STATE BOARD OF TECHNICAL EDUCATION, BIHAR

Scheme of Teaching and Examinations for

IIIrd SEMESTER DIPLOMA IN CHEMICAL ENGINEERING

(Effective from Session 2020-21 Batch)

THEORY

Sr. No.	SUBJECTS	SUBJECT CODE	TEACHING Periods per Week	EXAMINATION – SCHEME							Credits
				Hours of Exam.	Teacher's Assessment (TA) Marks (A)	Class Test (CT) Marks (B)	End Semester Exam. (ESE) Marks (C)	Total Marks (A+B+C)	Pass Marks ESE	Pass Marks in the Subject	
1.	Introduction to Chemical Engineering	2014301	03	03	10	20	70	100	28	40	03
2.	Chemical Process Calculations	2014302	04	03	10	20	70	100	28	40	04
3.	Industrial Chemistry	2014303	03	03	10	20	70	100	28	40	03
4.	MechanicalOperation	2014304	03	03	10	20	70	100	28	40	03
5.	Momentum Transfer	2014305	04	03	10	20	70	100	28	40	03
	Total:- 17						350	500			16

PRACTICAL

Sr. No.	SUBJECTS	SUBJECT CODE	TEACHING SCHEME Periods per Week	EXAMINATION – SCHEME					Credits
				Hours of Exam.	Practical (ESE)		Total Marks (A+B)	Pass Marks in the Subject	
					Internal (A)	External (B)			
6.	Momentum Transfer Lab	2014306	02 50% Physical 50% Virtual	03	15	35	50	20	01
7.	Mechanical OperationLab	2014307	02 50% Physical 50% Virtual	03	15	35	50	20	01
8.	Web Technology Lab	2018308	02 50% Physical 50% Virtual	03	07	18	25	10	01
	Total: - 06						125		03

TERM WORK

Sr. No.	SUBJECTS	SUBJECT CODE	TEACHING Periods per week	EXAMINATION – SCHEME				Credits
				Marks of Internal Examiner (X)	Marks of External Examiner (Y)	Total Marks (X+Y)	Pass Marks in the Subject	
9.	Development of Life Skills-II (TW)	2014309	04	15	35	50	20	02
10.	Professional Practices-III (TW)	2014310	04	15	35	50	20	02
11.	Python	2018311	02	07	18	25	10	01
	Total: - 10					125		05
Total Periods per week Each of duration One Hours = 33						Total Marks = 750		24

INTRODUCTION TO CHEMICAL ENGINEERING

SUBJECT CODE: 2014301	Theory			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	100	
	L	T	P/S	ESE	:	70	03
	03	-	-	T.A.	:	20	
				C.T.	:	10	

Course Learning Objectives:

- To give a comprehensive knowledge on various aspects practiced in chemical engineering.
- To give the sources of information on related topics.

Course Content:

UNIT I	Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.
UNIT II	Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.
UNIT III	Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipment's; Flowsheet representation of process plants,
UNIT IV	Role of Computer in Chemical Engineering; Chemical Engineering Software; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc.
UNIT V	Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

REFERENCE BOOKS:

1. S. K. Ghosal, S. K., Sanyal and S. Datta, "Introduction to Chemical Engineering", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. Pushpavanam.S., "Introduction to Chemical Engineering", PHI Learning Pvt. Ltd., New Delhi,
3. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", 6thEdition, Tata McGraw Hill, 1997.
4. Dryden, C.E., "Outlines of Chemicals Technology", Edited and Revised by Gopala Rao, M. and M.Sittig, 2nd Edition, Affiliated East-West press, 1993.

