, pressure measurement.

P A R T – B

1 x 2 = 12

Instructions : 1). Answer any one of the following questions.

2). Each question carries *twelve* marks.

4. Draw a neat line sketch of 2-4 Shell and tube heat exchanger and name the parts.
5. Draw a sketch of Standard vertical tube evaporator indicating all the parts with specified dimensions.

**State
Board of Technical
Education and
Training, Telangana**

**Model Question
paper**

**DCHE IV semester,
Mid Semester-II
Examination**

**18CH-409P –
Chemical Plant
Equipment Drawing**

TIME: 1 HOUR

MAXIMUM

MARKS: 20

P A R T – A

2 x 4 = 8

Instructions : 1).
Answer any two
questions.

2).

Each question carries
four marks.

1. Draw the
instrumentation
diagram for Hot
fluid Temperature
control in Heat
Exchanger
2. Draw the
instrumentation
diagram for
cooler
temperature
control.

Advanced Communication Skills and Life Skills

Course Title	Advanced Communication Skills and Life Skills	Course Code	18 Common 410 P
Semester	IV	Course Group	Foundation
Teaching Scheme in Periods- L:T:P	15:0:30	Credits	1.5
Methodology	Lecture + Practical	Total Contact Hours	45 Periods (3 Periods per Week)
CIE	60 Marks	SEE	40 Marks

Rationale:

This course is designed to impart writing skills and employability skills to the students of diploma which will help them in obtaining and maintaining the employment.

Prerequisites:

This course requires the basic knowledge of vocabulary, grammar and four language learning skills, viz. Listening, Speaking, Reading and Writing.

Course Outcomes:

Modules	At the end of the course the students will have the ability to:
Presentation Skills	Prepare a presentation. Use presentation aids effectively. Develop public speaking skills. Learn to make PowerPoint Presentations effectively. Present a Paper using appropriate body language.
Writing Reports	Learn kinds of reports. Learn the format of a report. Organise ideas. Develop essential vocabulary useful to write scientific and technical reports.
Interview Skills	Learn the techniques to face an interview. Learn the etiquette to communicate with employers. Learn the dos and don'ts of an interview. Learn the frequently asked questions in interviews. Use appropriate body language. Learn to face interviews telephonically. Gain the confidence to face an interview by attending mock interview.
Group Discussion	Learn the dos and don'ts of a Group Discussion. Participate in a Group Discussion in a healthy manner. Use effective non-verbal communication. Use appropriate phrases and expressions useful in a group discussion.

Workplace Awareness	Learn workplace etiquette. Identify the knowledge, skills and attributes useful at workplace. Build strong workplace relationships. Learn professional ethics. Understand gender equality at the workplace Develop a sense of responsibility towards the society.
Writing Skills Useful at Workplace	Learn various writing formats useful at workplace. Develop an ability to apply technical information in documentation. Revise and edit written documents effectively. Develop corresponding skills - learn the kinds of business letters - the format of a business letter. Learn effective e-mail writing skills. Learn Business Memos. Learn Notes and Narratives. Learn Forms and Applications. Prepare templates for different purposes. Prepare an agenda of a meeting. Prepare the minutes of a meeting. Prepare Notices / Circulars for various purposes. Prepare Press release.

CO-PO Matrix

	Course Outcome		Linked PO
CO 1	Making effective presentations	R/U/A	1, 2, 3,4, 5,6,7,8,9,10
CO 2	Writing scientific and technical reports	R/U/A	1,2,3,4, 5,6,7,8,9,10
CO 3	Learn to face oral and telephonic interviews	R/U/A	1,2,3,4, 7,9,
CO 4	Learn to face group discussion	R/U/A	1,2,3,7,8,9
CO 5	Learn to write various formats useful at workplace	R/U/A	1,2,3,5,7,8,9,10
CO6	Learn workplace etiquette and ethics	R/U/A	1,2,3,7,8,9,10

Course Contents:

I	Presentation Skills	Duration: 6 periods
II	Writing Reports	Duration: 9 periods
III	Interview Skills	Duration: 9 periods
IV	Group Discussion	Duration: 6 periods
V	Workplace Awareness	Duration: 6 periods
VI	Writing Skills Useful at Workplace	Duration: 9 periods

Suggested Student Activities:

- Paper Presentations
- Seminars
- Mock Interviews
- Telephonic Interviews
- Group Discussions
- Role Plays
- Creating advertisements
- Five-minute activities
- Creating a model of workplace

Evaluation Pattern:

I. Continuous Internal Examination: 60 Marks

- | | |
|--------------------------------|----------|
| a. Mid Sem - I | 20 marks |
| Syllabus: | |
| i. Presentation Skills | |
| ii. Writing Reports | |
| b. Mid – II: | 20 Marks |
| Syllabus: | |
| i. Interview Skills | |
| ii. Group Discussion | |
| c. Internal assessment: | 20 marks |
| i. Seminars: | 10 marks |
| ii. Assignments: | 5 marks |
| iii. Lab record submission: | 5 marks |

II. Semester End Examination : 40 Marks

- | | |
|---|----------|
| a. Write an essay on a given topic or participate in an activity: | 15 Marks |
| b. Interview or Group Discussion: | 15 Marks |
| c. <i>Viva Voce</i> | 10 marks |

References:

Adair, John. *Effective Communication*. London: Pan Macmillan Ltd., 2003.
Ajmani, J. C. *Good English: Getting it Right*. New Delhi: Rupa Publications, 2012.
Amos, Julie-Ann. *Handling Tough Job Interviews*. Mumbai: Jaico Publishing, 2004.
Collins, Patrick. *Speak with Power and Confidence*. New York: Sterling, 2009.
Fensterheim, Herbert and Jean Baer. *Don't Say Yes When You Want To Say No*. New York: D Raman, Meenakshi & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Second Edition. New Delhi: Oxford University Press, 2011

E-Learning Resources:

<http://www.dailywritingtips.com/>
<http://www.englishdaily626.com/c-errors.php>
<http://www.owl.net.rice.edu/~cainproj/>
<http://www.thehumorsource.com/>
<http://www.indiabix.com/group-discussion/topics-with-answers/>
<http://networketiquette.net/>
<https://public.wsu.edu/~brians/errors>
<http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/15>

BOARD DIPLOMA EXAMINATION (C-18)
FOURTH SEMESTER COMMON-410P
ADVANCED COMMUNICATION SKILLS AND LIFE SKILLS
MID SEM - I

Time : 1 Hour

Total Marks: 20 Marks

Part – A

10 marks

Instruction: Answer any one of the following questions.

- 1 Write the guidelines for preparing a PowerPoint presentation.
- 2 How do you prepare yourself for presenting a technical paper?
- 3 Mention a few presentation aids and how do you use them effectively?

Part – B

10 marks

Instruction: Answer any one of the following questions.

- 4 Write the format of a report and describe it.
- 5 Write a report on the accident you have seen recently.
- 6 Give the outline of a project report and describe it.

BOARD DIPLOMA EXAMINATION (C-18)
FOURTH SEMESTER COMMON-410P
ADVANCED COMMUNICATION SKILLS AND LIFE SKILLS
MID SEM - II

Time : 1 Hour

Total Marks: 20 Marks

Part – A

10 marks

Instruction: Answer any one of the following questions.

1. What are the dos and don'ts for a formal interview?
2. What at least ten frequently asked questions in a formal interview?
3. How do you prepare for a telephonic interview?

Part – B**10 marks**

Instruction: Answer any one of the following questions.

4. What are the dos and don'ts of a group discussion?
5. Mention some phrases and expressions commonly used in a group discussion.
6. Write a short paragraph on the steps you take while participating in a group discussion.

BOARD DIPLOMA EXAMINATION (C-18)
FOURTH SEMESTER 18 COMMON-410P
ADVANCED COMMUNICATION SKILLS AND LIFE SKILLS
SEMESTER END EXAM

Time : 3 Hours**Total Marks: 40 Marks****Part – A****10 marks**

Instruction: Pick any one question from the given lot.

1. Prepare the outline of a project report and describe it.
2. Write the guidelines for preparing the slides of a PowerPoint presentation.
3. Write the minutes of the meeting conducted at the Principal's chamber to conduct the annual day celebrations. Prepare the agenda of the annual day celebrations.
4. Describe the workplace etiquette.
5. Prepare a press note for the '*Job Mela*' which is going to be conducted at your institute.

