CURRICULUM – 2018

(C-18)

DIPLOMA IN CHEMICAL ENGINEERING



STATE BOARD OF TECHNICAL EDUCATION & TRAINING

TELANGANA, HYDERABAD

III SEMESTER

TEACHING AND EXAMINATION SCHEME

Sl. No.	Course Code	Course Name	Teaching Scheme					Examination Scheme						
			Instruction periods per week			Total Periods per semester	Credits	Continuous internal evaluation			Semester end examination			
			L	T	P			Mid sem. I	Mid sem. II	Internal evaluation	Max. Marks	Min. Marks	Total marks	for passing including
1	18CH-301F	Applied Engg Mathematics	3	1	0	60	3	20	20	20	40	14	100	35
2	18CH-302C	Electrical Technology	3	1	0	60	3	20	20	20	40	14	100	35
3	18CH-303C	Fluid Mechanics	3	1	0	60	3	20	20	20	40	14	100	35
4	18CH-304C	Applied Chemistry	3	1	0	60	3	20	20	20	40	14	100	35
5	18CH-305C	Material and Energy balances	2	2	0	60	3	20	20	20	40	14	100	35
6	18CH-306P	General Chemical Technology Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
7	18CH-307P	Electrical Technology Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
8	18CH-308P	Fluid Mechanics Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
9	18CH-309P	Applied Chemistry Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
10	18CH-310P	Communication & Life skills Lab Practice	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			19	6	17	630	25	200	200	200	400	170	1000	425
Activities: student performance is to be assessed through Rubrics														

APPLIED ENGINEERING MATHEMATICS

Course Title **: APPLIED ENGINEERING MATHEMATICS**	Course Code **: 18COMMON301F**
SEMESTER : **III**	Course Group **: Foundation**
Teaching Scheme (L : T : P) : **36 :24 : 0 (** in Periods)	Credits : **3 Credits**
Type of Course : **Lecture + Assignments**	Total Contact Periods : **60**
CIE : 6**0 Marks**	SEE : **40 Marks**
Programmes : **Common to all Engineering Diploma Programmes**	

Pre requisites

This course requires the knowledge of Basic Engg. Mathematics and Engg. Mathematics at Diploma 1st and 2nd Semester level.

Course Outcomes: COs

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

CO 1	Integrate different kinds of functions
CO 2	Integrate functions using different methods
CO 3	Find the values of definite integrals.
CO 4	Solve simple problems of Areas, Volumes.
CO 5	Find the Mean and RMS values of various functions and Approximate values of Definite integrals using Trapezoidal and Simpson's 1/3rd rule
CO 6	Form the Differential Equation and Solve Simple DEs of 1st order and 1stdegree.

Course Content:

Unit-I **Duration: 10 Periods (L: 6.0 – T:4.0)**

Indefinite Integration-I

Integration regarded as anti-derivative – Indefinite integral of standard functions. Properties of indefinite integral. Integration by substitution or change of variable. Integrals of the form $\sin^m\theta . \cos^n\theta$. where m and n are positive integers. Integrals of tan x, cot x, sec x, cosec x and powers of tan x, sec x by substitution.

Evaluation of integrals which are reducible to the following forms:

$i)\ \frac{1}{a^2+x^2}, \frac{1}{a^2-x^2}, \frac{1}{x^2-a^2}$

$ii)\ \frac{1}{\sqrt{a^2+x^2}}, \frac{1}{\sqrt{a^2-x^2}}, \frac{1}{\sqrt{x^2-a^2}}$

$iii)\ \sqrt{x^2+a^2}, \sqrt{a^2-x^2}, \sqrt{x^2-a^2}$

Unit – II **Duration: 08 Periods (L: 4.8 – T:3.2)**

Indefinite Integration-II

Integration by decomposition of the integrand into simple rational algebraic functions. Integration by parts, Bernoulli's rule.

Unit-III **Duration: 06 Periods (L: 3.6 – T:2.4)**

Definite Integral and its Properties:

Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Definite integral as the limit of a sum.

Unit – IV **Duration: 10 Periods (L: 6.0 – T:4.0)**

Applications of Definite Integrals:

Areas under plane curves – Sign of the Area – Area enclosed between two curves. Solid of revolution – Volumes of solids of revolution.

Unit – V **Duration: 08 Periods (L: 4.8 – T:3.2)**

Mean, RMS values and Numerical Integration:

Mean values and Root Mean Square values of a function on a given interval.

Trapezoidal rule, Simpson's 1/3 rule to evaluate an approximate value of a definite integral.

Unit – VI **Duration: 18 Periods (L: 10.8 – T:7.2)**

Differential Equations of First Order:

Definition of a differential equation – order and degree of a differential equation – formation of differential equations – solution of differential equation of first order, first degree : variables -separable, homogeneous, exact, linear differential equation, Bernoulli's equation.

Reference Books:

1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan
2. Thomas' Calculus, Pearson Addison –Wesley Publishers

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 Use Indefinite Integration to solve engineering problems

1.1 Explain the concept of Indefinite integral as an anti-derivative.

1.2 State the indefinite integral of standard functions and properties of Integrals $\int$ (u + v) *dx* And $\int$ *ku dx* where k is constant and *u, v* are functions of *x.*

1.3 Solve integration problems involving standard functions using the above rules.

1.4 Evaluate integrals involving simple functions of the following type by the method of substitution.

i) $\int f(ax + b)\,dx$ *where* $f(x)\,dx$ is in standard form.

ii) $\int [f(x)]^n f'(x)\,dx$

iii) $\int f'(x)/[f(x)]\,dx$

iv) $\int f\{g(x)\}\,g'(x)\,dx$

1.5 Find the Integrals of *tan x, cot x, sec x* and *cosec x using*the above.

1.6 Evaluate the integrals of the form $\int Sin^m\theta Cos^n\theta.\,d\theta$ where m and n are positive integers.

1.7 Evaluate integrals of powers of *tan x* and *sec x*.

1.8 Evaluate the Standard Integrals of the functions of the type

$$i)\ \frac{1}{a^2+x^2}, \frac{1}{a^2-x^2}, \frac{1}{x^2-a^2}$$

$$ii)\ \frac{1}{\sqrt{a^2+x^2}}, \frac{1}{\sqrt{a^2-x^2}}, \frac{1}{\sqrt{x^2-a^2}}$$

$$iii)\ \sqrt{x^2+a^2}, \sqrt{a^2-x^2}, \sqrt{x^2-a^2}$$

1.9 Evaluate the integrals of the type

$$\int \frac{1}{a \pm bSin\theta} d\theta, \int \frac{1}{a \pm b\cos\theta} d\theta \text{ and } \int \frac{1}{a\cos\theta \pm b\sin\theta \pm c} d\theta$$.

Unit-II

2.0 Use Indefinite Integration to solve engineering problems

2.1 Evaluate integrals using decomposition method.

2.2 Evaluate integrals using integration by parts with examples.

2.3 State the Bernoulli's rule for evaluating the integrals of the form $\int u.vdx$.

2.4 Evaluate the integrals of the form $\int e^x [f(x) + f'(x)]\, dx$.

Unit-III

3.0 Understand definite integral and use it in engineering applications

3.1 State the fundamental theorem of integral calculus

3.2 Explain the concept of definite integral.

3.3 Calculate the definite integral over an interval.

3.4 State various properties of definite integrals.

3.5 Evaluate simple problems on definite integrals using the above properties.

3.6 Explain definite integral as a limit of sum by considering an area.

Unit –IV

4.0 Understand definite integral and use it in engineering applications

4.1 Find the Areas under plane curves and area enclosed between two curves using integration.

4.2 Obtain the Volumes of solids of revolution.

Unit –V

5.0 Understand Mean, RMS values and Numerical Methods

5.1 Obtain the Mean value and Root Mean Square (RMS) value of the functions in any given Interval.

5.2 Explain the Trapezoidal rule, Simpson's 1/3 rules for approximation of definite integrals andprovide some examples.

Unit –VI

6.0 Solve Differential Equations in engineering problems.

6.1 Define a Differential equation, its order and degree

6.2 Form a differential equation by eliminating arbitrary constants.

6.3 Solve the first order first degree differential equations by the following methods:

i. Variables Separable.

ii. Homogeneous Equations.

iii. Exact Differential Equations

iv. Linear differential equation of the form $dy/dx + Py = Q$,
where P and Q are functions of x or constants.

v. Bernoulli's Equation (Reducible to linear form.)

6.4 Solve simple problems leading to engineering applications by using above methods.

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapped POs
CO1	3	2	2	1			1			3	1,2,3,4,7,10
CO2	3	2	2	1			1			3	1,2,3,4,7,10
CO3	3	2	2	1			1			3	1,2,3,4,7,10
CO4	3	2	2	1			1			3	1,2,3,4,7,10
CO5	3	2	2	1			1			3	1,2,3,4,7,10
CO6	3	2	2	1			1			3	1,2,3,4,7,10

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	

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					
3	III		2	10(a)	14(a)	
4	IV					
5	V		3 — 5, 6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	
6	VI		3 — 7,8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)	
Total Questions		8		8	8	

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

III SEMESTER

SKILL UPGRADATION IN - APPLIED ENGINEERING MATHEMATICS

ACTIVITY ASSESSMENT Steps

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

ACTIVITIES

1 .Write a short notes on different types of integrals.

2. Prepare a notes on different methods to evaluate integrals.

3. List out Properties of definite integrals.

4. List out and explain various applications of definite integrals.

5. Explain the procedure to solve problems on Areas using integration

6. Explain the procedure to find volumes of irregular shapes of solids of revolution using integration.

7. Prepare a presentation to find Mean values and R.M.S values of any given function.

8. Explain the procedure to calculate approximate area by using Trapezoidal rule.

9. Explain the procedure to calculate approximate area by Simpson's 1/3 rule

10. Prepare a presentation on solving 1^{st} order differential equations using any suitable method.

CO / PO - MAPPING OF ACTIVITIES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1			1	2	2	3
CO2	3	2	2	1			1	2	2	3
CO3	3	2	2	1			1	2	2	3
CO4	3	2	2	1			1	2	2	3
CO5	3	2	2	1			1	2	2	3
CO6	3	2	2	1			1	2	2	3
CO7	3	2	2	1			1	2	2	3
CO8	3	2	2	1			1	2	2	3
CO9	3	2	2	1			1	2	2	3
CO10	3	2	2	1			1	2	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

S.NO	PIN	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7	CO 8	CO 9	CO 10	AVERAGE

Code: C18-Common-301F

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

BOARD DIPLOMA EXAMINATIONS

MID SEM –I, MODEL PAPER, III SEMESTER

APPLIED ENGINEERING MATHEMATICS

TIME: 1: 00 Hour Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions 04 X 01 = 04

2 Each question carries **ONE** mark

1. Integrate: $e^x - \sin x + x^4$
2. Find : $\int \frac{dx}{5x+7}$ dx
3. Write Bernoulli's rule of integration
4. Find : $\int x \log x \, dx$

PART-B

Instructions: 1. Answer any **TWO** questions 02 X 03 = 06

2. Each question carries **THREE** marks

5 a). Evaluate : $\int \frac{x^5}{1+x^{12}} dx$.

Or

5 b) Evaluate : $\int \frac{dx}{(x^{2+}25)}$

6 a). Evaluate : $\int x \, sinx dx$

Or

6 b).Evaluate : $\int \frac{3x+2}{(x-1)(2x+3)} dx$.

PART C

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

2. Each question carries **FIVE** marks

7 a). Evaluate $\int \sqrt{x^2 + 2x + 5}\, dx$

Or

7 b) Evaluate : $\int cosx\, cos2x dx$.

8 a). Find $\int xTan^{-1}x dx$.

Or

8 b) Find $\int x^4 Cos2x dx$.

@@@

Code: C18-Common-301F

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TELANGANA

BOARD DIPLOMA EXAMINATIONS

MID SEM –II, MODEL PAPER, III SEMESTER

APPLIED ENGINEERING MATHEMATICS

TIME: 1: 00 Hour Max. Marks: 20

PART-A

Instructions: 1. Answer **ALL** questions 04 X 01 = 04

2 Each question carries **ONE** mark

1. Integrate : $\int_0^1 (x^4 + 1)\, dx$
2. Evaluate : $\int_0^{\pi} Sin3x dx$
3. Evaluate : $\int_0^1 \frac{1}{1+x^2} dx$
4. Write the formula to find area bounded by the curve y= f(x) , x-axis, between the limits x=a and x =b

PART-B

Instructions: 1. Answer any **TWO** questions 02 X 03 = 06

2. Each question carries **THREE** marks

Find the Mean value of the function y = logx on [1 , e]

5 a) Evaluate: $\int_0^{\frac{\pi}{2}} \sqrt{1 - Sin2x} dx$

Or

5 b) Evaluate : $\int_0^{\frac{\pi}{2}} sin^2 x dx$

6 a). Find the area bounded by the line 2x + y =8, x-axis and the lines x = 2 and x = 4.

Or

6 b). Find the Volume of the Solid generated by revolving the part of the Circle $x^2 + y^2 = 36$ From x = 0 to x = 4 about x – axis.

PART C

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

2. Each question carries **FIVE** marks

7 a). Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\sqrt{Sinx}}{\sqrt{Sinx}+\sqrt{Cosx}}\,dx$

Or

7 b). Evaluate : $\int_0^{\frac{\pi}{2}} \log sin\, x dx$

8 a) Find the area enclosed between the Parabolas $y = 3x - x^2 and y = x^2 - x$.

Or

8 b). Find the Volume of the Solid generated by the revolution of the area bounded by the Ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, about x- axis.

@@@

C18-common
SUB.CODE:301F

BOARD DIPLOMA EXAMINATION,(C-18)

MODEL PAPER

III SEMESTER EXAMINATION

APPLIED 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. Integrate: $x^7 - 3/x$

2. Evaluate: $\int_0^1 (x^2 + 1)$ dx

3. Write the formula to find mean value of y = f(x), in the interval (a, b)

4. Find the Order and Degree of the Differential Equation $x\frac{dy}{dx} = \sqrt{1 + \left(\frac{dy}{dx}\right)^2}$.

5 Write Trapezoidal Rule to find the approximate value of $\int_a^b f(x)dx$.

6. Write the formula to find RMS value of y = f(x) over the range x=a and x = b.

7. Solve: $\frac{dy}{dx} = e^{2x+y}$

8. Write the condition for exactness of the differential equation M(x,y)dx + N(x,y)dy =0

PART-B

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

2. Each question carries **THREE** marks

9 a). Evaluate: $\int_0^{\frac{\pi}{2}} \sqrt{1 - Sin2x}dx$

Or

9 b) Find the approximate value of $\int_0^6 \frac{dx}{1+x}$ by taking n = 6 using Trapezoidal rule.

10 a) Find the area bounded by the Parabola $y = x^2 - 2x + 1$ and x-axis.

Or

10 b) Form the Differential Equation from $y = Ae^x + Be^{3x}$ where A, B are arbitrary

Constants.

11 a) Find the RMS value of $\sqrt{\log x}$ over the range x= 1 and x= e

Or

11 b) Calculate approximate value of $\int_0^4 \frac{dx}{1+x}$ by taking n= 4 using Simpson's 1/3 rule

12 a) Solve: $x\frac{dy}{dx} + 2y = logx$.

Or

12 b) Solve: $x(1-y^2)dx + y(1-x^2)dy = 0$

PART C

Instructions: 1. Answer any **FOUR** questions 04 X 05 = 20

2. Each question carries **FIVE** marks

13 a) Evaluate: $\int \frac{1}{x^2+2x+2}$ dx

Or

13 b) Find the RMS value of y = $\sqrt{8-4x^2}$ between x = 0 and x = 2

14 a) Find the volume of solid generated by revolving the Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about Major axis

Or

14 b) Solve: $\frac{dy}{dx} = Sin(x+y)$

15 a) A curve is drawn to passing through the points given by the following table:

x	1	1.5	2	2.5	3	3.5	4
y	3	3.4	3.7	3.8	2.7	2.6	2.1

Calculate the approximate area bounded by the curve , x-axis and the lines x= 1 and x= 4 using Simpson's 1/3 rule

Or

15 b) Evaluate: $\int_0^1 \sqrt{(1-x^2)}dx$ approximately by taking n = 4 using Simpson's 1/3 rd Rule.

16 a) Solve : $(y^2 - xy)dx = x^2dy$.

Or

16 b) . Solve: $\frac{dy}{dx} + yCosx = y^3$Sin2x.