Chemical Process Calculations

SUBJECT CODE: 2014302	Theory			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	100	
	L	T	P/S	ESE	:	70	04
	04	-	-	T.A.	:	20	
				C.T.	:	10	

CONTENT

UNIT-I:	Basics of unit operations and unit processes, Units and dimensions.
UNIT-II:	Stoichiometric principles – composition relations, density and specific gravity. Behavior of Ideal gases - application of ideal gas law - gaseous mixtures - volume changes with change in composition.
UNIT-III:	Vapour pressure - effect of Temperature on vapour pressure - vapour pressure plots – vapour pressure of immiscible liquids - solutions. Humidity and Solubility: Humidity - saturation -vaporization - wet and dry bulb thermometry.
UNIT-IV:	Material Balance - Processes involving chemical reaction - Combustion of coal, fuel gases and Sulphur - Recycling operations - bypassing streams - Degree of conversion – excess reactant -limiting reactant. Unsteady state problems
UNIT-V:	Energy Balance: Thermo chemistry - Hess's law of summation - heat of formation, reaction, combustion and mixing - mean specific heat - Theoretical Flame Temperature.

REFERENCE BOOKS

1. K.V. Narayanan and B. Lekshmikutty, "Stoichiometry and Process Calculations", Prentice Hall of India Ltd, New Delhi..
2. V.Venkataramani, N.Anantharaman and K.M. Meera Sheriffa Begum, 'Process Calculations' Prentice Hall of India Ltd, New Delhi.
3. B. I. Bhatt, "Stoichiometry", Tata McGraw Hill Publishers Ltd., New Delhi.
4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors

Industrial Chemistry

SUBJECT CODE: 2014303	Theory			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	100	
	L	T	P/S	ESE	:	70	03
	03	-	-	T.A.	:	20	
				C.T.	:	10	

CONTENT

UNIT-I:	Organic Chemistry Nomenclatures of organic compounds, functional groups
UNIT-II:	Classification of organic compounds, aliphatic Compounds, closed chain compounds, unsaturated. Alkanes, alkenes, alkynes, cycloalkanes. Halogenations, saturated halogenation Reaction of alkenes, oxidation, halogenation, Nitration, pyrolysis, isomerization dehydrogenation, Structures and reactivity of alkanes, cycloalkanes. Alkenes, preparation, properties and reactions, Action of ozone, hydrogenation, halogenation, action of halogen acids, sulfuric acid, polymerization, uses of alkenes.
UNIT-III:	Aromatic Compounds, alkyl halides, alcohol and phenols. Concept of aromaticity, structure of benzene, properties of benzene, reactions of benzene, halogenation, hydrogenation, pyrolysis, Classification of alkyl halides, isomerism in alkyl halides, properties of alkyl halides, substitution reaction, elimination reaction, alcohols. Classification of alcohols, preparation, properties, reaction, phenols Classification, preparation, reaction.
UNIT-IV:	Phase rule, Phase rule, phase, component, degrees of freedom, One component system
UNIT -V:	Adsorption Definition, nature of adsorption, types of adsorption Langmuir adsorption isotherm, Freundlich adsorption Isotherm, application, Solutions and Indicators Ideal solution, non-ideal solution, Azeotropic Mixture, and theory of indicators.

REFERENCE BOOKS:
1. R. T. Morrison, R. N. Boyd and S.K. Bhattacharjee, 'Organic Chemistry" Pearson.
2. V Raghavan, "Material Science & Engineering" PHI Learning Pvt. Ltd.
3. P.L. Sony and H.M. Chawla, "Text book of organic Chemistry", Sultan Chand & Sons – Tb
4. B.R. Puri, L.R. Sharma and M.S. Padania, "Principles of physical chemistry" Vikas Publishing House Pvt Ltd.,
5. K. S. Tewari, S. N Mehrotra, N. K. Vishnoi, "Textbook of organic chemistry" Vikas Publishing House Pvt Ltd

Mechanical Operation

SUBJECT CODE: 2014304	Theory			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	100	03
	L	T	P/S	ESE	:	70	
	03	-	-	T.A.	:	20	
				C.T.	:	10	

CONTENT

UNIT-I:	Characteristics of Particulate Material: Properties and characterization of particulate solids, Flow properties of particulates.
UNIT-II:	Introduction to size reduction equipment, energy and power requirement in milling operations
UNIT-III:	Separation of solids, Solid – Solid Separation Equipment's
UNIT-IV:	Particulate Processes: Solid-Liquid and Gas-Solid separation methods, Equipment's Classification by size, agitation and mixing of solids and liquids,
UNIT- V:	Handling of Particulate Material: Conveying methods, Storage methods, Feeders and elevators.

