Syllabus for Environmental Engineering

Name of the Course: Diploma in Chemical Engineering	
Subject: Environmental Engineering	
Subject Code:	**Semester:** Third
Duration: 6 months	**Maximum Marks:** 100
Teaching Scheme	**Examination Scheme**
Theory: 3hours/week	Mid Semester Exam: 20 Marks
Tutorial: Nil	Attendance, Assignment & Interaction: 10 Marks
Practical: Nil	End Semester Exam: 70 Marks
Credit: 3	

Aim:

Sl. No.	The aim of this subject is
1.	To impart knowledge of environment and different types of pollution
2.	To impart knowledge about causes and preventive measures against air pollution
3.	To impart knowledge about causes and preventive measures against water pollution
4.	To impart knowledge about causes and preventive measures against soil pollution
5.	To impart knowledge about causes and preventive measures against noise pollution

Objective:

Sl. No.	Upon successful completion of this syllabus students will be able to
1.	Understand importance of environment and different types of pollution.
2.	Explain causes and preventive measures against air pollution.
3.	Describe causes and preventive measures against water pollution.
4.	Describe causes and preventive measures against soil pollution.

5.	Explain causes and preventive measures against noise pollution.
Pre-Requisite:	
Sl. No.	
1.	Basic knowledge of Chemistry and Physics
2.	Basic knowledge of environment and its composition

DETAIL COURSE CONTENT			
Group-A		**Hrs/Unit**	**Marks**
Unit 1	**INTRODUCTION** **Man and Environment:** Overview (socio-economic structure & occupational exposures) – Scope of Environmental Engineering – pollution problems due to urbanization & industrialization	**2**	
Unit2	**AIR POLLUTION :** **Causes of air pollution** – types & sources of air pollutants- Climatic & Meteorological effect on air pollution concentration- formation of smog and fumigation	**2**	
Unit 3	**Analysis of Air Pollutants** Collection of Gaseous Air Pollutants- Collection of Particulate Pollutants – Analysis of Air Pollutants like : Sulphur dioxide – Nitrogen oxide – Carbon monoxide – Oxidants &Ozone – Hydrocarbons – Particulate Matter	**3**	
Unit 4	**Air Pollution Control Measures & Equipment** Control of Particulate Emission – Control of Gaseous Emission – Flue Gas Treatment Methods : Stacks Gravitational and Inertial Separation, Settling Chambers, Dynamic Separators, Cyclones, Filtration, Liquid Scrubbing, Spray Chambers, Packed Towers, Orifice and Ventury Scrubbers, Electrostatic Precipitators, Gas/solid Adsoruption, Thermal Decomposition	**4**	
Unit 5	**Methods &Approach of Air Pollution Control** Controlling smoke nuisance – Develop air quality criteria and practical emission standards – Creating zones suitable for industry based on micrometeorology of air area – Introducing artificial methods of removal of particulate and matters of waste before discharging to open atmosphere	**3**	