@@@

Electrical Technology

Course title:	**Electrical Technology**	Course Code:	**18CH-302C**
Semester:	**III**	Course group:	**Elective**
Teaching scheme in Hrs. (LTP):	**36:24:0**	Credits:	**3**
Type of course:	**Lecturer+ Assignment:**	Total contact Hrs. :	**50 Hrs./60 periods**
CIE:	**60 Marks**	SEE:	**40 Marks**

Prerequisites: Basic knowledge of Electricity, Physics and Mathematics

Course Outcomes COs

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

CO1: Solve D.C. circuits and Choose proper measuring instruments depending on the purpose and safety procedures of electricity

CO2: Relate the concepts of Electromagnetism to explain the concepts of Induced E.M.F.

CO3: Correlate the induced E.M.F. concepts to explain the construction and working of D.C.machines

CO4: Summarize the characteristics of A.C waveforms, interpret and solve their effects in 1-phase and 3-phase circuits.

CO5: Correlate the induced E.M.F. concepts to explain the construction and working of A.C.machines

COURSE CONTENTS

Unit 1.0 D.C. circuits and Measuring instruments and safety procedures

Duration: 10 periods

1. Solutions of D.C. series, parallel circuits- Kirchoff's laws safety precautions to be adopted for prevention of electric shock to persons working on electrical equipments- procedures for first aid to a person came into contact with live wires

Unit 2.0 Measuring instruments Duration: 6 periods

Electrical Instruments- Construction and working of moving coil and moving iron instruments ammeter, voltmeter, Megger, multi meter and energy meter (single phase).applications

Unit 3.0 Electro Magnetism and Electromagnetic Induction Duration: 06 periods

Explain the terms-permeability,magnetic field strength,flux and flux density-Electro Magnetism –faraday's laws of electromagnetic induction-flemmings left hand rule – flemmings right hand rule-statically induced emf-dynamically induced emf- Electromagnetic induction - Self and Mutual inductances derivations and problems

Unit 4.0 D.C. machines Duration: 15 periods

D.C. generators – working & construction - types of generators - E.M.F. equation(no derivation)-- torque euiation(no derivation)-problems on emf and torque-applications of D.C generators.D.C. motors- working & construction - types of motors – applications - back E.M.F, torque equation - 3point starter - speed control of DC shunt motor by armature and field control methods

Unit 5.0 A.C. Circuits Duration: 08 periods

Single phase circuits – Sinusoidal E.M.F.- wave form - values of A.C. –relationships between voltage and current in (i) R,(ii)L (iii)C, (iv)R-L in series(v)R-C in series (vi)R-L-C in series- phase and phase difference, power factor, equation for power, different expressions for apparent and reactive power - 3 phases - star and delta connected systems - Balanced loads.

Unit 6.0 A.C. Machines Duration: 15 periods

Induction Motors, Classification – Constructional details & Principles of operation – Torque -slip – Startersdol starter-star delta starter, Types of Three phase & Single phase motors- Applications with respect to Metallurgical Industry.Transformers construction & working – EMF equiation of a transformer (no derivation)-Step up, Step down - single phase and 3-phase transformers - Auto transformer.

SPECIFIC LEARNING OBJECTIVES

On completion of this subject, the student should be able to

Unit – 1

1.0 Solve D.C. Series – parallel circuits

1.1 Calculate equivalent resistance of series – parallel circuits
1.2 To solve problems on series - parallel circuits
1.3 State and explain Kirchhoff's laws

1.4 state safety precautions to be adopted for prevention of electric shock to persons working on electrical equipments

1.5 state procedures for first aid to a person came into contact with live wires

Unit – 2

2.0know the use of measuring instruments

2.0

2.1 Explain the construction and working of moving coil and moving iron instruments

2.2 State the use of M.C. and M.I. Ammeter and Voltmeter

2.3 State the use of Megger, Multi meter and Energy meter in electrical measurements

Unit-3

3.0 Understand principles of Electro-Magnetism and Electromagnetic Induction

3.1 Explain the terms - Permeability, Field strength, Flux and Flux Density.

3.2 State flemmings left and right hand rules

3.3 State Faraday's Laws of Electro – Magnetic Induction

3.4 state statically induced emf and dynamically induced emf

3.5 state electromagnetic induction

3.6 State Lenz's Law

3.7 Explain self inducede.m.f and mutually induced e.m.f

3.8 State expression for self-inductance and mutual inductance (No derivation).

Unit – 4

4.0 Understand working of D.C. Machines

4.1 Explain working principle of D.C. generators

4.2 List the parts of D.C. generators and materials used

4.3 State functions of each part of D.C. generator.

4.4 State E.M.F equation(No derivation)

4.5 Solve formula substitution problems on E.M. F. equation.

4.6 Classify D.C. Generators and indicate current directions.

4.7 Explain principle of working of D.C. motors

4.8 Classify D.C. motors and indicate current directions.

4.9 State back E.M.F. (no derivation)

4.10 Write formula for speed of D.C. motor in terms of supply voltage current and flux.

4.11 State Torque equation (no derivation).

4.12 Explain necessity of starter.

4.13 Explain the working of 3-point starter.

4.14 Explain speed control of D.C. shunt motor by Armature control and Field control

4.15 State applications of D.C. motors

Unit – 5

5.0 Understand Single and Three phase systems

5.1 Define: waveform, cycle, time, period, frequency, instantaneous value, maximum value, average value and R.M.S. value.

5.2 state the relationships between voltage and current in(i) R,(ii)L (iii)C, (iv)R-L in series(v)R-C in series (vi)R-L-C in serie

5.3 State expression for average and R.M.S. values in terms of maximum value
5.4 Explain instantaneous value in terms of maximum value
5.5 Explain phase and phase difference (with graph only), and power factor
5.6 State equation for power in single-phase circuits.
5.7 State actual, apparent and reactive currents and powers
5.8 State phase and line voltage & currents and their relationships in star and delta connections
5.9 State the expression for power in a 3-phase circuit.
5.10 Work problems on balanced star and delta connected loads

Unit – 6

6.0 Explain the working of Induction Motors , Single and 3 phase Transformers

6.1 Describe the constructional details of an induction motor.
6.2 Explain the principle of operation of induction motors.
6.3 Define Torque and Slip in Induction motors.
6.4 Explain the methods of starting of induction motors.
6.5 Classify the Three Phase and Single Phase induction motors.
6.6 State the applications of induction motors.
6.7 Explain working principle of transformers.
6.8 Explain construction of a transformer.
6.9 Classify transformers based on types of core
6.10 State step up and step down transformers
6.11 State autotransformer and its uses
6.12 Comprehend the construction and working of 3 phase transformers

Suggested Student Activities

1. Visit nearbyIndustries to examine and interpret the use of Electrical machinery and equipment there.
2. Quiz
3. Group discussion
4. Surprise test
5. Seminars

Reference Books

1. Electrical Technology by B.L. Theraja
2. Advanced Electrical Technology by H. Cotton
3. Electrical Technology by Huges
4. Electrical technology by V.K. Mehta.
5. Electrical Engineering by M.S.Naidu&S.Kamakshiah

LIST OF LEARNING WEBSITES

1. **http://nptel.ac.in**
2. **https://ocw.mit.edu/courses/materials-science-and-engineering**
3. **http://khansacademy.org**

	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			

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			Q7,Q8	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 III semester Mid Semester-I Examination

Course Code: 18CH-302C **Duration: 1 hour**

Course Name: Electrical Technology **Max.Marks : 20**

PART-A

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

1. Two resistors of 10Ω, each are connected in series. Find the equivalent resistance.
2. Define Kirchhoff current law.
3. Which type of measuring instrument is used to measure D.C?
4. What is the purpose of Megger?

PART-B

Answer two questions. Each question carries three marks 2x 3 = 6 Marks

5. (a) Three resistors of 18 Ω each are connected on parallel. Calculate the equivalent resistance.

(Or)

5. (b) State the procedure for first aid to a person electrocuted.

6. (a) Write any three differences between MC and MI instruments.

(Or)

6.(b) What are different quantities which can be measured by multimeter?

PART-C

Answer two questions. Each question carries five marks 2x 5 = 10 Marks

7. (a) Two resistors of 3 Ω and 6 Ω are connected in parallel and in series with a 5 Ω resistor. Find the equivalent resistance.

(Or)

7. (b) State any five safety precautions adopted for prevention of electric shock.

8. (a) Describe the construction of MI instrument.

(Or)

8. (b) Explain the working principle of energy meter.

****

State Board of Technical Education and Training,Telangana
Model Question paper
DCHE III semester Mid Semester-II Examination

Course Code: 18CH-302C **Duration: 1 hour**
Course Name: Electrical Technology **Max.Marks : 20**

PART-A

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

1. Define Permeability.
2. Mention the unit of flux density.
3. State the working principle of D.C. Generator.
4. Give the expression for torque of a D.C. motor.

PART-B

Answer two questions. Each question carries three marks 2x 3 = 6 Marks

5. (a) State Fleming's left hand rule.

(Or)

5(b) Distinguish between self induced and mutual induced emf.

6 (a) State the functions of (i) Pole (ii) Commutator (iii) Brushes

(Or)

6(b) State any three applications of D.C. motor.

PART-C

Answer two questions. Each question carries five marks 2x 5 = 10 Marks

7. (a) State and explain Faradays laws of electromagnetic induction.

(Or)

7. (b) Explain self induced EMF and mutually induced EMF with expression.

8. (a) Give the classification of DC generator.

(Or)

8. (b) Explain the speed controls of DC shunt motor by armature control.

****

State Board of Technical Education and Training, Telangana
Model Question paper
DCHE III Semester
Semester End Examination

Corse Code:18CH-302C **Duration:2 hours**
Course Name: Electrical Technology **Max.Marks:40 Marks**

PART-A
Answer all questions. Each question carries one mark **8x1 =8 Marks**

1. Two resistors of 5 Ω each are connected in parallel. Find the equivalent resistance.
2. Define flux density.
3. Define cycle.
4. State the equation of power in single phase circuit.
5. State the relation between voltage and current in a pure resistive current.
6. Give the relationship between phase voltage and line voltage in a 3 phase star connected circuit.
7. Define Slip.
8. Define step-up transform.

PART-B
Answer four questions. Each question carries three marks **4 x 3 = 12 Marks**

9. (a) Define Kirchhoff Voltage Law.
(Or)
9. (b) Define RMS value of an alternating quantity.

10. (a) State Fleming's Right Hand rule.
(Or)
10. (b) State the relationship between voltage and current in delta connected system.

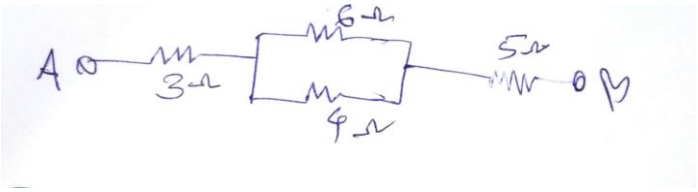
11. (a) State the relation between current and voltage in R-L series circuit.
(Or)
11. (b) State the relation between current and voltage in R-C series circuit.

12. (a) Name the parts of an induction motor.
(Or)
12. (b) Classify the transformer based on core.

PART-C

Answer four questions. Each question carries five marks **4 x 5 = 20 Marks**

13. (a).



For the circuit shown above find the equivalent resistance.

(OR)

13.(b) Give the expressions for (i) Average and R.M.S. value in terms of maximum value.

14. (a) Draw a neat sketch of 3 point starter

(Or)

14. (b) State any 5 uses of Auto transformer.

15. (a) State the relation between current and voltage in a RLC series circuit.

(Or)

15. (b) Explain phase or phase difference and power factor with graphics.

16. (a) Classify the induction motor

(Or)

16. (b) Write the construction and working of 3 phase transformer.

****

FLUID MECHANICS

Course Title :	**FLUID MECHANICS**	Course Code	**18CH-303C**
Semester	**III**	Course Group	**Core**
Teaching Scheme in Hrs(L:T:P)	**3:1:0**	Credits	**3**
Methodology	**Lecture + Assignments**	Total Contact Hours :	**45/60Pds**
CIE	**60 Marks**	SEE	**40 Marks**

Pre requisites

This course requires the basic knowledge of fundamentals of science and maths

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

Course Outcomes

CO1	Apply the basic concepts of fluid statics and fluid dynamics, concepts of fluid flow phenomena and analyse the nature of flow of different types of fluids.
CO2	Apply the basic equations of fluid flow and Bernoulli's theorem
CO3	Explain the concepts of flow of incompressible fluids, energy losses due to friction in the flow system
CO4	Principles and applications of flow past immersed bodies, flow through packed bed and fluidization.
CO5	Classify flow meters, demonstrate working principles and applications of various flow measuring devices and calculate discharge co-efficient for the flow of fluid using various flow meters.
CO6	Classify the different types of pumps, and know their operations, and specific applications

Course Content and Blue Print of Marks for SEE

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE</th></tr>
<tr><th colspan="2">R</th><th>U</th><th>A</th></tr>
<tr><td>1</td><td>Introduction & fluid flow phenomena</td><td>11</td><td rowspan="6">Q4</td><td rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>2</td><td>Basic equations of fluid flow</td><td>10</td></tr>
<tr><td>3</td><td>Flow of incompressible fluids in pipes</td><td>12</td><td rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>4</td><td>Flow past immersed bodies</td><td>7</td></tr>
<tr><td>5</td><td>Metering of fluids</td><td>8</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),Q11(a), Q11(b)</td><td>Q13(b),Q15(a), Q15(b)</td></tr>
<tr><td>6</td><td>Transportation of fluids</td><td>12</td><td>Q7,Q8</td><td>Q10(b),Q12(a), Q12(b)</td><td>Q14(b),Q16(a), Q16(b)</td></tr>
</table>

Course Content

UNIT 1 - Introduction & fluid flow phenomena Duration: 11 Periods (L:8-T:3)

Definition of fluid– Compressible and in compressible fluids– Newtonian and Non-Newtonian fluids– Physical properties of fluids– Density, Viscosity, velocity head, pressure head and static head– Pressure concept– Manometers: U – Tube Manometer, inverted U tube manometer, Inclined manometer– Laminar flow – Turbulent flow– Reynold's experiment- Importance of Reynold's number- Flow in boundary layer- Solve problems on Reynolds number and Pressure drop in manometers.

UNIT 2 - Basic equations of fluid flow Duration: 10 Periods(L:7-T:3)

Mass balance- Momentum balance, Continuity equation- Bernoulli's equation– Modified Bernoulli's equation for frictional flow and pump work- kinetic energy correction- Solve problems on various heads using Bernoulli's equation and pump work in Bernoulli's equation

UNIT 3 - Flow of incompressible fluids in pipes Duration: 12 Periods (L:9-T:3)

Flow of incompressible fluids-Shear stress distribution in pipes- Equation for friction factor- Laminar flow in pipes- Average velocity- Kinetic energy factor- Hagen Poiseuille equation- average velocity- Roughness- Friction factor chart- Energy loss for fluids during flow – Expansion and contraction losses in fitting- equivalent length- Solve simple problems on friction factor in Laminar & turbulent flow , Hagen Poiseuille equation and energy losses in fluid flow through pipes.

UNIT 4 - Flow past immersed bodies Duration: 07 Periods (L:5-T:2)

Drag- Types of Drag-Drag coefficient– Stokes law- Friction in flow through beds of solids– Packed bed-void fraction- Free settling-hindered settling-equations for terminal velocities for different particle Reynolds number ranges– Fluidization – Applications of fluidization -simple problems on stoke's law.

UNIT 5 - Metering of fluids Duration: 08 Periods (L:5-T:3)

Flow meters- Head meters, Area meters-Orifice meter, Venturi meter, Pitot tube, Rotameter- Solve simple problems on calculation of velocities, volumetric flow rates using venturi and orifice meters, pitot tube.

UNIT 6 - Transportation of fluids Duration: 12 Periods (L:9-T:3)

Pipes and tubes – Pipe fitting and joints – Valves – Pumps- functions of a pump- Classification- Positive displacement pumps –Reciprocating pumps : Piston, Plunger pumps, Diaphragm pumps, - Rotary pumps- Gear pump, screw pump– Centrifugal pumps – Suction head – Discharge head – Total developed head- NPSH– Priming – Cavitation– Characteristic curves – Equipment for gas flow- fans, blowers, Vacuum producing equipment– Ejectors– Solve problems on power required by a centrifugal pump, NPSH

SPECIFIC LEARNING OUTCOMES

1.0 Introduction & fluid flow phenomena

1.1 Define fluid and classify fluids.
1.2 State the important physical properties of fluid and give their units.
1.3 Explain compressible and incompressible fluids and give examples.
1.4 Explain the concepts of pressure and its measurement.
1.5 Select different types of manometers
1.6 Measure preesure drop using manometers
1.7 State Newton's law of viscosity.
1.8 Demonstrate Newtonian and non Newtonian fluids.
1.9 Distinguish Laminar and turbulent flow.
1.10 Importance of Reynold's number in fluid flow
1.11 Imagine the flow in boundary layers.
1.12 Determine type of flow using Reynolds number
1.13 Solve problems to calculate pressure drop in Manometers.