REFERENCE BOOKS
1. Anup. K.Swain, Hemlata Patra, G.K.Roy., "Mechanical Operations", McGraw Hill Education.
2. McCabe and J.C.Smith," Unit Operation of Chemical Engineering", McGraw Hill., New York.
3. M. Coulson and J.F. Richardson, "Chemical Engineering", Vol. II, Butterworth-Heinemann
   4. Badger and Banchero, "Introduction to Chemical Engineering", McGraw Hill, New York.

Momentum Transfer

SUBJECT CODE: 2014305	Theory			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	100	
	L	T	P/S	ESE	:	70	03
	04	-	-	T.A.	:	20	
				C.T.	:	10	

CONTENT:

UNIT-I:	Properties of fluids and concept of pressure: Introduction - Nature of fluids - physical properties of fluids - types of fluids. Fluid statics: Pressure - density - height relationships. Pressure measurement. Dimensional analysis. Similarity - forces arising out of physical similarity - dimensionless numbers.
UNIT-II:	Momentum Balance and their Applications: Kinematics of fluid flow; Newtonian and non-Newtonian fluids - Reynolds number - experiment and significance - Momentum balance - Forces acting on stream tubes - Bernoulli's equation - Correction for fluid friction
UNIT-III:	Flow of incompressible fluids in pipes – laminar and turbulent flow through closed conduits - velocity profile & friction factor for smooth and rough pipes - Head loss due to friction in pipes, fitting etc.
UNIT-IV:	Flow of Fluids through Solids: Form drag - skin drag - Drag co-efficient. Flow around solids and packed beds. Friction factor for packed beds. Ergun's Equation - Motion of particles through fluids - Terminal settling velocity. Fluidization - Mechanism, types, general properties – applications
UNIT-V:	Transportation and Metering: Measurement of fluid flow: Orifice meter, Venturi meter, Pitot tube, Rotameter, weirs and notches Wet gas meter and dry gas meter. Hot wire and hot film anemometers. Transportation of fluids: Fluid moving machinery performance. Selection and specification. Positive displacement pumps, Rotary and Reciprocating pumps, Centrifugal pumps and characteristics, Introduction to Fans, Blowers & Compressors

REFERENCE BOOKS:
1. A. K. Mohanty, "Fluid Mechanics", Prentice Hall of India Ltd, New Delhi.
2. W. L. McCabe, J.C. Smith and P. Harriot, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.,
 3. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol 1, Butterworth Heinemann.
 4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors.

PRACTICAL
Momentum Transfer Lab

SUBJECT CODE: 2014306	Practical			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	50	**01**
	L	T	P/S	ESE	:	50	
		-	02	Internal	:	15	
				External	:	35	

CONTENTS:

To conduct experiment to study

    1. Different types of manometers
    2. Major losses in pipe flow
    3. Minor Losses (Globe Valve, Bends and Elbows)
    4. Major losses in spiral coil flow
    5. Major losses in helical coil flow
    6. Flow Through Packed Bed
    7. Flow Through Fluidized Bed
    8. Calibration of orifice meter
    9. Calibration of venturi meter
    10. Calibration of pitot tube
    11. Calibration of channel
    12. Characteristics of reciprocating pump
    13. Characteristics of centrifugal pump

REFERENCES:

1. Lab Manual
2. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.
3. G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering, Pen ram International Publishing (India) Pvt. Ltd.