Group –B WATER & ENVIRONMENT			
Unit 6	**Water Sources** Origin of waste water – Types of water pollutants and their effects	2	
Unit 7	DIFFERENT SOURCES OF WATER POLLUTION Biological Pollution (point & non-point sources) – Chemical Pollutants: Toxic Organic & Inorganic Chemicals – Oxygen demanding substances – Physical Pollutants: Thermal Waste – Radioactive waste – Physiological Pollutants: Taste affecting substances – other forming substances	3	
Unit 8	WATER POLLUTION & ITS CONTROL 2 Adverse effects on: Human Health & Environment, Aquatic life, Animal life, Plant life — Water Pollution Measurement Techniques – Water Pollution Control Equipments & Instruments – Indian Standards for Water Pollution Control	4	
GROUP – C SOIL & ENVIRONMENT			
Unit 9	SOIL POLLUTING AGENCIES & EFFECT OF SOLUTION Liquid & Solid Wastes – Domestic & Industrial Wastes – Pesticides – Toxic: Inorganic & Organic Pollutants – Soil Deterioration – Poor Fertility, Septicity, Ground Water Pollution, Concentration of Infecting Agents in Soil	3	
Unit 10	SOLID WASTE DISPOSAL Dumping domestic & Industrial Solid Wastes: Advantages & Disadvantages – Incineration: Advantages & Disadvantages – Sanitary Land Field: Advantages & Disadvantages – Management of Careful & Sanitary Disposal of Solid Wastes	4	
GROUP – D NOISE AND ENVIRONMENTAL MANAGEMENT SYSTEM			
Unit 11	NOISE POLLUTION & CONTROL Noise Pollution: Intensity, Duration – Types of Industrial Noise – Ill effects of Noise – Noise Measuring & Control – Permissible Noise Limits	2	
Unit 12	ENVIRONMENTAL LEGISLATIONS, AUTHORITIES & SYSTEMS 6 Air & Water Pollution Control Acts & Rules (Salient Features only) – Functions of State / Central Pollution Control Boards – Environmental Management System: ISO 14 000 (Salient Features only	4	

EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1 2 3 4 5	10	20	1	20	FOUR	ANY FIVE, TAKING AT LEAST ONE FROM EACH OF THE GROUPS A & B, AND, AT LEAST ONE FROM THE GROUPS C & D TAKEN TOGETHER	10	10 X 5 = 50
B	6 7 8	5				TWO			
C	9 10	5				TWO			
D	11, 12	5				TWO			

Text Books/ Reference Books			
Name of Authors	**Title of the Book**	**Edition**	**Name of the Publisher**
1. Kormondy	Concept of Ecology Prentice-Hall of India, N. Delhi		Prentice-Hall of India, N. Delhi
2. Odum	Fundamental of Ecology		
3. J. Turk & A. Turk	Environmental Science		
4. Dix	Environmental Pollution		
5.	Pollution Control Acts, Rules and Notification / Central Pollution Control Board, New Delhi		Central Pollution Control Board, New Delhi
6. Dr. A.K. De	Environmental Chemistry		
7. D. Lal	Water Supply & Waste Water		

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Syllabus for

C O M P U T E R   O R I E N T E D   N U M E R I C A L   M E T H O D S

Name of the Course:	C O M P U T E R O R I E N T E D N U M E R I C A L M E T H O D S	
Subject Code:	**Semester: 3rd**	
Duration: 17 Weeks	**Maximum Marks: 100**	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester Exam.: 20 Marks	
Tutorial: Nil	Attendance, Assignment & interaction: 10 Marks	
Practical: Nil	End Semester Exam.: 70 Marks	
Credit: 3		
Aim:		
Sl. No**.**		
1.	This subject enhances the knowledge of numerical side of mathematical analysis.	
2.	It also intends to teach methods and means for estimating the accuracy of numerical results.	
Objective:		
Sl. No.	Students will be able to Learn	
1	Approximation in Numerical Computation Significant Figures Absolute, Relative and Percentage Errors Truncation and Round-off Errors Accumulation and Propagation of Errors	
2.	Forward, Backward and Divided Difference Table — Newton's Forward and Backward Interpolation Formula	
3.	Method of Tabulation — Bisection Method , Newton-Raphson Method Convergence	
4.	Differentiation of Forward and Backward Formula — Trapezoidal rule and Simpson's 1/3 rule.	
5	Gauss-Elimination Method Matrix Inversion Method Gauss-Jacobi Method Gauss-Siedal Method	

6.	Solution of first order Differential Equation by Euler's Method
	Modified Euler's and Runge-Kutta methods

Pre-Requisite:

Sl. No.	
1.	Knowledge of basic concepts of mathematics.