2.0 Basic equations of fluid flow

2.1 Make use of mass balance derive continuity equation.
2.2 Make use of momentum balance equation
2.3 Analyse the various forces acting on a fluid to make energy balance
2.4 Derive Bernoulli's theorem without friction
2.5 Develop Bernouilli's equation for friction flow, pump work and kinetic energy Correction
2.6 Modify Bernoulli's equation
2.7 Solve problems to calculate various heads using Bernoulli's equation
2.8 Apply Bernoulli's equation to solve problems on pump work calculation.

3.0 Flow of incompressible fluids in pipes

3.1 Explain flow of incompressible fluids in pipes.
3.2 Analyse Shear Stress distribution in pipes
3.3 State the equation of friction factor.
3.4 Explain laminar flow in pipes
3.5 State Hagen Poiseuille equation.
3.6 Solve problems on Hagen Poiseuille equation for pressure drop calculation.
3.7 Calculate friction factor in laminar and turbulent flow
3.8 Develop relation between pressure drop and friction factor.
3.9 Build friction factor chart.
3.10 Explain energy loss due to flow, pipe fittings, sudden expansion and contraction.
3.11 Solve problems on friction factor in Laminar & turbulent flow and energy losses in fluid flow through pipes.

3.12 Determine pressure drop due to friction in laminar and turbulent flow

4.0 Flow past immersed bodies

4.1 Define Drag and analyze different types of drag.
4.2 Define drag coefficient.
4.4 Demonstrate motion of particles through fluids
4.5 Explain about stokes law and differentiate Free & Hindered settling.
4.6 Construct Packed bed and Fluidised bed

4.7 Explain the process of fluidization.

4.8 Applications of fluidization.

4.9 Calculate settling velocities of particles using Stoke's Law.

5.0 Metering of fluids

5.1 Classify Flow meters (a) Head Meters (b) Area meters
5.2 Explain the principle of working of flow meter – Venturi meter
5.3 Derive the equation for Volumetric flow rate in Venturimeter
5.4 Explain the principle of working of Orifice meter, Pitot tube and Rotameter
5.5 Compare flow meters
5.6 Solve problems to calculate volumetric flow rates using venturi and orifice meters.

6.0 Transportation of fluids

6.1 List various types of pipe fittings and valves.
6.2 Choose valves and fittings based on their function
6.3 Select a pump for the given duty
6.4 Classify different types of pumps.
6.5 Differentiate positive displacement and centrifugal pumps.
6.6 Demonstrate the working and operation of Reciprocating positive displacement pumps.
(i) Piston pump (ii) Plunger Pump (iii) Diaphragm Pump
6.7 Demonstrate the working and operation of Rotary positive displacement pumps
i) Gear pump (ii) Screw pump
6.8 Demonstrate with neat sketch the construction and operation of the Centrifugal pump.
6.9 Importance of a) Suction head (b) Discharge head (c) Total head (d) NPSH (e) Cavitation (f) Priming in centrifugal pump
6.10 Construct characteristic curves of centrifugal pumps.
6.11 Differentiate between fan and blower.
6.12 Demonstrate the working of (i) Fan (ii) Blower iii) Ejectors iv) Compressors
6.13 Calculate NPSH in centrifugal pump.
6.14 Determine power required by a centrifugal pump and solve problems.

Suggested Student Activities

1. List out any five pressure measuring devices available in market with its specifications and current market price.
2. Each student will give an activity to prepare a tabulated summary for types of fluids, pipes and pipe fittings available in market. (Summary includes type, specification, size range, material, rate and applications).
3. Collect information regarding different types of pumps available in the market for a specific duty and prepare a tabulated summary including type, specifications, size, advantages, disadvantages, cost, applications etc
4. Study the Profile of a company manufacturing pumps and turbines on internet.
5. To visit & submit a report on nearby hydel power plant to know the setup of various components.
6. Student is encouraged to participate in Tech fest/Srujana fest to evolve any novel method of water supply systems
7. Prepare/Download a dynamic animation to illustrate the working principle of hydraulic pumps.
8. Paper/Poster presentation
9. Quiz and Group discussion
10. Surprise test

e-Learning links:

11. **http://nptel.ac.in**
12. www.flow master.com
13. www.vlab.co.in
14. Pipeflow.co.uk
15. You tube videos on working of pumps and flow meters.

Recommended Books

(1) Unit operations of Chemical Engg. by Warren 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
(3) Chemical engineering Series, Coulson & Richardson, Vol-1,5th edition.
(4) Unit operations –1, K.A.Ghavane, Nirali Prakashan Publications.

5. A text book of Hydraulics fluid machines and Hydraulic machines by R. S. Kurmi

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	Apply the basic concepts of fluid statics and fluid dynamics, concepts of fluid flow phenomena and analyse the nature of flow of different types of fluids.	R/U/A	1,2,3,4,9,10	**11**
CO2	Apply the basic equations of fluid flow and Bernoulli's theorem	R/U/A	1,2,3,4,9,10	**10**
CO3	Explain the concepts of flow of incompressible fluids, energy losses due to friction in the flow system	R/U/A	1,2,3,4,9,10	**12**
CO4	Principles and applications of flow past immersed bodies, flow through packed bed and fluidization.	R/U	1,2,3,4,9,10	**07**

CO5	Classify flow meters, demonstrate working principles and applications of various flow measuring devices and calculate discharge co-efficient for the flow of fluid using various flow meters.	R/U/A	1,2,3,4,6,8,9, 10	**8**
CO6	Classify the different types of pumps, and know their operations, and specific applications	R/U/A	1,2,3,4,5,6,10	**12**
				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			Q7,Q8	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 III semester Mid Semester-I Examination

Course Code: 18CH-303C **Duration: 1 hour**
Course Name: Fluid Mechanics **Max.Marks : 20**

PART-A

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

1) What are Compressible and Incompressible fluids?
2) Write the importance of Reynold's number.
3) State Bernoulli's equation.
4) Explain briefly the equation of continuity.

PART-B

Answer **two** questions. Each question carries three marks **2x 3 = 6 Marks**

5(a) Differentiate between laminar and turbulent flow?

(or)

5(b) Explain pressure measurement using simple U-tube manometer

6(a) Explain different energies involved in Bernoulli's equation.

(or)

6(b) A fluid is flowing through a 5 cm diameter pipe at a velocity of 2 m/s. Suddenly it enters into the larger cross sectional part of the pipe having diameter of 10 cm. Calculate the velocity in 10 cm diameter pipe?

PART-C

Answer **two** questions. Each question carries five marks **2x 5 = 10 Marks**

7(a) With the help of shear stress and shear rate plot explain Newtonian and Non-Newtonian fluids

(or)

7(b) Sulphuric acid is pumped at a rate of 3 l/s through a pipe of diameter 50 mm. Calculate the value of Reynolds number. Density of acid = 1840 kg/m^3 and viscosity = 25 $(mN.s)/m^2$

8 (a) Derive Bernoulli's equation for an incompressible and frictionless fluid.

(or)

8(b). A 300 mm pipe carries water at a velocity of 25 m/s. At station A and B measurements of pressure and elevation were 360 kN/m^2 and 268 kN/m^2 and 30.5 m and 35 m respectively. Find the loss of head between station A and B

State Board of Technical Education and Training, Telangana
Model Question paper
DCHE III semester Mid Semester-II Examination

Course Code: 18CH-303C **Duration:1 hour**
Course Name: Fluid Mechanics **Max.Marks:20**

PART-A

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

1. Define friction factor
2. Give equations for friction factor in laminar and turbulent flow.
3. Define Free settling.
4. What are the forces acting on particle settling in a fluid?

PART-B

Answer **two** questions. Each question carries three marks **2x 3 = 6 Marks**

5(a) Write about friction losses due to sudden contraction

(or)

5(b) Write the fanning equation and explain the significance?

6(a) Define terminal velocity and state Stoke's law (or)

6(b) Explain about Packed bed and give its applications.

PART-C

Answer **two** questions. Each question carries five marks **2x 5 = 10 Marks**

7(a) The Acetic acid is to be pumped at a rate of 0.02 m^3/s through a 75 mm I.D. pipe of 70 m. What is the pressure drop in the pipe.

(or)

7(b) Water is to be pumped at a rate of 55.5 l/s from a river to an overload tank of a chemical factory situated at a height of 25 m from the river bed. The total length of pipeline is 1500 m. a cast iron pipe of 300 mm inside diameter to be used for this purpose. Calculate the head loss due to friction and power requirement if pump efficiency is 60%, neglected fitting losses.

8(a) Explain the process of Fluidization with a neat sketch. List out various applications of fluidization?

(or)

8(b) (i). Define drag coefficient and write the equation

(ii). What will be the settling velocity of a spherical steel ball of diameter 2.4mm in an oil of specific gravity 0.87 and viscosity μ is 10 $N\text{-}S/m^2$? Specific gravity of steel ball is 7.87

State Board of Technical Education and Training,Telangana
Model Question paper
DCHE III Semester
Semester End Examination

Corse Code:18CH-303C **Duration:2 hours**
Course Name: Fluid Mechanics **Max.Marks:40 Marks**

PART-A

Answer **all** questions 8**x1 =8 Marks**

1. Explain the importance of Reynolds number?
2. Write fanning equation.
3. What is Priming?
4. Define terminal velocity.
5. What are Insertion meters?
6. Write the flow equation for Venturi meter.
7. List different types of valves.
8. Write the classification of Pumps.

PART-B

Answer **four** questions **4 x 3 = 12 Marks**

9(a). Explain pressure measurement using simple U-tube manometer.
(or)
9(b). Explain the working principle of Pitot tube.

10(a).What is fluidization? What are its applications?
(or)
10(b) Define Cavitation and NPSH.

11(a) Draw a neat sketch of Orifice meter and show the flow pattern and vena contracta.
(or)
11(b) Why the pressure recovery in venturimeter is more than that in orifice meter?

12(a) Write the working principle of Rotary pump.
(or)
12(b) Differentiate between fan and blower?

PART-C

Answer **four** questions 4 **x 5 = 20 Marks**

13(a). Derive Bernoulli's equation for incompressible and frictionless fluid.
(or)
13(b) A Venturimeter is installed in a pipeline for measurement of flow rate of water. The pressure

drop across the throat and upstream of the meter isten centimeters of mercury. Calculate the volumetric flow rate of water. Diameter of throat = 15 mm, Diameter of pipe = 30 mm

Coefficient of meter = 0.98, Density of water is 1000 kg/$m^{3,}$

Density of mercury 13600 kg/m^3

14(a) The Acetic acid is to be pumped at a rate of 0.02 m^3/s through a 75 mm I.D. pipe of 70 m. What is the pressure drop in the pipe.

(or)

14(b) (i). How Cavitation is reduced in centrifugal pumps

(ii). Calculate the NPSH of the pump using following data.

Vapor pressure of the liquid = 126.66 KN/m^2

Distance between the level of liquid in the reservoir and suction line = 12 m

Density of liquid = 965 kg/m^3, Friction in suction line = 4.5 J/kg,

Reservoir is open to atmosphere

15(a) Explain the construction and working principle of Venturi meter with a neat sketch.

(or)

15(b) Explain the construction and working principle of Rota meter with a neat sketch.

16(a) Explain the working principle of Centrifugal pump with a neat sketch.

(or)

16(b) Describe the working the reciprocating pump with a neat sketch.

QUESTION BANK

18CH-303C – FLUID MECHANICS

PART –A

1) What are Compressible and Incompressible fluids?
2) State Newton's law of viscosity
3) Explain the importance of Reynolds number.
4) Define boundary layer.
5) What are different types of flows?
6) What is the value of NRe for laminar and turbulent flow
7) Define boundary layer
8) Define Viscosity, give its units
9) Define specific gravity
10) What are Newtonian fluids?
11) What is ideal fluid?
12) Define potential flow.
13) What is steady state?
14) Name some pressure measuring devices
15) List different types of manometers.
16) What is priming?
17) List different types of fittings.
18) List the different types of flow measuring devices.
19) Write fanning equation.
20) Define terminal velocity.
21) What are Insertion meters?
22) Write the flow equation for Venturi meter.
23) List different types of valves.
24) Write the classification of Pumps.
25) Define friction factor
26) Give equations for friction factor in laminar and turbulent flow.
27) Define Free settling.
28) What are the forces acting on particle settling in a fluid?

PART –B

1. Explain pressure measurement using simple U-tube manometer.
2. The pressure difference over manometer is 2452 N/m^2. If the manometric fluid is carbon tetra-chloride (sp. gr. 1.6) and water is flowing through the pipeline and fills the manometer leads, what will be the manometer reading?
3. Differentiate between laminar and turbulent flow?
4. Why kinetic energy correction is required in Bernoulli's equation
5. Explain briefly the equation of continuity.
6. Write fanning equation and explain the significance?
7. Write about energy loss due to fittings. Express it in terms of equivalent length.
8. Write modified Bernoulli's equation and explain the terms
9. Derive continuity equation?
10. Define boundary layer. How the velocity changes take place in a boundary layer?
11. Define pressure and what is pressure head?
12. A fluid is flowing through a 5 cm diameter pipe at a velocity of 2 m/s. Suddenly it enters into the larger cross sectional part of the pipe having diameter of 10 cm. Calculate the velocity in 10 cm diameter pipe?
13. State Bernoulli's equation and explain the terms
14. State Hagen- Poiseuille equation. Give its applications
15. State the equation of friction factor.
16. Why there is a friction loss if the cross-section is suddenly enlarged? Write the equation for friction loss.
17. Differentiate variable head and variable area meters?
18. Write the function of different types of fittings
19. Classify different types of pumps.
20. Differentiate between Fan and blower?
21. What is priming? How it is done?
22. Explain the importance of Reynolds number?
23. Why kinetic energy correction is required in Bernoulli's equation
24. Write fanning equation and explain the significance?
25. Define Drag and drag coefficient.
26. Explain briefly about friction factor chart.
27. Define Drag and Drag Coefficient.
28. Differentiate between free settling and hindered settling?

29. Explain shear stress distribution in pipes.

30. Define terminal velocity and state Stoke's law

31. List the different types of flow measuring devices.
32. Write the function of different types of fittings
33. Define NPSH and Cavitation.
34. Explain about packed bed? Write its applications.
35. Define terminal velocity. Write the equation for terminal velocity.
36. Differentiate between Fan and blower?
37. Write the fanning equation and explain the significance?
38. State Hagen Poiseuille equation and give its applications

39. Write about friction losses due to sudden contraction of the cross-section with neat sketch.
40. Explain the process of Fluidization.
41. What will be the settling velocity of a spherical steel ball of diameter 2.4mm in an oil of specific gravity 0.87 and viscosity μ is 10 N-S/m^2 ?
    Specific gravity of steel ball is 7.87
42. Explain shear stress distribution in flow of incompressible fluid in pipes.
43. Write about friction losses due to sudden contraction of the cross-section with neat sketch.
44. Write notes on Transportation of Gases

PART-C

1. Explain the working principle of U-tube manometer and inclined U-tube manometer and also derive equations for pressure difference.

2. 2.a). Explain the working principle of inclined U-tube manometer with a neat sketch. Derive equations for pressure difference.

3. (a). List different types of manometers.
   (b). A simple U-tube manometer is installed across in a pipeline through which water is flowing. The manometric fluid is mercury (sp.gr 13.6). The manometer reads 240 mm. What is the pressure difference in N/m^2

3. (a). Describe Reynold's experiment.

   (b). Calculate the critical velocity of water flowing through 25 mm i.d pipe.
   Data: Density of water = 1000 kg/m^3, viscosity of water = 0.0008 N.s/m^2
5. Explain the formation of boundary layer with a neat sketch
6. Sulphuric acid is pumped at a rate of 3 l/s through a pipe of diameter 50 mm. Calculate the value of Reynolds number.

7. Explain briefly about Newtonian and Non- newtonian fluids with the help of shear stress vs shear rate

plot..

8. A 300 mm pipe carries water at a velocity of 25 m/s. At station A and B measurements of pressure and elevation were 360 kN/m^2 and 268 kN/m^2 and 30.5 m and 35 m respectively. Find the loss of head between station A and B.