Mechanical Operation Lab

SUBJECT CODE: 2014307	Practical			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	50	01
	L	T	P/S	ESE	:	50	
		-	02	Internal	:	15	
				External	:	35	

CONTENTS:
1. Different types of density of particle (Bulk, Particle, Repose)
2. Angle of repose
3. Particle size distribution
4. Screen effectiveness
5. Jaw crusher
6. Ball mill
7. Drop weight crushes
8. Drag studies
9. Settling studies
10. Separation of solids using settling characteristics
11. Constant Pressure Filtration
12. Constant Volume Filtration
13. Elutriation
14. Agitated vessel
15. Storage of Solids

REFERENCES:
1. Lab Manual
2. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.,
3. G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering, Penram International Publishing (India) Pvt. Lt

WEB TECHNOLOGY LAB

SUBJECT CODE: 2018308	Practical			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	25	**01**
	L	T	P/S	ESE	:	25	
		-	02	Internal	:	07	
				External	:	18	

Course Learning Objectives:

This Lab course is intended to practice whatever is taught in theory class of 'Web Technologies'. Some of the things that should necessary be covered in lab.

Course outcomes:

Student will be able to program web applications using and will be able to do the following:

- Use LAMP Stack for web applications
- Write simple applications with Technologies like HTML, Java script, AJAX, PHP
- Connect to Database and get results
- Parse XML files Student will be able to develop/build a functional website with full features.

Content: Practical		Hrs.	Marks
Unit – 1	Home page Development static pages (using Only HTML) of an online Book store.		
Unit – 2	Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.		
Unit – 3	Write a PHP program to display a digital clock which displays the current time of the server.		
Unit – 4	Write an HTML code to display your CV on a web page.		
Unit – 5	Write an XML program to display products.		
Unit – 6	Create a web page with all types of Cascading style sheets.		
Unit – 7	Write a PHP program to display a digital clock which displays the current time of the server.		
Unit – 8	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.		

This is a skill course. More student practice and try to find solution on their own, better it will be.

Reference Books:

1. "Web Technologies--A Computer Science Perspective", Jeffrey C.Jackson
2. "Internet & World Wide Web How to Program", Deitel, Deitel, Goldberg, Pearson Education
3. "Web programming- Building Internet Application", Chris Bales
4. Web Applications: Concepts and Real-World Design, Knuckles

Development of Life Skills-II(TW)

SUBJECT CODE: 2014309	Practical			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	50	
	L	T	P/S		:		02
	-		04	Internal	:	15	
				External	:	35	

Unit-1	Society, social structure, develop sympathy and empathy.
Unit-2	Swot Analysis – Concept, how to make use of SWOT
Unit-3	Sources of conflict, Resolution of conflict, Ways to enhance interpersonal relations.
Unit-4	1) Steps in Problem Solving. 2) Identify and Clarify the Problem, 3) Information Gathering Related to Problem, 4) Evaluate the Evidence, 5) Consider Alternative Solutions and their Implications. 6) Choose and Implement the Best Alternative, 7) Review 8) Problem solving technique. (Any one technique may be considered) 1) Trial and error, 2) Brain storming, 3) Lateral thinking
Unit-5	Body language -- Dress like the audience Posture, Gestures, Eye contact and facial expression. Presentation Skill – Stage Fright, Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language, Practice of speech. Use of aids –OHP, LCD projector, white board
Unit-6	Introduction to group discussion, Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making Interview Technique Necessity, Tips For Handling Common Questions

Unit-7	Understand and work within the dynamics of a Groups. Tips to work effectively in terms, establish good rapport, interest with others and work effectively with them to meet common Objectives, tips provide and accept feedback in a constructive and considerate way, leadership in term, handling frustration in group.
Unit-8	Introduction, Task Identification, Task planning, Organizing and Execution, Closing the Task.