Content s : TOTAL 51 hrs /week		hrs/Unit	Marks
Unit I: **ERROR HANDLING**	Approximation in Numerical Computation Significant Figures Absolute, Relative and Percentage Errors Truncation and Round-off Errors Accumulation and Propagation of Errors	15	

Unit II : **POLYNOMIAL INTERPOLATION**	Forward, Backward and Divided Difference Table	12	
	Newton's Forward and Backward Interpolation Formula — Newton's General Interpolation Formula with the remainder term		
	Lagrange's Interpolation Formula		
	Inverse Interpolation		
UNIT III : SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS	Method of Tabulation	10	
	Bisection Method		
	Newton-Raphson Method		
	Convergence		
UNIT IV: **NUMERICAL DIFFERENTIATION AND INTEGRATION**	Differentiation of Forward and Backward Formula	5	
	Trapezoidal rule		
	Simpson's 1/3 rule		
UNIT V : **NUMERICAL SOLUTION OF A SYSTEM OF LINEAR EQUATIONS**	Gauss-Elimination Method	5	
	Matrix Inversion Method		
	Gauss-Jacobi Method —		
	Gauss-Siedal Method		
UNIT VI : **SOLUTION OF ORDINARY DIFFERENTIAL EQUATION**	Solution of first order Differential Equation by Euler's Method Modified Euler's and Runge-Kutta methods	4	
	TOTAL	51	

Text and reference books:

Sl. No.	Title of the Book	Name of Authors	Publisher
1.	Computer Oriented Numerical Methods	Rajaraman	Prentice Hall of India, N. Delhi
2.	Numerical Algorithms	E. V. Krishnamurthy & S. K. Sen	___
3.	Numerical Mathematics Analysis	J. B. Scarborough	Oxford & IBH Publishing Co. Pvt. Ltd.
4.	Introductory Numerical Analysis	Dutta & Jana	Sreedhar Prakashani, Kolkata

5.	Numerical Methods	Balagurusamy	Tata McGraw-Hill
6.	Introductory Methods of Numerical Analysis	S. S Sastry	Prentice Hall of India, N.Delhi
7.	Numerical Methods (Problems & Solutions)	Jain, Iyengar & Jain	_____
8.	Introduction to Numerical Analysis	C. Froberg	Addison Wesley

Question Paper Setting Tips :

Short questions :20 marks, Students will answer 20 questions out of 25 questions ,each carrying 1 mark

Long question :50 marks ,Students will answer 5 questions , out of 8 questions, each carrying 10 marks.

Basic Electronics – common as Electrical Engineering

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SyllabusFor Fundamentalsof Chemical Engineering

Name of theCourse:	Fundamentals of Chemical Engineering	
Subject Code:		**Semester:Third**
Duration: 17 Weeks		**MaximumMarks: 100**
Teaching Scheme		**Examination Scheme**
Theory: 3hrs./week		MidSemester Exam.: 20Marks
Tutorial: Nil		Attendance ,Assignment & interaction:10Marks
Practical:Nil		End Semester Exam.: 70Marks
Credit:3		

Aim:	
Sl. No**.**	
1.	This subject will provide an exposure to the students about different areas of Chemical Engineering process & operations, Units & Dimensions.
2.	It will provide the knowledge of mole.
3.	This will make the students familiar with the physico-chemical properties & behavior of liquids and gases.
4.	It will provide the knowledge of Psychrometry
5.	It will also provide knowledge of formulating & solving material & energy balances along with developing problem solving skills.
6.	It will provide an exposure the students about Instrumentation, names of various pipe fittings like valves .