9. Water is flowing at a flow rate of 50 kg/hr in a pipe line 78 mm i.d, the viscosity of water is $8x\ 10^{-4}$ Pa.s. Calculate the value of Reynolds number and determine the type of flow?
10. Explain different eneergies involved in Bernoull's equation.

11. State Bernoulli's equation without friction and explain the terms.
12. Derive modified Bernoulli's equation for frictional flow and pump work.

14. Derive Bernoulli's equation for an incompressible and frictionless fluid.

15. A 15 kW pump with 75% efficiency is discharging a solution of specific gravity 0.84 to a over head tank from a storage tank. The surface of the solution in the storage tank from datum line is 5 m and that in over head tank from datum line is 25 m. Both the tanks are open to atmosphere. If the losses in the entire system are 1.7 m of the solution. Calculate the volumetric flow rate of the solution

16. Derive equation for point velocity and maximum velocity for laminar flow of an incompressible fluid through circular tube.

17. (a). State fanning equation and give its applications
    (b). Estimate the pressure drop when 3 kg/s of sulphuric acid flows through 80 meters of 30 mm i.d pipe. Density of acid = 1840 kg/m^3, viscosity of acid = 0.025 Pa.s

18. (a).State Hagen Poiseuille equation and give its applications

    (b). Sugar syrup is flowing in a pipe of 50 mm i.d at a flow rate of 60 cm^3/s, the viscosity is 0.15 $N.s/m^2$ and density 1040 kg/m^3. Calculate the pressure drop due to friction & friction loss over a length of 20 meters.

19. Write modified Bernoulli's equation and explain the different terms in it. Derive Bernoulli's equation by introducing pump work in it

20. It is planned to install a steel pipe with an inside diameter of 20 cm to transfer 1000 kg/min, molasses having a density of 1.6 gm/cc from an open reservoir. The line is to be 1000 m long, and the delivery end is to be 5 m higher than the intake. If the friction losses are 6.25 J/kg and the overall efficiency of the pump is 60%, what will be the horse power required.

21. Crude oil of 840 kg/m^3 flows through the piping system consisting of 40 mm pipe, connected to 60mm pipe which is divided into two sections. An equal quantity of water flows through each of the pipes. The velocity through 40 mm pipe is 3 m/s. Calculate mass flow rate in all pipes, velocity in 60 mm pipe, diameter of one branch of pipe line in which water velocity is 3.6 m/s and velocity in another branch of diameter 30mm

22. Water is to be pumped at a rate of 55.5 l/s from a river to an overload tank of a chemical factory situated at a height of 25 m from the river bed. The total length of pipeline is 1500 m. a cast iron pipe of 300 mm inside diameter to be used for this purpose. Calculate the head loss due to friction and power requirement if pump efficiency is 60%, neglected fitting losses
23. Explain about the energy loss due to sudden contraction and due to presence of fittings and valves

24. Write short notes on (a).Drag Coefficient Vs particle Reynolds number curve (b). Flow through beds of solids

25. Explain the construction and working principle of Orifice meter with neat sketch? Show the flow pattern. Explain about Vena contracta

26. Write notes on Packed bed and fluidized bed

27. Describe with a neat sketch the construction and operation of the Centrifugal pump.

28. Draw a neat sketch of Orifice meter and explain the construction and working principle. What are its advantages and disadvantages over Venturimeter?

29. Explain the working principle of Rotameter with neat sketch.

31. A Venturimeter is installed in 25 mm I.D pipe. The pressure drop across the upstream side and throat of venturi meter is 2 m of water. Calculate the volumetric flow rate of water in m^3/s through the pipe. Diameter of throat is 15 mm, density of water is 1000 kg/m^3 and C_v =0.98.

32.Explain the principle and operation of Reciprocating piston pump and Diaphragm pump with neat sketches

33. Explain about the characteristic curves of Centrifugal pump.

34. Explain the working principle of venturimeter with aneat sketch.
35. A venturimeter is installed in a pipeline for measurement of flow rate of water. The pressure drop across the throat and upstream of the meter is ten centimeters of mercury. Calculate the volumetric flow rate of water Diameter of throat = 15 mm, Diameter of pipe = 30 mm Coefficient of meter = 0.98, Density of water is 1000 $kg/m^{3,}$ Density of mercury 13600 kg/m^3

36. Explain the construction and operation of a Reciprocating Pump with a neat sketch.

37. The Acetic acid is to be pumped at a rate of 0.02 m^3/s through a 75 mm I.D. pipe of 70 m. What is the pressure drop in the pipe.

38.Water is to be pumped at a rate of 55.5 l/s from a river to an overload tank of a chemical factory situated at a height of 25 m from the river bed. The total length of pipeline is 1500 m. a cast iron pipe of

300 mm inside diameter to be used for this purpose. Calculate the head loss due to friction and power requirement if pump efficiency is 60%, neglected fitting losses.

39. Explain the process of Fluidization with a neat sketch. List out various applications of fluidization?

40. Derive the Bernoulli's equation without friction. Write modified Bernoulli's equation.

41. A pump delivers water from a holding tank at atmospheric pressure to a process equipment at 450 kPa at a flow rate of 6.2 l/s. The process equipment is located 10m higher than the holding tank. Calculate the power requirement of the pump if its efficiency is 70% and if the fluid friction and changes in kinetic energy are negligible.

42. Derive flow equation of venturimeter.

43. Explain the construction and operation of a centrifugal pump with a neat sketch

44. (a). How Cavitation is reduced in centrifugal pumps

(b). Calculate the NPSH of the pump using following data.
Vapor pressure of the liquid = 126.66 KN/m^2
Distance between the level of liquid in the reservoir and suction line = 12 m
Density of liquid = 965 kg/m^3, Friction in suction line = 4.5 J/kg,
Reservoir is open to atmosphere.

45. Write notes on

(a). Primimg in Centrifugal pump
(b). Cavitation and NPSH

46. Explain the process of Fluidization. Give advantages and applications of fluidization

APPLIED CHEMISTRY

Course Title :	APPLIED CHEMISTRY	Course Code	18CH-304C
Semester	III	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	3:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours :	60 Pds
CIE	60 Marks	SEE	40 Marks

COURSE: Diploma in Chemical Engineering

COURSE OBJECTIVES:

After studying this course, the student will be able to understand and appreciate the importance of Organic compounds in different spheres of chemical industries.

PRE REQUISITES:

Basics of chemistry concepts up to Secondary education and I / II Semester Diploma.

COURSE OUTCOME:

On successful completion of of the course, the students will have ability to attain below Course Outcomes

CO	Course outcome
CO1	Explain Main Features of Modern Periodic Table, Classification of elements, Merits and demerits of modern priodic table
CO2	Explain Internal energy and Enthalpy, Law of conservation of energy, Exothermic and Endothermic reactions, Heat of Reaction and types of heats of reactions
CO3	Discuss the Classification of Organic compounds, IUPAC Nomenclature of Organic compounds, Different classes of Organic compounds
CO4	Discuss the Classification of Hydrocarbons, Preparation methods and Reactions of Methane, Ethylene and Acetylene
CO5	Aromatic Hydrocarbons, Explain Huckle's rule, Arene and Poly nuclear aromatic compounds, Preparation methods and Reactions of benzene
CO6	Explain the Preparation methods and Reactions of various classes of hetero atomic organic compounds

Cognitive levels: R = Remember, U= Understand, A = Apply

COURSE CONTENTS:

UNIT-I: CLASSIFICATION OF ELEMENTS Duration: 12 Periods (L:9-T:3)

Modern Periodic Law- Main Features of Modern Periodic Table- Classification of elements based on electronic configuration & based on the no. of incomplete shells- Merits and demerits of modern periodic table

UNIT –II: THERMO CHEMISTRY Duration: 8 Periods (L:6-T:2)

Internal energy and Enthalpy- Change in Internal energy and Enthalpy- Law of conservation of energy-Exothermic and Endothermic reactions- thermo chemical equations- Heat of Reaction- Types of heats of reactions i) Heat of formation ii) Heat of combustion iii) Heat of neutralization iv) Heat of solution

UNIT-III: BASICS OF ORGANIC CHEMISTRY Duration: 10 Periods (L:7.5-T:2.5)

Study of organic chemistry as a separate branch- Unique characteristics of carbon- Classification of Organic compounds- Functional group- IUPAC Nomenclature of Organic compounds- Different classes of Organic compounds.

UNIT-IV: ALIPHATIC HYDROCARBONS Duration: 8 Periods (L:6-T:2)

Classification of Hydrocarbons- Preparation methods and Reactions of Methane, Ethylene and Acetylene

UNIT-V: AROMATIC HYDROCARBONS Duration: 8 Periods (L:6-T:2)

Aromatic compounds- Huckle's rule of aromaticity- Arenes- Polycyclic aromatic hydrocarbons- Preparation methods and Reactions of benzene

UNIT-VI: HETERO ATOMIC ORGANIC COMPOUNDS Duration: 14 Periods (L:10.5-T:3.5)

Preparation methods and reactions of: 1. Ethyl chloride 2. Ethanol 3. Diethyl ether 4. Acetaldehyde 5. Acetone 6. Acetic acid

SPECIFIC LEARNING OUTCOMES:

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

UNIT-I: CLASSIFICATION OF ELEMENTS Duration: 12 Periods (L:9-T:3)

1.1 Identify the need for classification of the elements
1.2 Define modern periodic law
1.3 Explain the main features of modern periodic table
1.4 Classify the elements based on their electronic configuration in to s,p,d and f block elements

1.5 Classify the elements based on the no of incomplete shells in their atoms
1.6 Summarize the merits and demerits of modern periodic table

UNIT-II: THERMO CHEMISTRY **Duration: 8 Periods (L:6-T:2)**

2.1 Define the terms Internal energy and Enthalpy and explain the relation between them
2.2 Define and explain Law of conservation of energy
2.3 Define Exothermic and Endothermic reactions and explain with examples
2.4 Define Heat of Reaction

2.5 Define thermochemical equation and give examples

2.6 Explain the Types of heats of reactions with examples: i) Heat of formation

ii) Heat of combustion iii) Heat of neutralization iv) Heat of solution

UNIT-III: BASICS OF ORGANIC CHEMISTRY **Duration: 10 Periods (L:7.5-T:2.5)**

3.1 Justify the need for the study of Organic chemistry as a separate branch
3.2 Appraise the unique properties of Carbon
3.3 Classify Organic compounds in to various classes
3.4 Define functional group and list various functional groups
3.5 Illustrate the rules of IUPAC nomenclature method
3.6 Make use of IUPAC Nomenclature method in giving the names of organic compounds
3.7 Make use of IUPAC Nomenclature method in writing the structures of organic compounds
3.8 List various classes of Organic compounds and give examples

UNIT-IV: ALIPHATIC HYDROCARBONS **Duration: 8 Periods (L:6-T:2)**

4.1 Classify Hydrocarbons and give examples
4.2 Prepare Methane by 1) Decarboxylation 2) Reduction of Alkyl halide
4.3 Prepare Ethylene and Acetylene by 1) Dehydrohalogenation 2) Dehalogenation
4.4 Explain Substitution Reaction of Methane with chlorine (chlorination)
4.5 Explain Addition reactions of Ethylene and Acetylene with
1) Hydrogen in presence of Nickel
2) Bromine in carbon tetrachloride
3) Alkaline $KMnO_4$

UNIT-V: AROMATIC HYDROCARBONS **Duration: 8 Periods (L:6-T:2)**

5.1 Explain structure of benzene
5.2 Explain Huckle's rule of Aromaticity with examples
5.3 Define Arenes
5.4 Define Polycyclic aromatic compounds
5.5 Distinguish between Aliphatic and Aromatic Hydrocarbons
5.6 Prepare Benzene from 1) Sodium benzoate 2) Benzene sulphonic acid
5.7 Explain substitution reactions of Benzene
1) Halogenation 2) Nitration 3) Friedel-Craft's alkylation

UNIT-VI: HETEROATOMIC ORGANIC COMPOUNDS Duration: 14 Periods (L:10.5-T:3.5)

5.1 Prepare :**Ethyl chloride** from 1) Alcohol 2) Alkene
: **Ethanol** by 1) Hydrolysis of alkyl halide 2) Hydration of alkene 3) from molasses
: **Acetaldehyde and Acetone** by 1) Oxidation of alcohol 2) Hydration of alkyne
: **Diethyl ether** by 1) Dehydration of alcohol 2) Williamson's synthesis
: **Acetic acid** by 1) Oxidation of alcohol 2) Hydrolysis of ester

5.4 Explain the reactions of:
: **Ethyl chloride** 1) Substitution reaction with aq.KOH 2) Elimination reaction with alcoholic KOH 3) Action with Mg
: **Ethanol** with 1) Na 2) Acetic acid 3) conc. H_2SO_4
: **Acetaldehyde and Acetone** 1) Addition of HCN 2) Oxidation 3) Reduction 4) With Tollen's reagent 5) With Fehling's reagent
: **Diethyl ether** with 1) H_2SO_4 2) HI
: **Acetic acid** with 1) Na 2) NaOH 3) Ethanol

Suggested Student Activities

1. Student visits Library to refer the Text books, reference books and manuals to find their specifications
2. Arranging all the elements in tabular form in which groups, periods, s,p,d,f blocks are clearly demarcated
3. Identify and explain various natural processes, exothermic and endothermic reactions in our daily life.
4. Quiz on IUPAC nomenclature of organic compounds.
5. Prepare chart of classification of Organic compounds
6. Prepare chart of classification of Hydrocarbons
7. Make chart showing preparation and reactions of methane, ethylene and acetylene
8. Write resonance structures of benzene and other aromatic compounds
9. Make chart showing preparation and reactions of various organic compounds

Step-1: Data/ literature collection.

Step-2: Summarization of data/ literature collected.

Step -3: Explain the process and compare them with the help of power point presentation/ Chart preparation

Step-4: Submit the report.

Method of evaluation of the student activities (Rubrics)

Model Rubrics

No	Sub activity	Performance			
		excellent	**Good**	**Satisfactory**	**Need improvement**
1	Step-1	Data was collected from more than four sources.	Data was collected from three to four sources	Data was collected from two sources.	Data was collected only one source.
2	Step-2	All materials and data required for the activity were accurately prepared based on the data collected independently.	Almost all materials and data required for the activity were accurately prepared based on the data collected independently.	The materials and data required for the activity were accurately prepared based on the data collected with the help of teacher.	The materials and data required for the activity were inaccurately prepared
3	Step-3	Procedures were outlined in a step-by-step fashion that could be followed by anyone & performed the activity effectively.	Procedures were outlined in a step-by-step fashion, require explanation & performed the activity effectively.	Procedures that outlined were complete with 1 or 2 gaps and require explanation & performed the activity normally	Procedures that outlined were not sequential, & performed the activity in a poor way
4	Step-4	Presented/ explained the information about the activity in logical, interesting sequence with attractive visuals or diagrams.	Presented/ explained the information about the activity in logical sequence with visuals or diagrams.	Presented/ explained the information about the activity in logical sequence with less visuals or diagrams.	Presented/ explained the information about the activity without sequence and visuals or diagrams.
5	Conclusion / summary	Provided a detailed conclusion/ summary clearly based on the data and activity	Provided a conclusion / summary clearly based on the data and activity	Student provided a conclusion/ summary less effectively	Conclusions /summary was not relevant.

E - learning links:

1. **https://www.khanacademy.org/science/chemistry/periodic-table**
2. **https://www.chemicool.com/**
3. **http://apple.niu.edu.tw/ezfiles/0/1000/img/48/wang_chemistry_ch08.pdf**
4. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
5. https://www.masterorganicchemistry.com/

Reference Books :

1. Text book of Inorganic Chemistry by Puri & Sharma
2. Text book of Organic Chemistry by Puri & Sharma
3. Text book of Organic Chemistry by Arun Bahl & B.S.Bahl

CO-PO Mapping Matrix

CO	Course outcome	CL	Linked PO	Teaching periods
CO1	Explain Main Features of Modern Periodic Table, Classification of elements, Merits and demerits of modern priodic table	R/U/A	1,2,9,10	**12**
CO2	Explain Internal energy and Enthalpy, Law of conservation of energy, Exothermic and Endothermic reactions, Heat of Reaction and types of heats of reactions	R/U/A	1,2,9,10	08
CO3	Discuss the Classification of Organic compounds, IUPAC Nomenclature of Organic compounds, Different classes of Organic compounds	R/U/A	1,2,9,10	10
CO4	Discuss the Classification of Hydrocarbons, Preparation methods and Reactions of Methane, Ethylene and Acetylene	R/U/A	1,2,5,6,9,10	**08**
CO5	Aromatic Hydrocarbons, Explain Huckle's rule, Arene and Poly nuclear aromatic compounds, Preparation methods and Reactions of benzene	R/U/A	1,2,5,6,9,10	08
CO6	Explain the Preparation methods and Reactions of various classes of hetero atomic organic compounds	R/U/A	1,2,5,6,9,10	14
	Total Periods			**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			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q14(b), Q16(a), Q16(b)
Total Questions	8			8	8

Model Paper for Mid-I **C 18-CH-304 C**

BOARD DIPLOMA EXAMINATION, (C-18)
DIPLOMA IN CHEMICAL ENGINEERING
MID SEM-I III - SEMESTER
APPLIED CHEMISTRY

Time : **1** Hr Total Marks :20 Marks

PART-A

Instructions: Answer **all** questions. Each question carries **one** mark 4 X 1 = 4

1. What is the need for classification of elements?
2. Write modern periodic law
3. What are Lanthanide?
4. Define Internal energy.