Text/ Reference Books:

Titles of the Book	Name of Authors	Name of the Publisher
Adams Time management	Marshall Cooks	Viva Books
Basic Managerial Skills for All	E.H. Mc Grath , S.J.	Pretice Hall of India, Pvt Ltd
Body Language	Allen Pease	Sudha Publications Pvt.
Creativity and problem solving	Lowe and Phil	Kogan Page (I) P Ltd
Decision making & Problem Solving	by Adair, J	Orient Longman
Develop Your Assertiveness	Bishop , Sue	Kogan Page India
Make Every Minute Count	Marion E Haynes	Kogan page India

Professional Practices-III (TW)

SUBJECT CODE: 2014310	Practical			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	50	
	L	T	P/S				02
	-		04	Internal	:	15	
				External	:	35	

Unit -1	Field Visits
	Structured field visits (minimum three) be arranged and report of the same should be
	submitted by the student, as part of the term work.
	The field visits may be arranged in the following areas / industries:
	1.1 Visit to Electric Power Generation Station
	2.1 Visit to Wind Mill and/or Hybrid Power Station of Wind and Solar
	3.1 Multi Storied Building for Power Distribution Scheme
	4.1 Visit to a Multi Plex
	5.1 Visit to a Captive Power Plant (Thermal)
Unit – 2	Lectures by Professional / Industrial Expert to be organized from of the following areas (any four)
	2.1 Modern Techniques in Power Generation
	2.2 Role of Power Factor Improvement a tool in reducing cost of generation
	2.3 New trends for built environment
	2.4 Software for drafting
	2.5 Digital Metering
	2.6 Various government schemes such as EGS,
	2.7 Industrial hygiene.
	2.8 Hydro power generation
	2.9 Special purpose wiring in chemical/hazardous industries
Unit -3	Seminar:
	Any one seminar on the topics suggested below:
	Students (Group of 4 to 5 students) has to search /collect information about the topic through literature survey, visits and discussions with experts/concerned persons:
	Students will have to submit a report of about 10 pages and deliver a seminar for 10 minutes.

	3.0 Water supply schemes/Problems of drinking water in rural area 3.1 Role of Traffic Signals in smooth flow of vehicles 3.2 Gram Swaraj Yojana 3.3 Schemes of power of generation in coming five years 3.4 Impact of load shading on rural population 3.5 Any other suitable topic
Unit -4	Market Survey: A group of four students is expected to collect information from the market regarding specifications and cost of any four items, used in Electrical wiring for domestic, commercial and industrial use

Python (TW)

SUBJECT CODE: 2018311	Term Work			No. of period in one session:			Credits
	No. of Periods per Week			Full Marks:	:	25	**01**
	L	T	P/S				
	-		02	Internal	:	07	
				External	:	18	

	CONTENTS	Hrs.	Marks
UNIT – 01	Write a program to demonstrate basic data type in python.		
UNIT – 02	Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)		
UNIT – 03	Write a python program Using for loop, write a program that prints out the decimal equivalent of $1+\frac{1}{2}+1/3\ldots1/n$		
UNIT – 04	Write a Python program to find first n prime numbers. Write a program to demonstrate list and tuple in python.		
UNIT – 05	Write a program using a for loop that loops over a sequence. Write a program using a while loop that asks the user for a number and prints a countdown from that number to zero.		
UNIT – 06	Write a Python Program to add matrices. Write a Python program to multiply matrices.		
UNIT – 07	Write a Python program to check if a string is palindrome or not.		
UNIT – 08	Write a Python program to Extract Unique values dictionary values		
UNIT – 09	Write a Python program to read file word by word Write a Python program to Get number of characters, words.		
UNIT – 10	Write a Python program for Linear Search		

References Books:

1. Taming Python by Programming, Jeeva Jose, Khanna Publishing House

2. Starting Out with Python, Tony Gaddis, Pearson

3. Core Python Programming, Wesley J. Chun, Prentice Hall

4. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University

5. Introduction to Computation and Programming Using Python. John V. Guttag, MIT Press.