Objective:	
Sl. No.	Students will be able to Learn :
1	The basic units , notations and conversion of units Dimensions, Dimensionless groups, Unit operations & Unit process.
2.	The concept of mole, basis of calculation, mass relations, volume relations.
3.	Some important laws of gases. The solving of some elementary numerical problems.
4.	The elementary concept of psychrometry. Some elementary numerical problems of psychrometry.

| 5 | Mass balance & simple numerical problems associated with this Concept of Recycle & By-pass. Learn concept of energy balance & simple numerical problems. |
| 6. | Names & purpose of instruments related to Chemical process industry. The names of various pipe fitting : valves. |

Pre-Requisite:

Sl. No.	
1.	Basic knowledge of mathematics tosolvetheproblems.
2.	Knowledgeofbasicconcepts ofsciencessuchasphysics,chemistryand mathematics
3.	Visualizationandanalytical approachtowardsthesubject isnecessary

Content s : Fundamentals of Chemical Engineering , TOTAL 51 hrs /we ek		hrs/Unit	Marks
Unit I: **INTRODUCTION**	Definition & Applicationof Chemical Engineering. Concept of fundamental units & notations, Derived units,Dimensions,Different Unit system and conversion of one from other and related simple numerical problems. Names of some important dimensionless groups related to Chemical Engineering. Concept of unit operation & unit process with common examples.	8	
Unit II **MOLE CONCEPT**	Concept of Basis of calculation Concept of Mole, mole fraction, weight percent, volume percent, atomic fraction Associated simple numerical problems.	10	

Unit III : ELEMENTARY THEORIES OF FLUIDS	Ideal gas law. Concept of Partial Pressure,Pure component volume. Dalton' s law, Amagat' s law. Average molecular weight, Density of mixture. Simple numerical problems associated to this. Theory of Raoult' s law, Henry' s law,Concept of vapour pressure.(Only theory , no numerical problem).	11	
Unit IV : ELEMENTARY THEORIES ON PSYCHROMETRY	Concept of Humidity, Definition of Dry Bulb Temperature,Wet Bulb Temperature,Absolute Humidity,Relative humidity,Percentage saturation,dew Point. Simple numerical problems .	8	
Unit V: MASS BALANCE & ENERGY BALANCE	Concept of mass balance , Simple numerical problems associated with mass balance.. Concept of Recycle ,By-Pass. (Only theory ,No numerical Problem.) Concept of Energy Balance , Heat of Formation, Heat of Reaction, Heat of Mixing. Simple numerical problems related with energy balance.	11	
Unit VI: TECHNICAL ASPECTS	Names of modern Instruments used in Chemical Process Industry(Description , diagrams of instruments are not necessary.). Names of various Pipe Fittings : Valves (Description , diagrams are not necessary).	3	
	TOTAL	51	

Text andreferencebooks:

Sl. No.	Titleof theBook	Nameof Authors	Publisher
1.	Basic Principles and Calculations in Chemical Engineering	Himmelblau	Prentice Hall of India, N. Delhi
2.	Chemical Engineers' Handbook	Perry	McGraw-Hill
3.	Chemical Process Principles (part I)	Hougen, Watson &Ragatz	Asia Publishing House, New Delhi
4.	Chemical Engineering Fundamentals	Krikbride	McGraw-Hill Book Co. Ltd., New York &Kogakusha Co. Ltd., Tokyo
5.	Introduction to Chemical Engineering	Ghosal, Sanyal, Dutta	Tata McGraw-Hill Pub. Co. Ltd., New Delhi

6.	Stoichiometry	Bhatt and Vohra	Tata McGraw-Hill Pub. Co. Ltd., New Delhi

Question Paper Setting Tips :

Short questions :20 marks, Students will answer 20 questions out of 25 questions ,each carrying 1 mark

Long question :50 marks ,Students will answer 5 questions , out of 8 questions, each carrying 10 marks.

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Syllabus for : Fluid Mechanics

Name of the Course: FLUID MECHANICS	
Course Code:	**Semester:** 3rd
Duration: : Seventeen weeks	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory: 3hrs./week	Mid Semester Exam.:20Marks
Tutorial: Nil hrs./week	Attendance & Teacher's Assessment 10 Marks
Practical: Nil hrs./week	End Semester Exam.:70Marks
Credit: 5	Practical : 100

Aim:

Sl. No.	
1.	Understand some basic principles of fluid mechanics
2.	Analyze logically the different types of fluid mechanics
3.	Solve different problems using mathematics as a tool
4.	Derive results using mathematical formula
5.	The knowledge of fluid mechanics is essential in understanding the mechanism of flow of fluids in chemical process plant and equipment.