PART-B

Instructions: Answer the following questions. Each Question carries three marks 2 X 3 = 6

5 a) Write main features of the modern periodic table

or

b) What are representative elements? Write their general electronic configuration.

6 a) Define and explain Law of conservation of energy

or

b) What are exothermic reactions? Give two examples

PART-C

Instructions: Answer the following questions. Each question carries five marks 2 X 5 = 10

7 a) Explain the classification of elements in to s,p,d and f blocks

or

b) Write the advantages of modern periodic table.

8 a) Define and give one example for each: a)Heat of formation b) Heat of combustion

or

b) Identify the Exothermic and Endothermic reactions from the following.
1. Burning of paper 2. Formation of nitric oxide 3. Cooking of rice 4. Breathing of air 5. Rusting of iron

Model Paper for Mid-II **C 18-CH-304 C**

BOARD DIPLOMA EXAMINATION, (C-18)
DIPLOMA IN CHEMICAL ENGINEERING
MID SEM-II III - SEMESTER
APPLIED CHEMISTRY

Time : **1** Hr Total Marks :20 Marks

PART-A

Instructions: Answer **all** questions. Each question carries one mark 4 X 1 = 4

1. What is catenation?
2. Write the structures of the compounds: a) 1-hydroxy pentane b) Methyl Benzene
3. What are parrafins?
4. Write the first two members of alkynes

PART-B

Instructions: Answer the following questions. Each Question carries three marks 2 X 3 = 6

5 a) What are the unique characteristics of carbon?

or

b) Write the IUPAC nomenclature for CH_3-CH=CH-CH_2 and CH_3-CH_2-CH_2-OH

6 a) Why are alkenes called olefins? Give an example

Or

b) Write the preparation method of Acetylene from 1,2 dibromo ethane

PART-C

Instructions: Answer the following questions. Each question carries five marks 2 X 5 = 10

7 a) Discuss general rules for naming a branched chain hydrocarbon

or

b) Classify organic compounds on the basis of functional groups .

8 a) Explain Chlorination reactions of Methane with equations

or

b) Write the reactions of Acetylene with: a) H_2 /Ni b) Br_2 / CCl_4

Model Paper for SEE **C 18-DCHE-CH-304 C**

BOARD DIPLOMA EXAMINATION, (C-18)

DIPLOMA IN CHEMICAL ENGINEERING

III – SEMESTER EXAMINATION

APPLIED CHEMISTRY

Time : 2 Hrs Total Marks : 40 Marks

PART-A

Instructions: Answer **all** questions. Each question carries **two** marks 8 X 1 =8 Marks

1. Write modern periodic law
2. Define functional group
3. What is Lucas test?
4. Why are alkanes called paraffins?
5. What are Arenes?
6. Write the structure of Benzaldehyde
7. What are carbonyl compounds?
8. Write a reaction of acetic acid which shows its acidic nature

PART-B

Instructions: Answer all questions. Each question carries Three marks 4 X 3 = 12 Marks

9 a) Define internal energy and enthalpy. Mention the relation between them

Or

b) How does Huckle's rule explain aromaticity of benzene?

10 a) What are the unique characteristics of carbon?

Or

b) Write the preparation methods of Diethyl ether from Ethyl iodide

11 a) Write the structure of benzene & identify the ortho, meta and para positions in benzene.

Or

b) What are Arenes? Give 2 examples

12 a) Write the oxidation reaction of Acetaldehyde

Or

b) Write the reaction of Ethyl alcohol with Acetic acid

PART-C

Instructions: Answer all questions. Each question carries Five marks 4 X 5 = 20 Marks

13 a) Write main features of the modern periodic table

or

b) Explain the structure of benzene

14 a) Explain Chlorination reactions of Methane with equations

Or

b) Write the reactions of diethyl ether with a) dil.H_2SO_4 b) HI

15 a) Explain chlorination and nitration of benzene with equations

or

b) Explain Friedel-Craft's Alkylation of benzene with example

16 a) Write the preparation methods of Acetic acid from 1) ethyl acetate 2) ethanol

Or

b) Distinguish between Acetaldehyde and Acetone

QUESTION BANK

1. PERIODIC CLASSIFICATION

SHORT: 1 Mark [2 & 1]

1. What is the need for classification of elements?
2. Write modern periodic law
3. Define period & group
4. What are the groups present in s-block of the periodic table
5. What are noble gases?
6. Define Representative elements
7. Define Transition elements
8. Define Inner transition elements
9. Define Lanthanides and Actinides.
10. Write the general electronic configuration of s -block elements.
11. Write the general electronic configuration of p- block elements.
12. Write an informative note on the size of atoms along the periods from left to right.
13. Write an informative note on the atomic size of atom as go down the groups.
14. Justify that noble gases are considered as inert elements.
15. Explain ionization energy variation along the periods
16. Explain ionization energy variation along the groups.
17. Write the general electronic configuration of d - block elements.
18. Write the general electronic configuration of f- block elements.
19. Predict the period and group to which Aluminum element belongs.

ESSAY: 3 & 5 Marks [1,1 & 0,1]

20. Write main features of the modern periodic table
21. Explain the classification of elements in to s,p,d and f blocks
22. Explain the Classification of elements in to 4 types based on their electronic configuration
23. Recognize alkali and alkaline earth metals with examples.
24. What are representative elements? Write their general electronic configuration.
25. Write the advantages of modern periodic table.
26. Write the demerits of Modern periodic table

II. THERMO CHEMISTRY

SHORT: 1 Mark [2 & 0]

1. Define Internal energy.
2. Define Enthalpy.
3. What are exothermic reactions?
4. Give an example for Exothermic reactions
5. What are endothermic reactions?

6. Give an example for Endothermic reactions
7. Define heat of reaction
8. What are the types of Heat of reaction?
9. Define Heat of formation and give an example
10. Define Heat of combustion and give an example
11. Define Heat of Neutralization and give an example
12. Define Heat of solution and give an example

ESSAY: 3& 5 Marks [1,1 & 1,0]

1. Define and explain Law of conservation of energy
2. Define internal energy and enthalpy. Mention the relation between them
3. What are the change in Internal energy and change in Enthalpy? How are they related?
4. What are exothermic reactions? Give two examples
5. What are endothermic reactions? Give two examples
6. Identify the Exothermic and Endothermic reactions from the following.
   1. Burning of paper 2. Formation of nitric oxide 3. Cooking of rice 4. Breathing of air 5. Rusting of iron
7. Define and give one example for each: a)Heat of formation b) Heat of combustion
8. Define and give one example for each: a)Heat of neutralization b) Heat of solution

III. BASICS OF ORGANIC CHEMISTRY

SHORT: 1 Mark [2 & 1]

1. What is the need for study of Organic chemistry as a separate branch?
2. What is catenation?
3. Name two elements that show catenation
4. Explain as to why carbon has maximum tendency of catenation?
5. Define functional group.
6. Give functional group for aldehyde.
7. Write the correct name of an organic compound whose incorrect name is 2-ethyl, 2-pentene.
8. What are alicyclic compounds? Give examples.
9. Write the structure and IUPAC name of iso-butylene.
10. Write IUPAC names for the following compounds: a) ethyl alcohol (b) acetone
11. Write IUPAC names for the following compounds: a) phenol b) aniline
12. Write IUPAC names for the following compounds: a) formaldehyde b) methyl ethyl ketone
11. Write the structures of the following compounds: a) 1-hydroxy pentane b) Methyl Benzene
12. Write the structures of the following compounds: a) 1,3-butadiene b) 1,3-dichloro benzene
13. Write the structures of the following compounds: a) iso propanol b) 2-pentanone
14. Write the structures of the following compounds: a) 2-methyl 1-pentene b) 3-chloro,2-butanol
15. Write the structures of the following compounds: a) 2-methyl butanoic acid b) 2-hexene
16. Write the structures of the following compounds: a)2-chloro,1-butanol b) 2-butyne
17. Write the structures of the following compounds: a) 3-chloro pentane b) 3-pentanone
18. Write the IUPAC nomenclature for CH_3-CH=CH-CH_2

19. Write the IUPAC nomenclature for CH_3-CH_2-CH_2-OH
20. Write the IUPAC nomenclature for CH_2=CH-CH=CH_2
21. Write the IUPAC nomenclature for the following CCl_4
22. Write the IUPAC nomenclature for the following C_6H_5-NO_2
23.

ESSAY : 3& 5 Marks [1,1 & 1,0]

c) What are the unique characteristics of carbon?
d) Explain why does carbon form such a large number of compounds?
e) Explain the classification of organic compounds.
f) Classify organic compounds on the basis of functional groups .
g) Discuss general rules for naming a branched chain hydrocarbon
h) Write the IUPAC nomenclature for CH_3-CH=CH-CH_2 and CH_3-CH_2-CH_2-OH
i) Write the IUPAC nomenclature for CH_2=CH-CH=CH_2 and CCl_4

IV. ALIPHATIC HYDROCARBONS

SHORT : 1 Mark [2 & 1]

c) Why are alkanes called paraffins?
d) Why are alkenes called olefins?
e) Write the IUPAC and common names of first member of the family represented by C_nH_{2n}
f) List the first two members of saturated hydrocarbons.
g) What are substitution reactions?
h) What are addition reactions?
i) How does Bromine react with ethylene?
j) How will you detect the presence of a multiple bond in a hydrocarbon?
k) How will you distinguish between methane and ethylene?
l) How will you distinguish between methane and acetylene?

ESSAY: 3 & 5 Marks [1,1 & 0,1]

1. How are hydrocarbons classified? Discuss with examples.
2. Distinguish between saturated and unsaturated hydrocarbons.
3. Write the preparation method of Methane from sodium acetate
4. Write the preparation method of Methane from Methyl chloride
5. Write the preparation methods of Methane from:
   a) sodium acetate b) Methyl chloride
6. Write the preparation method of Ethylene from Ethyl bromide
7. Write the preparation method of Ethylene from 1,2-dibromo ethane
8. Write the preparation methods of Ethylene from
   a) Ethyl bromide b) 1,2-dibromo ethane
9. Write the preparation method of Acetylene from 1,2 dibromo ethane
10. Write the preparation method of Acetylene from 1,1,2,2 – tetra bromo ethane
11. Write the preparation methods of Acetylene from
    a) 1,2 dibromo ethane b) 1,1,2,2 – tetra bromo ethane
12. Explain Chlorination reactions of Methane with equations
13. How does Ethylene react with H_2 /Ni
14. How does Ethylene react with Br_2 / CCl_4

15. How does Ethylene react with: a) H_2 /Ni b) Br_2 / CCl_4
16. Write the reaction of Acetylene with H_2 /Ni
17. Write the reaction of Acetylene with Br_2 / CCl_4
18. Write the reactions of Acetylene with: a) H_2 /Ni b) Br_2 / CCl_4

V. AROMATIC HYDROCARBONS

SHORT: 1 Mark [2]

1. Write the structures of a) Benzaldehyde b) p-Nitro phenol
2. Write the structures of a) Toluene b) o-hydroxy benzoic acid
3. Write the structures of a) methyl benzoate b) m-Dinitro benzene
4. Write the structures of a) p-methyl aniline b) Ethyl benzoate
5. What is Huckle's rule?
6. What are Arenes?
7. What are Polycyclic aromatic hydrocarbons?
8.

ESSAY: 3 & 5 Marks [3,3]

1. What are aromatic compounds? Explain with Hukle's rule.
2. How does Huckle's rule explain aromaticity of benzene?
3. Explain the structure of benzene
4. Write the structure of benzene & identify the ortho, meta and para positions in benzene.
5. Distinguish aromatic compounds from aliphatic compounds by using Huckle's rule
6. Distinguish between an alkene and benzene
7. What are Arenes? Give 2 examples
8. What are Polycyclic aromatic hydrocarbons? Give two examples
9. Justify the aromaticity of Naphthalene
10. Write a brief note on the resonance structures of benzene
11. Write a brief note on the resonance structures of naphthalene
12. Write the preparation method of benzene from sodium benzoate
13. Write the preparation method of benzene from benzene sulphonic acid
14. Explain substitution reaction of benzene with example.
15. Explain chlorination of benzene with equation
16. Explain nitration of benzene with equation
17. Explain Friedel-Craft's Alkylation of benzene with example
18. How will you convert benzene in to toluene?
19. How can you convert benzene in to ethyl benzene

VI. Hetero atomic Organic compounds

SHORT: 1 Mark [3]

1. What are Hetero atomic organic compounds?
2. Give two examples for hetero atomic organic compounds
3. What is Lucas test?
4. Write the functional groups for aldehydes and ketones
5. What are carbonyl compounds?

6. What is silver mirror test?
7. What is Fehling's test?
8. Write a reaction of acetic acid which shows its acidic nature
9. What is esterification?

ESSAY: 3& 5 Marks [3, 3]

1. Write the preparation methods of Ethyl alcohol from ethyl halide
2. Write the preparation methods of Ethyl alcohol from ethylene
3. Write the preparation methods of Ethyl alcohol from: a) ethyl halide b) ethylene
4. Describe the preparation of ethyl alcohol from molasses.
5. Write the preparation method of Diethyl ether from Ethyl iodide
6. Write the preparation method of Diethyl ether from ethanol
7. Write the preparation methods of Diethyl ether from: a) Ethyl iodide b) ethanol
8. Write the preparation method of Acetaldehyde from ethanol
9. Write the preparation method of Acetaldehyde from acetylene
10. Write the preparation methods of Acetaldehyde from: a) ethanol b) acetylene
11. Write the preparation method of Acetone from Isopropanol
12. Write the preparation method of Acetone from propyne
13. Write the preparation methods of Acetone from: a) Isopropanol b) propyne
14. Write the preparation method of Acetic acid from ethyl acetate
15. Write the preparation method of Acetic acid from ethanol
16. Write the preparation methods of Acetic acid from: a) ethyl acetate b) ethanol
17. Write the reactions of Ethyl alcohol with Acetic acid
18. Write the reactions of Ethyl alcohol with conc.H_2SO_4
19. Write the reactions of Ethyl alcohol with: a) Acetic acid b) conc.H_2SO_4
20. Write the reaction of diethyl ether with dilute and concentrated H_2SO_4
21. Write the reaction of diethyl ether with HI
22. Write the reactions of diethyl ether with: a) dil.H_2SO_4 b) HI
23. Write the oxidation reaction of Acetaldehyde
24. Write the reduction reaction of Acetaldehyde
25. Write the oxidation and reduction reactions of Acetaldehyde
26. Write the oxidation reaction of Acetone
27. Write the reduction reaction of Acetone
28. Write the oxidation and reduction reactions of Acetone
29. Write the reaction of Acetic acid with sodium
30. Write the reaction of Acetic acid with Ethanol
31. Write the reactions of Acetic acid with: a) Na b) Ethanol
32. Distinguish primary, secondary and tertiary alcohols
33. Explain Lucas test
34. Distinguish between Acetaldehyde and Acetone

Material and Energy Balances

Course Title :	**Material and Energy Balances**	Course Code	**18CH-305C**
Semester	**III**	Course Group	**Core**
Teaching Scheme in Hrs(L:T:P)	**2:2:0**	Credits	**3**
Methodology	**Lecture + Assignments**	Total Contact Periods:	**60Pds**
CIE	**60 Marks**	SEE	**40 Marks**

Pre requisites

This course requires the basic knowledge of Maths and Physical Chemistry.
On completion of the course, the student will be able to:

Course Outcomes

CO1	Memorise and apply the units and conversions.
CO2	Calculate the composition of liquid and solid mixtures and apply the principles of behaviour of ideal gases and gaseous mixtures in solving chemical process calculations
CO3	Apply material balance and solve problems on material balance with and without chemical reactions.
CO4	Apply principles of energy balance and solve problems to calculate heat requirement, heat of reaction and heat of formation
CO5	Apply the mechanism of combustion, heating values of fuels and perform calculations

Course Content and Blue Print of Marks for SEE

<table>
<tr><th rowspan="2">Unit No</th><th rowspan="2">Unit Name</th><th rowspan="2">Periods</th><th colspan="4">Questions to be set for SEE</th></tr>
<tr><th colspan="2">R</th><th>U</th><th>A</th></tr>
<tr><td>1</td><td>Units and Dimensions:</td><td>06</td><td rowspan="6">Q4</td><td colspan="2" rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>2</td><td>Basic Calculations</td><td>14</td></tr>
<tr><td>3</td><td>Material balance without chemical reactions</td><td>12</td><td colspan="2" rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>4</td><td>Material balance with chemical reactions</td><td>10</td></tr>
<tr><td>5</td><td>Energy Balance</td><td>10</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),Q11(a), Q11(b)</td><td>Q13(b),Q15(a), Q15(b)</td></tr>
<tr><td>6</td><td>Combustion process</td><td>08</td><td>Q7,Q8</td><td>Q10(b),Q12(a), Q12(b)</td><td>Q14(b),Q16(a), Q16(b)</td></tr>
</table>

Course Content

UNIT 1 - Units and Dimensions: Duration: 06 Periods (L:3-T:3)

Physical Quantities-Fundamental and Derived quantities-Unit and System of units-Formula, Units in SI system and Dimensional formula of different derived quantities-Area, Volume, Velocity, Acceleration, Density, Specific volume, Work done-Energy-Enthalpy-Power-Heat Capacity-Humidity-Mass flow rate-Momentum-Volumetric flow rate-Viscosity-Specific heat-Latent heat- Surface Tension- Kinematic viscosity- Conversion factors for various fundamental quantities-Mass, Length, Time and Temperature from one system of unit to another system of unit-Conversion factors for various derived quantities-Force, Pressure, Work done, Heat, Power, Viscosity, Heat capacity, Latent heat, Specific heat, Kinematic Viscosity, Surface Tension, Density, Specific volume from one system of unit to another system of unit-Dimensionless groups-Reynolds number, Prandtl number, Nusselt number, Peclet number, Schmidt number, Graetz number, Sherwood number, Stanton number-Conversion of one system of equation into another system.