Part – B**15 marks**

6. Interview / Group Discussion

Part – C**15 marks**

7. *Viva Voce*

SKILL UPGRADATION ACTIVITIES

Course Title :	Skill Upgradation	Course Code	
Semester	IV	Course Group	Practical
Teaching Scheme in Hrs(L:T:P)	0:0:105	Credits	2.5
Methodology	PRACTICALS	Total Contact Hours :	105 Pds

- 1 Prepare a model of Size reduction equipments and size separation equipment and write a report.
- 2 Write a report about filters and conveyors other than mentioned in the syllabus.
- 3 Write a report on different Standard sieves available in the market with their size ranges.
- 4 Prepare a study report on separation of fine particles from fluids by methods other than that mentioned in the syllabus content
- 5 Each student should visit library to refer to manual/Journals of Chemical Engg
- 6 Prepare a report with illustrations of the equipment on water treatment by visiting a nearby municipal water treatment plant.
- 7 Write a report about manufacture of paints, pigments and varnishes other than mentioned in the syllabus.
- 8 Write a report on the advantages and disadvantages of nitrogenous fertilizers. and can they be replaced by organic fertilizers
9. Prepare a study report on recovery of CO₂ from various sources.
10. Prepare models / charts for any manufacturing process.
11. Each student will give an activity to prepare a tabulated summary for types of evaporators which is available in the market.
12. List out any five heat exchangers devices available in market with its specifications and current market price.
13. Prepare a report on diffusion mass transfer, humidifying and dehumidifying equipments.
14. Write a report on vapour liquid equilibrium at constant temperature & pressure.

15. Prepare a study report on construction and working of various distillation towers.
16. Prepare a report on types of absorption columns, extraction equipments.
17. Write a report on leaching applications and search out suitable possible solvents for each application.
18. Write a report on extraction of vegetable oils or synthetic detergents.
19. Each student will give an activity to prepare a tabulated summary of new exploration methods of crude petroleum which are in now practice
20. Write a summary of usage of petroleum and its products in various fields
21. Identify and list at least 10 equipments/devices which are used for size separation, and fluid – solid separation. Also state their principles
22. At least one visit of any chemical industry where various mechanical operations are carried out can be shown to students and prepare a report
23. Carry out sieve analysis using different standard screens
24. Collect/ download product catalogues with specification of various types of energy conservation equipment/ devices and heat exchanger of recent trends.
25. Identify and list at least 10 equipments/devices which require heat transfer. Also state mode of heat transfer and methods used to prevent heat loss.
26. At least one visit of any power plant/ industry where various items like air compressor, heat exchanger, cooling tower, condenser etc. can be shown to students.
27. Seminars related subject topics, environment and sustainability.
28. Group discussions on various topics
29. Quiz
30. Paper and Poster Presentation

SKILL UPGRADATION IN - ADVANCED ENGINEERING MATHEMATICS

ACTIVITY ASSESSMENT Steps

- 1 Mathematical concepts**
- 2 Procedure**
- 3 Explanation**
- 4 Working with others**
- 5 Mathematical errors**

ACTIVITIES

1. List out the methods to find complimentary function and explain to solve a homogeneous Linear Differential equations.
2. List out the methods to find Particular integrals and explain the solution of Non-homogeneous Linear Differential equations.
3. Write short notes on expansion of simple functions as a Fourier series.
- 4 . Prepare a presentation on Laplace Transforms of simple functions.
- 5 . Prepare a presentation on Inverse Laplace Transforms of simple functions.
6. List out different applications of Laplace Transforms.
7. Solve the Differential equation by applying Laplace Transformations.

CO / PO - MAPPING OF ACTIVITIES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1			1	3	2	3
CO2	3	2	2	1			1	3	2	3
CO3	3	2	2	1			1	3	2	3
CO4	3	2	2	1			1	3	2	3
CO5	3	2	2	1			1	3	2	3
CO6	3	2	2	1			1	3	2	3
CO7	3	2	2	1			1	3	2	3

Rubrics for Activity assessment

CATEGORY	4	3	2	1
Mathematical Concepts	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
Procedures	Typically, uses an efficient and effective procedure to solve the problem(s).	Typically, uses an effective procedure to solve the problem(s).	Sometimes uses an effective procedure to solve problems, but does not do it consistently.	Rarely uses an effective procedure to solve problems.
Explanation	Explanation is detailed and clear.	Explanation is clear.	Explanation is a little difficult to understand, but includes critical components.	Explanation is difficult to understand and is missing several components OR was not included.
Working with Others	Student was an engaged partner, listening to suggestions of others and working cooperatively throughout lesson.	Student was an engaged partner but had trouble listening to others and/or working cooperatively.	Student cooperated with others, but needed prompting to stay on-task.	Student did not work effectively with others.
Mathematical Errors	90-100% of the steps and solutions have no mathematical errors.	Almost all (85-89%) of the steps and solutions have no mathematical errors.	Most (75-84%) of the steps and solutions have no mathematical errors.	More than 75% of the steps and solutions have mathematical errors.

PASS SCORE: 2.5

STUDENT ASSESSMENT by RUBRICS