Objective:

Sl. No.	
1.	Fundamental ideas on fluid properties.
2.	Characteristics of different types of flow of fluid.
3.	Basic concepts of flow measuring devices.

Pre-Requisite:

Sl. No.	
1.	Elementary knowledge on physics and mathematics
2.	Basic knowledge in Algebra and Differential Calculus

Contents : TOTAL Contact Hours: 51/week		Hrs./Unit	Marks
Unit: 1 **INTRODUCTION: FLUID STATUS & ITS APPLICATIONS**	Definition of fluid — Classification of fluids: Ideal – Compressible – Incompressible – Newtonian – Non-Newtonian — Manometers: U-tube – Well type – Inclined tube – Inverted U-tube	8	

Unit: 2 **FLUID FLOW PHENOMENON**	Concept of**:** Laminar flow – Turbulent flow – Velocity gradient – Viscosity – kinematics viscosity – Boundary layer	6	
Unit: 3 **BASIC EQUATIONS OF FLUID FLOW**	Concept of**:** Streamline flow – Steady flow – Unsteady flow — Equation of continuity — Bernoulli equation & its industrial applications — Momentum correction factor & kinetic energy correction factor — Concept of skin friction & form friction — Simple problems	12	
Unit: 4 **FLOW OF INCOMPRESSIBLE FLUIDS IN CONDUITS**	Laminar flow characteristics through pipes – shear stress distribution, average velocity & maximum velocity — Fanning's friction factor — Hagen-Poiseuille equation — Frictional losses due to different piping components, sudden expansion & sudden contraction — Simple problems	**12**	
Unit: 5 **MEASURING DEVICES**	Flow measuring devices & their industrial applications like: Venturi meter – Orifice meter – Pitot tube – Rotameter – Notches & weirs-rectangular,Vee & trapezoidal — Simple problems **FLOW THROUGH PACKED BED** Definition of equivalent diameter – Porosity & sphericity – Ergun equation – Kozeny-Carman equation – Blake-Plummer equation (only statements) – Definition of fluidization.	13	
	Total	**51**	

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
McCabe & Smith	Unit Operations of Chemical Engineering / /		McGraw-Hill Book Co. Ltd., New York
Knudsen	Fluid Dynamics & Heat Transfer		McGraw-Hill Book Co. Ltd., New York
Ghosal, Sanyal, Dutta	Introduction to Chemical Engineering		Tata McGraw-Hill

Reference Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Foust & others	Principles of Unit Operations	(2nd ed.)	John Wiley & Sons Inc., London
Coulson and Richardson	Chemical Engineering (in SI units), Vol. 1 & 4		Pargamon Press, Oxford

Sl. No.	Question Paper setting tips
A	Short questions: 20 marks, students will answer 20 questions out of 25 questions, each carrying 1 mark.
B	Long questions: 50 marks, students will answer 5 questions out of 8 questions, each carrying 10 mark.

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Syllabus for : Chemical Engineering Thermodynamics of D.Ch.E-II(SEM-II).

Name of the Course: Chemical Engineering Thermodynamics			
Course Code		**Semester:** Third	
Duration: : Seventeen weeks		**Maximum Marks: 150**	
Teaching Scheme		**Examination Scheme**	
Theory: 3hrs./week, Total 51 Weeks.		Mid Semester Exam.:20Marks	
Tutorial: Nil hrs./week		Attendance & Teacher's Assessment 10 Marks	
Practical:3 hrs./week		End Semester Exam.:70Marks	
Credit: 5		Practical:50	

Aim:			
Sl. No.			
1.	This subject has great importance in Chemical Engg as it provides knowledge in practical applications of the principles of the Physical Chemistry to the solution of complicated industrial problems.		
2.	It helps in predivting missing Physico-chemical data from the generalized principles.		
3.	To study the energy requirements for the initiation of unit processes, study of the energy changes in these processes.		
4.	To determine to what extent the transformations can be carried out in view of energy perspective.		
5.	It imparts important knowledge about analysis of chemical processes by application of different thermodynamic principles.		