.

UNIT 2 - Basic Calculations: Duration: 14 Periods (L:7-T:7)

(a) Stoichiometric and composition relationships:

Define Atom, Molecule, Mole, Gram–atom, Gram–molecule, Gram molar volume-Different methods of expressing concentration-Define Molarity, Normality, Molality, PPM, Weight percent, Volume percent, Mole percent, Analyze on dry basis and wet basis-Define Density and Specific gravity, Conversion of specific gravity scales, Variation of density and specific gravity with temperature- Simple problems on all the above topics.

(b) Behavior of ideal gases:

Kinetic theory of gases- Gas laws: Boyle's law, Charles law, Avogadro's law, Derivation of Ideal gas equation-Vander Waal's equation of state, -Ideal gas constant–Derive the value of ideal gas constant in different system of units-Define and explain Dalton's law of partial pressures, Amagat's law of partial volumes for gaseous mixtures-Characteristics of an Ideal gas, Differences between Ideal gas and Real gas-Derive the equation volume % = mole % = pressure % for an ideal gas mixture-Average molecular weight of a gas mixture-Density of a gaseous mixture-simple problems on Raoult's and Henry's Law.

(c) Vapor Pressures:

Vapor pressure, Relation between vapor pressure and boiling point-Effect of temperature on vapor pressure-Methods of vapor pressure determination-Antoine equations, Clausius– Clapeyron equation-Duhring's lines-Ideal solutions and Non-Ideal solutions- Raoult's Law and Henry's Law for solutions-Simple problems on all the above topics.

UNIT 3 - Material balance without chemical reactions: Duration: 12 Periods (L:6-T:6)

Unit operation and Unit Process-Give examples for unit operation and unit processes-Representation of unit operations/unit processes by a process flow chart or a block diagram-Basis for material balances-Terms in the general material balance equation-Tie substance, key component and inert substance-Steps to solve material balance problems-Degrees of Freedom-Steady and un-steady state mass balance-Material balance problems related to Evaporation-Drying-Mixing-Distillation- Extraction and Crystallization-

Thoery; Bypass in continuous chemical processes with examples-Recycle and Purge streams in continuous chemical processes with examples.

UNIT 4 - Material balance with Chemical Reactions: Duration: 10 Periods (L:5-T:5)

Stoichiometry, application of stoichiometry, stoichiometric equations, stoichiometric coefficients and proportions-Limiting component-Excess reactant- % conversion and % yield in a chemical reaction system-Degree of completion in a chemical reaction system-Theoretical quantity of reactant-Selectivity of a chemical process-Oxidation of sulphur compounds- Recovery of metals and non-metals from ores-Problems related to all the above concepts.

UNIT 5 - Energy Balance: Duration: 10 Periods (L:5-T:5)

Internal energy and enthalpy-Heat and Work-1st law of thermodynamics-Problems related to 1st law-General energy balance equation for a steady flow process-Sensible heat, Latent heat of Fusion, Latent heat of vaporization-Heat capacity and Specific heat-Importance of mean heat capacity-Problems on heat requirement calculations using $Q = mc_p \Delta T$ and $Q = nc_p \Delta T$-Exothermic, Endothermic, Adiabatic and Isothermal reaction systems-Heat of Reaction, Heat of Formation and Heat of combustion-Heat of Solution, Heat of Neutralization, Heat of mixing and Heat of crystallization.

UNIT 6 - Combustion process: Duration: 08 Periods(L:4-T:4)

Distinguish between Partial and Complete Combustion-Calorific values (Gross and Net Calorific values)-Calorific value of a fuel using Dulong's Formulae-Net hydrogen-Combustion problems related to refuse analysis-Proximate and ultimate analysis of coal-Composition of flue gas obtained after combustion of a fuel-Air requirement for combustion of a specific fuel-Compositions of fuel and flue gases, and calculate the flue gas analysis using fuel analysis-Fuel analysis using flue gas analysis for complete combustion and incomplete combustion-Problems related to combustion.

SPECIFIC LEARNING OUTCOMES

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

7.0 Units and Dimensions:

7.1 State physical quantities, derived quantities.
7.2 Uses of different system of units.
7.3 Write dimensional formula of different derived quantities.
7.4 Convert fundamental and derived quantities from one system of units to another system
7.5 Compare different system of units
7.6 Define different dimensionless groups Explain the concepts of pressure and its measurement.
7.7 Solve problems on conversion of one system of units to another

.

8.0 Basic Calculations:

8.1 Define Atom, Molecule, Mole, Gram–atom, Gram–molecule, Gram molar volume, Molarity, Normality, Molality, PPM, Weight percent, Volume percent, Mole percent,

2.2 Analyze on dry basis and wet basis and calculate composition of liquid and solid mixtures.

2.3 State Boyle's law, Charles law

2.4 Define and explain Dalton's law of partial pressures, Amagat's law of partial volumes for gaseous mixtures

2.5 Differentiate between Ideal gas and Real gas., Ideal solutions and Non-Ideal solutions

2.6 Solve the problems to express the compositions of liquids and solids, to determine the equivalent weight, normality, molarity, molality.

2.7 Solve the problems to express the compositions of liquids and solids, to determine the weight%, volume%, mole%, density

2.8 Derive the equation volume % = mole % = pressure % for an ideal gas mixture.

2.9 Determine vapor pressure

2.10 State Raoult's law and Henry's law for solutions
2.11 Solve problems by applying Ideal gas law to determine the density and average molecular weight of the gaseous mixtures at the given temperature and pressure
2.12 Solve problems to calculate compositions of gaseous mixtures and solutions

9.0 Material balance without chemical reactions:

3.1 Explain unit operation and unit process with examples.
3.2 Draw process flow chart or a block diagram for representing unit operations/unit processes.
3.3 Select the basis for material balances.
3.4 Define and explain tie substance, key component and inert substance.

3.5 Apply steady state mass balance to various unit operations.

3.6 Solve material balance problems related to evaporation, drying, distillation, extraction and Crystallization.

3.7 Demonstrate Bypass, Recycle, and Purge streams in continuous chemical processes

4.0 Material balance with chemical reactions:

4.1 Apply principles of stoichiometry to solve material balance problems.
4.2 Select limiting component and excess reactant.
4.3 Calculate % conversion and % yield in a chemical reaction system.
4.4 Calculate theoretical quantity of reactant.
4.5 Solve problems related to oxidation of sulphur compounds.
4.6 Solve problems related to recovery of metals and non-metals from ores.
4.7 Analyse chemical reactions and apply material balance to processes involving chemical reactions

5.0 Energy balance:

5.1 Explain the terms internal energy and enthalpy, 1^{st} law of thermodynamics
5.2 Derive the general energy balance equation for a steady flow process.
5.3 Define the terms sensible heat, latent heat of fusion, latent heat of vaporization, Heat capacity
5.4 Solve problems on heat requirement calculations, using $Q = mc_p \Delta T$ and $Q = nc_p \Delta T$

5.5 Define and explain Heat of Reaction, Heat of Formation and Heat of combustion.
5.6 Define Heat of Solution, Heat of Neutralization, Heat of mixing and Heat of crystallization.
5.7 Apply energy balance to solve problems

6.0 Combustion process:

6.1 Distinguish between Partial and Complete Combustion.
6.2 Define and explain Calorific values (Gross and Net Calorific values).
6.3 Calculate the calorific value of a fuel using Dulong's Formulae.

6.4 Solve combustion problems related to refuse analysis.
6.5 Explain the proximate and ultimate analysis of coal.

6.6 Calculate the air requirement for combustion of a specific fuel.

6.7 Apply combustion principles to calculate the compositions of fuel and flue gases,

6.8 Compose flue gas analysis using fuel analysis.

6.9 Calculate the fuel analysis using flue gas analysis for complete combustion and incomplete combustion.

Suggested Student Activities

1. Each student will give an activity to prepare a tabulated summary for different system of units and conversion of some quantities into one system of unit to another.

2. Solve problems related to basic concept of chemical calculations
3. Study and report the Combustion appliances other than mentioned in the syllabus
4. Solve problems related to Material balance and apply it to chemical processes
5. Solve problems related to energy balance
6. Quiz and Group discussion
7. Surprise test

Recommended Books

S.No.	Book Title	Author	Publications
1	Chemical Process Principles	1. Olaf A. Hougen 2. Kenneth M.Watson	Asia Publishing House
2	Basic Principles and calculations in Chemical Engg	1. David M.Himmel Bleau	
3	Introduction to Stoichiometry	1. K.A.Gavhane	Nirali Prakashan
4	Stoichiometry and Process Calculations	1. K.V.Narayanan 2. B.Lakshmikutty	Prentice Hall of India Pvt Limited, New Delhi
5	Stoichiometry (SI Units)	1. B.I.Bhatt 2. S.M.Vora	Tata McGraw-Hill Publishing company Limited, New Delhi
6.	Process Calculations	1. V.Venkataramani 2. N.Anantharaman	Prentice Hall of India

e-Learning links:

1. **http://nptel.ac.in**
2. www.flow master.com

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	Memorise and apply the units and conversions.	R/U/A	1,2,3,10	06
CO2	Calculate the composition of liquid and solid mixtures and apply the principles of behaviour of ideal gases and gaseous mixtures in solving chemical process calculations	R/U/A	1,2,3,10	14
CO3	Apply material balance and solve problems on material balance with and without chemical reactions.	R/U/A	1,2,3,10	22
CO4	Apply principles of energy balance and solve problems to calculate heat requirement, heat of reaction and heat of formation	R/U	1,2,3,5,10	10
CO5	Apply the mechanism of combustion, heating values of fuels and perform calculations	R/U/A	1,2,3,4,5,6,10	08
				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			Q7,Q8	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 III semester Mid Semester-I Examination

Course Code: 18CH-305C **Duration: 1 hour**
Course Name: Material & Energy Balance **Max.Marks : 20**

PART-A

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

5) Write the dimensional formulae of molar Heat capacity

6) Convert 1400 lb/ ft^3 into S.I Units.

3).Write about the Brix Scale.

4). Calculate the equivalent weight of H_3PO_4.

PART-B

Answer **two** questions. Each question carries three marks **2x 3 = 6 Marks**

5(a) Write any two dimensionless groups and prove that they are dimensionless.

(or)

5(b) A sample of caustic soda flakes contains 74.6 % Na_2O by weight. Determine the purity of the flakes.

6(a) Find the equivalent moles of Na_2SO_4 in 640 gm of $Na_2SO_4\ 10H_2O$ crystals

(or)

6 (b) Define Raoult's law and Henry's law for solutions.

PART-C

Answer **two** questions. Each question carries five marks **2x 5 = 10 Marks**

7(a) A gas mixture has the following composition by volume SO_2 - 9.5 % , N_2 - 81.5 %, and Oxygen O_2 - 9% . Find a).Average molecular weight of gas b) the density of gas mixture at 373 K and 205.65 K Pa.

(or)

7(b) A gas mixture has the following composition by volume:

CO_2 - 10 %, CO= 12.5 %, O_2 = 6 % , H_2O = 5% , CH_4 = 1% and N_2 - 66 %,

Calculate a). Average molecular weight of gas mixture.

8 (a) An aqueous solution is prepared by dissolving 43 Kg of K_2CO_3 in 100 Kg of water at 293 K. Calculate morality, molality and normality of solution.

Density of the solution is 1.3 Kg / lit.

(or)

8(b). (i). Define Gram atom and Gram mole.

(ii). Aqueous solution of triethanolamine (TEA) i.e., $N(CH_2CH_2OH)_3$, contains 50% TEA by mass. Find the molarity of the solution if the density of the solution is 1.05 kg/l.

State Board of Technical Education and Training, Telangana

Model Question paper
DCHE III semester Mid Semester-II Examination

Course Code: 18CH-305C **Duration: 1 hour**
Course Name: Material & Energy Balance **Max.Marks : 20**

PART-A

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

8. Draw the block diagram for extraction.
9. Write the steps in doing material balance problem.
10. What is theoretical air and excess air?
11. Define conversion.

PART-B

Answer **two** questions. Each question carries three marks **2x 3 = 6 Marks**

5(a) Draw the block diagram for distillation and write material balance equations

(or)

5(b) An evaporator is fed with 10000 kg/h of weak liquor containing 5% by weight caustic soda and is concentrated to get thick liquor containing 30% solids by weight. Find the evaporation of water and thick liquor produced.

6(a) In the manufacture of SO_3, 50 Kmol of SO_2 and 150 K.mol of air is fed to reactor. Find the excess air used

(or)

6(b) Define the following with examples a). Limiting component b). Excess reactant

PART-C

Answer **two** questions. Each question carries five marks **2x 5 = 10 Marks**

7(a). A 5000 Kg of mixture of Benzene , Toluene , containing 50 mole % Benzene is distilled to get an overhead product containing 95 mole % benzene and residue containing 90 mole % Toluene. Find the weights of Benzene and Toluene in Feed , distillate and residue or bottoms.

(or)

7(b) The waste acid from a nitrating process plant containing HNO_3 - 20 % , H_2SO_4 - 55 % by weight. It is to be concentrated by addition of concentrated sulfuric acid - 95 % and nitric Acid - 90 % to get desired mixed acid containing 36 % Nitric Acid, and 60 % sulfuric acid. Find the quantities of waste and concentrated acids that are required for 1000 Kg of desired mixed acid.

8(a) The analysis of the gas entering the secondary converter in a contact sulfuric acid plant SO_2 – 4 % , O_2 – 13 % and N_2 – 83 % by volume. The gas leaving the converter is found to contain 0.45 % SO_2

– on SO_3 – free basis.

Calculate i). The percentage of SO_2 entering the converter getting converted to SO_3

ii). The analysis of gases leaving the converter

(or)

8(b) A mixture of pure carbon dioxide and hydrogen is passed over a nickel catalyst .The temperature of the bed is 588 K and the reactor pressure is 2.02 M. Pa g. The gas mixture leaving the reactor is analysed to contain 57.1 % CO_2 , 41.1 % H_2, 1.68 % CH_4 and 0.12 % CO by volume on a dry basis. The reactions taking place in the reactor are:

$$CO_2 + 4\,H_2 \longrightarrow CH_4 + 2\,H_2O$$

Find a). Conversion of CO_2 b). Yield of CH_4 in terms of CO_2 reacted

State Board of Technical Education and Training, Telangana
Model Question paper
DCHE III Semester
Semester End Examination

Corse Code:18CH-305C **Duration:2 hours**
Course Name: Material and Energy Balance **Max.Marks:40 Marks**

PART-A

Answer **all** questions 8**x1 =8 Marks**

1. Define molality and normality.
2. Define yield.
3. Write the equation to calculate standard heat of reaction from heats of formation?
4. Draw the block diagram for evaporation.
5. Define Heat of Neutralization
6. Define Latent heat of vaporisation.
7. Define calorific value.
8. What is Complete combustion?

PART-B

Answer **four** questions **4 x 3 = 12 Marks**

9(a). Convert the following into S.I Units. i). 4000 lb/ ft^3 ii). 1680 mm Hg.

(or)

9(b). The amount of heat transferred in heating the pure Ethylene from 303 K to 523 K at atmospheric pressure is 12142.35 K J / K mol. Find the amount of heat required for 7 k mol and specific heat of the Ethylene in the given temperature range.

10(a). 100 k mol of SO_2 and 50 k mol of oxygen are fed to reactor. If the conversion of SO_2 is 65 % find i). moles of SO_2 reacted ii).moles of SO_3 formed

(or)

10(b). Define theoretical air, excess air and % excess air in combustion.

11(a) Define standard heat of formation and standard heat of reaction.

(or)

11(b) Calculate the heat needed to raise the temperature of 1 kmol of ammonia from 311^0K to 422^0K using mean molal heat capacity.

Cp_m for NH_3 between 311 K and 298K = 35.8641 kJ / kmol.K

Cp_m for NH_3 between 422 K and 298K = 37.7063 kJ / kmol.K

12(a) Define GCV and NCV. How do you calculate GCV from NCV?

(or)

12(b) A fuel has the following composition: C – 74%, H_2 - 5%, O_2 – 5%, S – 1%. Find the theoretical air required for complete combustion.

PART-C

Answer **four** questions 4 **x 5 = 20 Marks**

13(a). By electrolyzing a mixed brine a mixture of gases is obtained at the cathode having the following percentage composition by weight: Cl_2 - 66, Br_2 - 28, O_2 – 6

Using the ideal gas law, calculate

(i).Average molecular weight of the gas mixture (ii).Composition of the gas by volume

(iii).Density of the mixture in grams per liter at 28^0C and 740 mm of Hg pressure

(or)

13(b) Calculate the standard heat of reaction of the following reaction at 298 K.

$$C_5H_{12}\ (g) + 8\ O_2\ (g) \longrightarrow 5CO_2\ (g) + 6\ H_2O\ (l)$$

The standard heats of formation of the components are:

S.No.	Component	Heat formation ΔH^0_f kJ / mol
1	CO_2 (g)	- 393.519
2	H_2O (g)	- 241.818
3	C_5H_{12} (g)	- 146.66

14(a) A 5000 Kg of mixture of Benzene , Toluene , containing 50 mole % Benzene is distilled to get an overhead product containing 95 mole % benzene and residue containing 90 mole % Toluene. Find the weights of Benzene and Toluene in Feed, distillate and residue or bottoms.

(or)

14(b). The GHV of gaseous Propane at 298 k is 2219.71 K J / mol. at 298 K . Calculate NHV in KJ / mol and KJ / Kg , Latent heat of water vapor at 298 K = 2445.5 K J / Kg.

15(a) Calculate the heat required to raise the temperature per k mol of pure SO_2 from 300 K to 1000 K .

Data : $C_p = 43.458 + 10.634 \times 10^{-3}\ T - 5.945 \times 10^5 / T^2$

(or)

15(b) Calculate the standard heat of reaction at 298.15 K when gaseous ammonia is dissolved in water to form 2 % by wt. ammonia solution.

S.No.	Component	Heat formation H^0_f, k J / mol
1	NH_3 (g)	- 49.94
2	$NH_4OH_{(l)}$	- 361.20
3	H_2O	- 285.83

16(a) The Orsat analysis of the flue gases from a boiler house chimney by volume is as given below CO_2 – 11. 4 % , O_2 – 4.2 % and N_2 – 84.4 % by volume.

Assuming complete combustion, Calculate the % excess air and C : H ratio in the fuel.

(or)

16(b) The Ultimate analysis of residual fuel oil (RFO) sample is as given below by weight :

C – 88. 4 % , H – 9 . 4 % S – 2.2 %.

It is used as a fuel in a power generating boiler with 25 % excess air. Calculate (i). Theoretical dry air requirement (ii). The actual air supplied (iii). The Orsat analysis of flue gases.

GENERAL CHEMICAL TECHNOLOGY LAB PRACTICE

Course Title:	**General Chemical Technology Lab Practice**	**Course Code**	**18CH 306P**
Semester	**III**	**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.

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	Analyse the different types of water for various parameters and characters.	1,2,3,4.8,10	U,A	1,2,3,7,8,10	15
CO2	Analyse common salt for chloride content	1,2,3,4,5,6	U,A	1,2,3,7,8,10	12
CO3	Analyse bleaching powder for chlorine.	1,2,3,4,7,8,9, 10	U, A	1,2,3,6,7,8,10	6
CO4	Estimation of percentage loss on ignition and SiO_2, CaO in a sample of Portland cement	1,2,3,4,5,6,7,8,9,10	U, A	1,2,3,4,6,7,8, 10	12

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Determination of total solids in ppm in tap water/Sea water.	3
2	Estimation of dissolved solids p.p.m in tap water/sea water	4
3	Determination of the total hardness & permanent hardness in water by EDTA method	4
4	Determination of the total hardness and permanent hardness in water by soap solution method	4
5	Estimating of chlorides content present in common salt.	6
6	Determination of sulphates content in a given sample.	6
7	Determine the available chlorine in the given sample of Bleaching powder.	6
8	Estimate the percentage loss on ignition in sample of Portland cement.	6
9	Determination of SiO_2.	3
10	Analysis of CaO in Portland cement	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. Write the procedure of the experiment before the commencement of each experiment.
6. Strict following of instructions given at 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
5. Instrument methods of analysis Chathan & Sharma

Electrical Technology Lab Practice

Course Title	**Electrical Technology Lab Practice**	Course Code	**18CH307P**
Semester	III	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	7.5:0.0:30	Credits	1.5
Methodology	Lecture+Practice	Total Contact Hours :	37.5Hrs/45Pds
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic skills of Handling Domestic tools, this course also requires the basic knowledge of basic mathematics at secondary school level.

COURSE CONTENTS

I Verify Network Laws & Theorems Measurement of Power

1. Verify Ohm's Law
2. Verify Kirchoff's current Law
3. Verify Kirchoff's Voltage law
4. Measurement of power in D.C circuit consisting of resistance in a)series b) parallel

II Calibration of meters

5. Calibrate single phase Energy meter
6. Study of starters a) 3-point starters b)D.O.L staters c) star/delta starters

III Perform Speed control of DC Shunt Motor

7. a) Armature / Rheostatic control method
   b) Field control method

IV Measurement of line voltage and line current in star and delta connected load and measurement of primary and secodary voltages in a transformer

8. Measurement of line voltage and line current in a) star and b)delta connected load
9. measure the primary and secondary voltages of step-up transformers and step down transformers

V Identification of teminals in a given motor and single phase circuit wiring

10. a) identify the terminals of a suirrel cage induction motor and run the motor by star/delta strter and measure the speed and different loads

    b) identify the terminals of starting winding and running winding of a 1-phase capacitor start in induction motor and run the motor by D.O.L starter and measure the speed and different loads

11. single –phase circuit wiring (single lamp controlled by a single way switch and single lamp controled by a two two way swich)

FLUID MECHANICS LAB PRACTICE

Course Title:	FLUID MECHANICS LAB PRACTICE	Course Code	18CH 308P
Semester	III	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 Momentum transfer and Chemical Process calculations

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	Distinguish laminar and turbulent flow	1,10	U,A	1,2,3,8,10	6
CO2	Identify different heads and prove Bernoulli's theorem	2	U,A	1,2,3,8,10	6
CO3	Determines the frictional losses in pipes and fittings	3	U, A	1,2,3,6,8,10	6
CO4	Apply the knowledge of principle for determination of discharge coefficients of flow metres	4,5,6	U, A	1,2,3,4,6,8,10	12
CO5	Calculate the pressure drop for flow through packed bed and fluidized bed	7	U,A	1,2,3,8,9,10	6
CO6	Evaluate the characteristics of pumps	8	U,A	1,2,3,8,9,10	9

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Identification of laminar & turbulent flow using Reynold's apparatus	3
2	Conduct an experiment on Bernoulli's apparatus and verify Bernoulli's theorem	6
3	Determination of friction losses in various pipe fittings.	6
4	Conduct an experiment on Orifice meter and determine the coefficient of discharge	6
5	Conduct an experiment on Venturi meter and determine the coefficient of discharge	3
6	Calibration of a given Rotameter	3
7	Determination of Pressure drops in a packed bed and fluidized bed for different fluid velocities	6
8	Determination of Characteristics of a Centrifugal Pump.	6
9	Demonstration of various pipe fittings and valves with cut models.	3
10	Draw the graph between f Vs N_{Re} in Laminar and Turbulent flow conditions.	3

Specific Learning Outcomes

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

1. Distinguish laminar and turbulent flow
2. Identify different heads
3. Determine the frictional losses in pipes and fittings
4. Apply the knowledge of principle for determination of discharge coefficients of flow meters
5. Calculate the pressure drop for flow through packed bed and fluidized bed
6. Demonstrate various pipe fittings and valves
7. Design Packed bed
8. Determine Characteristics of a Centrifugal Pump.
9. Choose a given pump for specific application

Suggested Student Activities

1. List out any five pressure measuring devices available in market with its specifications and current market price.

2. Each student will give an activity to prepare a tabulated summary for types of fluids, pipes and pipe fittings available in market. (Summary includes type, specification, size range, material, rate and applications).
3. Collect information regarding different types of pumps available in the market for a specific duty and prepare a tabulated summary including type, specifications, size, advantages, disadvantages, cost, applications etc
4. Group discussion & Quiz

Reference :

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. Particle Technology and Separation Processes, Coulson J.M. and Richardson J.F., 4th Edition.

4. Perry's Chemical Engineers' Handbook, McGraw Hill

Suggested E-Learning references

3. **http://nptel.ac.in**
4. www.flow master.com
5. www.vlab.co.in
6. Pipeflow.co.uk

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.	Identification of laminar & turbulent flow using Reynold's apparatus	3	15	10	15	40	100
2.	Conduct an experiment on Bernoulli's apparatus and verify Bernoulli's theorem	6	15	10	15	40	100
3.	Determination of friction losses in various pipe fittings.	6	15	10	15	40	100
4.	Conduct an experiment on Orifice meter and determine the coefficient of discharge	6	15	10	15	40	100
5.	Conduct an experiment on Venturi meter and determine the coefficient of discharge	3	15	10	15	40	100
6.	Calibration of a given Rotameter	6	15	10	15	40	100
7.	Determination of Pressure drops in a packed bed and fluidized bed for different fluid velocities	6	15	10	15	40	100
8.	Determination of Characteristics of a Centrifugal Pump.	6	15	10	15	40	100
	Total	45					

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 III Semester practical Examination

Corse Code: 18CH-308P **Duration:3 hours**

Course Name: Fluid Mechanics 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. Identify laminar & turbulent flow using Reynold's apparatus.
2. Conduct an experiment on Bernoulli's apparatus and verify Bernoulli's theorem.
3. Calibrate the given Rotameter.
4. Conduct an experiment on Orifice meter and determine the coefficient of discharge.
5. Determine the coefficient of discharge on Venturi meter.
6. Determine friction losses in various pipe fittings.
7. Determination of Pressure drops in a packed bed for different fluid velocities.
8. Determination of Pressure drops in a fluidized bed for different fluid velocities
9. Conduct an experiment and determine the Characteristics of a Centrifugal Pump.
10. Draw the graph between f Vs N_{Re} in Laminar and Turbulent flow conditions.

APPLIED CHEMISTRY LAB

Course Title	**APPLIED CHEMISTRY LAB**	Course Code	**18 CH-309P**
Semester	**III**	Core/Elective	**Core**
Teaching Scheme(L:T:P)	**1:0:2 periods**	Credits	**1.5**
Type of Course	**Tutorial & practical**	Total Contact Hours	**45 periods**
CIE	**60 Marks**	SEE	**40 Marks**

Course Objectives:

To provide practical knowledge about the Reactions of certain classes of Organic compounds and Identification of Organic compound.

Prerequisite:

Practical knowledge about the basics of preparation of chemical solutions and volumetric analysis of chemical compounds.

Course Outcomes:

On successful completion of the course, the student will have ability to attain CO:

	COURSE OUTCOME	**CL**	**LINKED PO**	**TEACING PERIODS**
CO1	Determination of the Melting & Boiling points of the given samples of organic compounds	U/A	1,2,3,8	06
CO2	Reactions of the functional groups of organic compounds	U/A	1,2,3,8	18
CO3	Identification of the given Organic compound sample by systematic	U/A	1,2,3,8	21
	Total Periods			**45**

Course Delivery:

The course will be delivered through lectures, classroom interaction, group discussion, demonstration and practicals.

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

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

COURSE CONTENTS:

1. Determination of Melting point and Boiling point of the given samples of organic compounds
2. **Reactions of the following functional groups present in organic compounds.**
   Alcohols, Aldehydes, Ketones, Carboxylic acids and Amines
3. Identification of Organic compound by systematic analysis

SPECIFIC LEARNING OUTCOMES:

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

1. Determine the Melting point of the given samples of organic compounds
2. Determine the Boiling point of the given samples of organic compounds
3. **Conduct the Reactions of the following functional groups present in organic compounds.**
   Alcohols, Aldehydes, Ketones, Carboxylic acids and Amines
4. Identify the given Organic compound sample by systematic analysis
   a) Preliminary Examination
   b) Ignition test
   c) Solubility test
   d) Test for unsaturation
   e) Functional group test
   f) Infer the functional group & confirm the organic compound

Suggested Student Activities:

1. Each Student prepares a chart of reactions of various classes of Organic compounds to identify them
2. Quiz
3. Seminar

Reference Books :

1. Vogel`s Organic Qualitative and Quantitative Analysis.
2. Qualitative and quantitative analysis byAlex
3. Practical organic chemistry –F.G. Mann
4. Practical Chemistry -O.P.Pandey, D.N. Bajpai, S. Giri

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	5
4	Observation and Results	3
5	Viva-voice	5
Total		20

Scheme of Valuation for SEE :

Sl. No.	Particulars	Marks
1	Identification of apparatus/equipment/chemical compounds/tools/etc.	05
2	Writing Procedure	10
3	Conducting of experiment	10
4	Observation and Results	05
5	Viva-voice	10
Total		40

Model Paper for Mid-I

BOARD DIPLOMA EXAMINATION, (C-18)
DIPLOMA IN CHEMICAL ENGINEERING: III- SEMESTER
APPLIED CHEMISTRY LAB 18-CH -309 P

Time : **2** Hrs Total Marks :20Marks

Instruction: Candidate has to do any ONE of the following experiment allotted by the examiner.

1. Determine the M.P of the given Organic compound
2. Determine the B.P of the given Organic compound
3. Conduct the tests of the functional group of the given alcohol
4. Conduct the tests of the functional group of the given aldehyde.

Model Paper for Mid-II

BOARD DIPLOMA EXAMINATION, (C-18)
DIPLOMA IN CHEMICAL ENGINEERING: III- SEMESTER
APPLIED CHEMISTRY LAB 18-CH -309 P

Time : **2** Hrs Total Marks :20Marks

Instruction: Candidate has to do any ONE of the following experiment allotted by the examiner.

1. Conduct the tests of the functional group of the given ketone
2. Conduct the tests of the functional group of the given Carboxylic acid
3. Conduct the tests of the functional group of the given alcohol

Model Paper for SEE

BOARD DIPLOMA EXAMINATION, (C-18)
DIPLOMA IN CHEMICAL ENGINEERING: III- SEMESTER
APPLIED CHEMISTRY LAB 18-CH -309 P

Time : 3 Hrs Total Marks :40Marks

Instruction: Candidate has to do the following experiment allotted by the examiner.

1. Identify the given Organic compound sample by systematic analysis

Communication Skills and Life Skills

Course Title	**Communication Skills and Life Skills**	Course Code	**18 Common 310 P**
Semester	**III**	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 communication skills and life skills to the students of diploma which will help them a great deal in personal and professional fronts.