Objective:			
Sl. No.	Introduction of basic concepts of Systems and Processes & their different parameters.		
1.	First Law of Thermodynamics & the properties from this Law; simple problems.		
2.	Second Law of Thermodynamics; concept of Heat Engines, other properties derived from 2nd law; simple problems.		
3.	Free Energy and its related equations.		
4.	Equations of state for fluids ; ideal and real gases & their properties, gas equations, heat of reactions etc.		
5.	Refrigeration principles ; Third Law thermodynamjcs ; different refrigeration cycles ; simple problems.		

Pre-Requisite:			
Sl. No.			
1.	Knowledge of basic Physics, Chemistry and Mathematics(Specially Calculus).		
2.	Knowledge about basic terms of Chemical engineering.		

Contents :	TOTAL PERIODS: 51 hrs/week	Hrs./Unit	Mark
Unit: 1:Introduction & basic concepts	Systems & Processes---States & properties---State & path functions---Reversible & irreversible processs---Steady state---Thermodynamic equilibrium---Zeroth Law-	5	

	--Ideal gas Temperature scale.		
Unit: 2:First Law of Thermodynamics	Statement---Jnternal energy---Enthalpy---Heat capacity---First Law of Thermodynamics for: Cyclic Process, Flow Process, Non-flow Process; Simple problems on 1st law of thermodynamics. .	8	
Unit: 3: Second Law of Thermodynamics	Statement---Carnot Cycle---Carnot Principle---Clausius inequality---Concept of Entropy---Simple problems	10	
Unit: 4: Preliminary concept of Free Energy	Free Energy---Work Function---Chemical Potential---Fugacity---Gibbs-Duhem Equation---Gibbs Helmholtz Equation---Clapeyron Equation.	8	
Unit: 5:Equation of State for Fluids	Preliminary concept of Ideal & Real Gases---Vander Waal's Equation---Redlich-Kwong equation---Peng-Robinson equation---Benedict-Webb-Rubin equation(all statements only)---Equation of Corresponding state---Compressibility factor---Standard Heat of Reaction, Combustion,Formation---Hess;s Law.	10	
Unit: 6: Refrigeration	Statement of Third Law of Thermodynamics---Ideal Refrigeration cycle---Air Refrigeration cycle---Vapor Compression cycle---Absorption Refrigeration cycle& Vacuum refrigeration---Choice of Refrigerant---COP---Ton of Refrigeration---Refrigeration capacity---Simple problems.	10	
		51	

Text Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher
Hougen, Watson &Ragtz	Ghemical Proess Principles, Part-II Thermodynamics		Asia Publishing House
Smith &,Vanness	Introduction to Chemical engg thermodynamics		McGrow-Hill Book Co.
Dodge	Chemical engg Thermodynamics		McGrow-Hill Book Co.
YVC Rao	Engineering Thermodynamics		University Press
K.V.Narayanan	A Textbook of Chemical Engineering Thermodynanics		Prentice Hall of India

Reference Books:

Name of Authors	Title of the Book	Edition	Name of the Publisher

Sl. No.	Question Paper setting tips
A	Short Questions: 20Marks, students will answer 20questions out of 25 questions, each carrying 1

	mark.
B	Long questions: 50 marks, students will answer 5questions out of 8 questions, each carrying 10 marks.

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Name of the Course : ENVIRONMENTAL ENGINEERING LABORATORY	
Course Code:	**Semester:** Third
Duration: : Seventeen weeks	**Maximum Marks: 50**
Practical: 3 hrs./week	
Credit: 2	

Sl. No.	Skills to be developed
1	Proper handling of instruments.
2.	Measuring physical quantities accurately.
3.	To observe the phenomenon and to list the observations in proper tabular form.
4.	To adopt proper procedure and precautions while performing the experiment.
5.	To plot the graphs
6	To verify the principles, laws, using given instruments under different conditions.