Prerequisites:

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

Course Outcomes:

	At the end of the course the students will have the ability to:
Listening Skills	Identify the main or the central idea. Listen for specific details. Learn the pronunciation.
Communication Skills – I	Learn relevant vocabulary to make introductions. Learn to introduce oneself in formal and informal situations. Learn vocabulary and expressions useful for describing objects Describe objects
Communication Skills – II	Learn vocabulary to talk about the past Describe the incidents that happened in the past Learn the techniques of organising the matter / content for one-minute speech. Speak fluently and accurately using appropriate body language.
Life Skills – I	Think positively. Develop positive attitude. Overcome negative attitude. Know the importance of setting goals.

	Set goals using SMART features.
Life Skills – II	Know the reasons for a problem. Learn to overcome problems. Learn the various techniques to solve the problems. Learn to make proper decisions on time. Think 'out of the box'. Learn to be creative. Think innovatively. Think critically.
Life Skills – III	Know how to be a leader. Learn the qualities of a good leader. Learn the qualities of a good team. Learn the advantages and disadvantages of a team. Manage time effectively. Learn various time management techniques. Learn the importance of prioritisation.

CO-PO Matrix

	Course Outcome		Linked PO
CO 1	Listening for main idea and specific details	**R/U/A**	**1, 2, 3, 4, 5,7,8, 9,10**
CO 2	Introduce oneself and Describe Objects	**R/U/A**	**1,2,3,8,9,10**
CO 3	Talk about the past and speak fluently for one minute	**R/U/A**	**1,2,3,7,8.9,10**
CO 4	Develop positive attitude and set short term and long term goals	**R/U/A**	**1,2,3,7,8,9,10**
CO 5	Learn to solve a problem, make decisions and think innovatively	**R/U/A**	**1,2,3,7,8,9,10**
CO6	Learn to become a good team member and leader	**R/U/A**	**1,2,3,7,8,9,10**

Course Contents:

I. Listening Skills **Duration: 9**

1. Listening – I
    - Digital Camera
    - A Dialogue
    - Wild Animal / Human conflict
2. Listening – II
    - A Recipe
    - A Telephone conversation
    - An Interview

II. Communication Skills – I **Duration:6**

3. Introducing Oneself
4. Describing Objects

III. Communication Skills – II **Duration:6**

5. Talking About the Past
6. Just A Minute

IV. Life Skills – I **Duration:6**

7. Attitude
8. Goal Setting

V. Life Skills – II **Duration:9**

9. Problem Solving and Decision-Making Skills
10. Critical Thinking & Creativity

VI. Life Skills – III **Duration:9**

11. Leadership and Teamwork
12. Time Management

Suggested Student Activities:

- Listening Comprehension
- Seminars
- Paper Presentations
- Line ups for introducing oneself
- Describing persons / places / things
- Picture description
- Role Plays
- Dumb charades
- What is in the bag? (Identify the objects)
- Games using Online Dictionaries
- Sharing the information using emails, chats and groups
- Just A Minute
- Writing diary events
- Find a solution to the problem
- Making innovative things through recycling
- Creating advertisements
- Five-minute activities on Life Skills
- Watching videos on life skills and making presentations
- Case studies

Evaluation Pattern:

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

a. **Mid Sem- I** 20 marks
Syllabus:

i. Listening Skills
ii. Communication Skills - I

b. **Mid Sem – II** 20 Marks
Syllabus:
i. Communication Skills - II
ii. Life Skills - I

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. Listening: 10 Marks
b. JAM or Role plays: 15 Marks
c. *Viva Voce* on any life skills topic : 15 Marks

References:

Flint, Chrisand Jamie Flockhart*Listening: A2 (Collins English for Life: Skills)*Collins. 2013

Brown, Stephen E. English in Everyday Life. McGraw-Hill Education.2008

Mohanraj, Jayashree. ***Let Us Hear Them Speak: Developing Speaking-Listening Skills in English*.Sage. 2015**

Susan Earle – Carlin. *Q Skills for Success: Listening and Speaking 5: Student Book with Online Practice*. Oxford University Press. 2013

Kumar, Sanjay and Pushpa Latha. *Communication Skills: A Work Book*. **Oxford University Press. 2018**

Carnegie, Dale. *The Leader in You*. Simon & Schuster: 1995

Carnegie, Dale. *The Art of Public Speaking*. Prabhat Prakashan. NewDelhi.2013

Kaye, Martin. *Goal Setting (Workbook Included): Goals & Motivation: Introduction To A Complete & Proven Step-By-Step Blueprint For Reaching Your Goals (Goal Setting Master Plan 1).* Kindle Edition. MK Coaching.2016.

West, Steven. *Critical Thinking Skills: Practical Strategies for Better Decision making, Problem-Solving and Goal Setting.* **Kindle Edition.2018**

Tracy, Brain. *Goals*. Berret-Koehler PublishersInc. San Francisco. 2017

Tracy, Brain. *Master your Time Master your Life.* Penguin Random House Inc. New York. 2017

Sean Covey . *The 7 Habits of Highly Effective Teens.* Simon and Schuster,2011

E-Learning Resources:

http://www.bbc.co.uk/worldservice/learningenglish/youmeus/learnit/learnitv39.shtml
https://www.examenglish.com/leveltest/listening_level_test.htm
https://www.oxfordonlineenglish.com/listening?utm_referrer=https%3A%2F%2Fwww.google.co.in%2F
https://takeielts.britishcouncil.org/prepare-test/free-ielts-practice-tests/listening-practice-test-1
https://learnenglish.britishcouncil.org/en/listening
https://www.cambridgeenglish.org/learning-english/activities-for-learners/?skill=listening
https://www.businessenglishsite.com/business-english-listening.html

BOARD DIPLOMA EXAMINATION (C-18)

THIRD SEMESTER 18 COMMON-310P

COMMUNICATION SKILLS AND LIFE SKILLS

MID SEM - I

Time : 1 Hour **Total Marks: 20 Marks**

Part – A **10 marks**

1. Listening Comprehension: 5 X 2 = 10

(Teacher should give the questions before reading the passage given below)

Florence Nightingale was an English social reformer and a statistician, and the founder of modern nursing. She was born in Florence, Italy, on May 12, 1820. Part of a wealthy family, Nightingale defied the expectations of the time and pursued what she saw as her God-given calling of nursing during the Crimean War. She and a team of nurses improved the unsanitary conditions at a British base hospital, greatly reducing the death count. Her writings sparked worldwide health care reform, and in 1860 she established St. Thomas' Hospital and the Nightingale Training School for Nurses. A revered hero of her time, she died on August 13, 1910, in London. Nightingale came to prominence while serving as a manager and trainer of nurses during the Crimean War, in which she organized care for wounded soldiers. She gave nursing a favourable reputation and became an icon of Victorian culture, especially in the persona of "The Lady with the Lamp" making rounds of wounded soldiers at night.

Questions:

1. Who was Florence Nightingale?
2. When and where was she born?
3. What does the passage convey?
4. When did she pass away?
5. Where did she establish nursing school?

PART- B **10 Marks**

Instruction: Answer any one of the questions in 150 words.

2. How do you introduce yourself formally in an interview?
3. Describe your polytechnic.

BOARD DIPLOMA EXAMINATION (C-18)

THIRD SEMESTER 18 COMMON-310P

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 in 150 words.

1. Describe how you have spent your summer vacation.

2. What are the features of good JAM presentation? What precautions do you before speaking for one minute on the given topic?

Part – B **10 marks**

Instruction: Answer any one of the following questions in 150 words.

3. What is positive attitude? Give examples of positive attitude from your life.

4. Mention your long term goal with SMART features. How do you achieve it?

BOARD DIPLOMA EXAMINATION (C-18)
THIRD SEMESTER 18 COMMON-310P
COMMUNICATION SKILLS AND LIFE SKILLS
SEMESTER END EXAM

Time : 3 Hours **Total Marks: 40 Marks**

Part – A **10 marks**

1. Listen to the following passage and answer the questions give below it**. 5 X 2 = 10**

(Teacher should give the questions before reading the passage)

Answer the following questions after teacher reads the following paragraph.

Prof. Jayashankar was born to Mahalaxmi and Laxmi Kantha Rao on 6th August 1934 in Akkampet village, Warangal District. He was a Doctorate in Economics. He worked as a Vice-Chancellor of Kakatiya University. He worked in many capacities. He was popularly known as "Pedda Sir." He inspired many a people to fight for the cause of Telangana Statehood.

At the age of twelve, Jayashankar refused to sing songs in praise of the Nizam and insisted on singing Vande Mataram instead. As an intermediate student, in 1952, he protested against State Reorganization Committee plan to merge with the Andhra Rashtra. He took an active part in the agitations of "Non – Mulki go back" and " Idli Sambar go back." He took an active part in Telangana separate statehood agitation in 1969 too. In 1999, Prof. Jayashankar started the Telangana Development Forum in the USA which helped to propagate the injustice, discrimination and exploitation meted out to Telangana region and people in the aspects of employment, funds and water resources. He relentlessly put his efforts to end the struggle of Telangana people. He passed away on June 21, 2011. He was 76 years old at the time of his death.

Questions:

1. Where was Prof. Jayashankar born?
2. Why didn't he sing songs in praise of the Nizam?
3. Why did Jayashankar start the Telangana Development Forum in USA?
4. What are the two agitations in which he took an active part?
5. What is the meaning of 'relentlessly'?

Part – B **15 marks**

2. JAM / Role Plays

Part – C **15 marks**

3. Viva Voce on Life Skills topics

DCHE- III- SEMESTER

Suggested Student Activities

1. Student visits Library to refer Standard Books on Mathematics and collect related material
2. Visit near by substation to examine and interpret the use of Electrical machinery and equipment
3. List out any five pressure measuring devices available in the market with its specifications and current market price.
4. Prepare a tabulated summary for types of fluids, pipes and pipe fittings available in market. (Summary includes type, specification, size range, material, rate and applications).
5. Collect information regarding different types of pumps available in the market for a specific duty and prepare a tabulated summary including type, specifications, size, advantages, disadvantages, cost, applications etc
6. Student is encouraged to participate in Tech fest/Srujana fest to evolve any novel method of water supply systems
7. Prepare/Download a dynamic animation to illustrate the working principle of hydraulic pumps.
8. Prepare a tabulated summary for preparation, properties and uses of various aliphatic and aromatic compounds
9. Each student will give an activity to prepare a tabulated summary for different system of units and conversion of some quantities into one system of unit to another.
10. Familiarize with basic concept of chemical calculations
11. Study and report the Combustion appliances other than mentioned in the syllabus
12. Maintenance of apparatus and equipments in the Laboratory, while being careful with acids, following the Do`s and Don'ts.
13. Identify and explain various natural processes, exothermic and endothermic reactions in our daily life.
14. Quiz on IUPAC nomenclature of organic compounds.
15. Prepare chart on classification of Organic compounds, Hydrocarbons
16. Make chart showing preparation and reactions of methane, ethylene and acetylene
17. Write resonance structures of benzene and other aromatic compounds
18. Make chart showing preparation and reactions of various organic compounds
19. Paper/Poster presentation
20. Group discussion on general topics related to subject, environment, society, and life skills
21. Seminars & Paper Presentations
22. Life skills & Communivvcation skills:
    - Listening Comprehension
    - Lineups for introducing oneself , Describing persons/places/things, Picture description
    - Role Plays, Dumb charades, Games using Online Dictionaries, Sharing the information using emails, chats and groups
    - Writing diary events., Find a solution to the problem
    - Making innovative things using unusable things
    - Creating advertisements
    - Five-minute activities on Life Skills

Method of evaluation of the student activities (Rubrics)

Model Rubrics

S.No	Sub activity	Performance			
		excellent	Good	Satisfactory	Need improvement
1	Step-1	Data was collected from more than four sources.	Data was collected from three to four sources	Data was collected from two sources.	Data was collected only one source.
2	Step-2	All materials and data required for the activity were accurately prepared based on the data collected independently.	Almost all materials and data required for the activity were accurately prepared based on the data collected independently.	The materials and data required for the activity were accurately prepared based on the data collected with the help of teacher.	The materials and data required for the activity were inaccurately prepared
3	Step-3	Procedures were outlined in a step-by-step fashion that could be followed by anyone & performed the activity effectively.	Procedures were outlined in a step-by-step fashion, require explanation & performed the activity effectively.	Procedures that outlined were complete with 1 or 2 gaps and require explanation & performed the activity normally	Procedures that outlined were not sequential, & performed the activity in a poor way
4	Step-4	Presented/ explained the information about the activity in logical, interesting sequence with attractive visuals or diagrams.	Presented/ explained the information about the activity in logical sequence with visuals or diagrams.	Presented/ explained the information about the activity in logical sequence with less visuals or diagrams.	Presented/ explained the information about the activity without sequence and visuals or diagrams.
5	Conclusion / summary	Provided a detailed conclusion/ summary clearly based on the data and activity	Provided a conclusion / summary clearly based on the data and activity	Student provided a conclusion/ summary less effectively	Conclusions /summary was not relevant.

Note: Separate rubrics may be prepared according to the activity.

RUBRICS FOR ACTIVITY - (VISIT) PO-08						
Dimension	**Exemplary**	**Good**	**Satisfactory**	**Developing**	**Unsatisfactory**	**REMARKS**
	5	**4**	**3**	**2**	**1**	
Attitude towards visit	Very eager about the about	Showing very much interest when opportunity comes	Showing interest under compulsion	Showing less interest	Reluctant	
Observation at the visit place	Very enthusiastic to know new things	Shows interest on existing things	Observation with less interaction	Observation without interaction	Not observing any thing	
Interaction with new persons at the visit place	Easily mingle and make friendship	Easily mingle	Less mingle	Reserved in nature	Not at all mingle	
Presentation about the visit	Excellent report with good presentation	Good report with fair presentation	Satisfactory report with fair presentation	Sufficient report with poor presentation	Insufficient report and not in order	

	RUBRICS FOR ACTIVITY - (Collection) Indiviual & Team work, Life long learning P-08,P-10					
Dimension	Exemplary	Good	Satisfactory	Developing	Unsatisfactory	
	5	4	3	2	1	
Subject/ Topic coordination	Concept linked to topic with advanced knowledge	Concept linked to topic with little knowledge	Concept linked to topic only	Concept not linked and not clear	Not at all linked with topic	
Sources used for the topic	Different sources with latest information	Different sources with sufficient information	Single source with limited information	Reproduced matter	Copied from others	
Quality and Quantity of the material /model /sample	Excellent in quality with enough quantity	Good quality with enough quantity	Appreciable in quality and quantity	Insufficient in quality and quantity	Irrelevant to the assigned topic/ Not submitted	
<u>Presentation ORAL/DOCUMENT</u>	Highly receptive/ Highly Exemplary	Receptive/ Exemplary	Moderately receptive/ Moderate	Mediocre/ Not in orientation	Non receptive Abstract/ Distorted	

RUBRICS FOR SEMINAR / INDIVIDUAL PRESENTATION P0-08,09						
Dimension	Exemplary	Good	Satisfactory	Developing	Unsatisfactory	
	5	4	3	2	1	
Personal Disposition	Poise	Disposition	Stance	Gait	Un pleasant	
Diction	vocabulary	continuous	confident	Lipsing	gibberish	
content	Thought Provoking	Alacrity	placid	Good	Insufficient inputs	
Interaction	Profound Reply	Ability to satisfy	Ability to respond	Misleading	evading	

	RUBRICS FOR GROUP DISCUSSION P-08,P-09,P-10					
Dimension	Exemplary	Good	Satisfactory	Developing	Unsatisfactory	
	5	4	3	2	1	
Participation towards the Topic	Initiative & Extempo	Contradictory	Pro initiative	Passive	Non inclined	
Dessimation of information	Updated presentation	Chronological	Only established facts	Misinterpretation of Facts	Distorted Dessimation	
Presence of mind	Focussed	Confident	Wavered	Confused	Vague	
Summation	Trouble shooter	Balanced	Convincing	In coherent	Mute spectator	

	RUBRICS FOR Group Discussion/seminar PO-05 & PO-06 ENVIRONMENT &SOCIETY					
Dimension	Exemplary	Good	Satisfactory	Developing	Unsatisfactory	
	5	4	3	2	1	
Awareness about the environment	Compassion	Concern	Responsibility	Compulsive	Irresponsible	
Concern towards the environment	Eco friendly	Close to nature	Recycle	Ignorant	Negligent	
Implementation	Penchant(craving)	Involvement	Commitment	No self motivation	Disinterested	
sustainability	Innovative	Incorporative	Practicing	Non reliable	irresponsible	