Examination scheme: Maximum marks: 50

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Part – II First Semester. **Distribution of marks:** Performance of Job – 15, Report– 10
2. **External Assessment of 25 marks** shall be held at the end of the 2nd Year First Semester on the entire syllabus.. **Distribution of marks:** Viva-voce – 25.

Laboratory Experiments :	
Sl. No.	
1	Determination of pH of industrial water.
2.	Determination of Iron in drinking water.
3.	Determination COD of industrial waste water.
4.	Determination BOD of industrial waste water.
5.	Determination of total coliform present in water.
6.	Determination of Turbidity in industrial waste water.
7.	Demonstration of particulate sampling by High-Volume/ Low-Volume Air Sampler.
8.	Preparation of fertilizer from kitchen waste.
9.	Determination of total residual chlorine in a water sample.
10.	Determination of Free CO_2 in a given sample of water.

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Name of the Course : **FLUID MECHANICS LABORATORY**	
Course Code:	**Semester:** Third
Duration: : Seventeen weeks	**Maximum Marks: 100**
Practical: 3 hrs./week	
Credit: 2	

Sl. No.	Skills tobedeveloped
1	Properhandlingofinstruments.
2.	Measuring physicalquantitiesaccurately.
3.	Toobservethephenomenonandto listtheobservationsinpropertabular form.
4.	Toadoptproperprocedureandprecautionswhileperformingthe experiment.
5.	Toplot thegraphs
6	Toverifytheprinciples,laws,using giveninstrumentsunder different conditions.

Examination scheme: Maximummarks: 100

1. **Continuous Internal Assessment of 50 marks** is to be carried out by the teachers throughout the Part – II First Semester. **Distribution of marks:** Performance of Job – 35, Report– 15

2. **External Assessment of 50 marks** shall be held at the end of the 2ndYear First Semester on the entire syllabus.Viva-Voce--50

Laboratory Experiments:

Sl. No.	
1	To plot the friction factor vs. Reynolds number using Reynolds apparatus
2.	To calibrate the flow measuring instruments such as Orifice meter, Venturimeter

3	To study the steady flow rate and determine the discharge co-efficient of V-notch
4	To determine the frictional losses for flow of fluids through pipelines
5.	Measurement of viscosity co-efficient using Hagen-Poiseulle equation
6.	To study the flow characteristics through packed bed column.

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Name of the Course : CHEMICAL ENGINEERING THERMODYNAMICS LABORATORY	
Course Code:	**Semester:** Third
Duration: : Seventeen weeks	**Maximum Marks: 50**
Practical: 3 hrs./week	
Credit: 2	

Sl. No.	Skills to be developed
1	Proper handling of instruments.
2.	Measuring physical quantities accurately.
3.	To observe the phenomenon and to list the observations in proper tabular form.
4.	To adopt proper procedure and precautions while performing the experiment.
5.	To plot the graphs
6	To verify the principles, laws, using given instruments under different conditions.

Examination scheme: Maximum marks: 50

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Part – II First Semester. **Distribution of marks:** Performance of Job – 15, Report– 10.

2. **External Assessment of 25 marks** shall be held at the end of the 2nd Year First Semester on the entire syllabus. Viva-voce –25.

Laboratory Experiments :

Sl. No.	
1	To determine the Critical Solution Temperature of a Binary system (Phenol- Water system).
2	To study three components Ternary Phase diagram for the following system:-. a) System: Water- Acetic acid- Chloroform. b) System: Water- Toluene- Acetic acid.
3	To study the variation in the solubility of Calcium- Hydroxide in the presence of Sodium Hydroxide and hence determine the solubility product of Calcium Hydroxide with variation in Temperature.
4	Determination of the solubility of Benzoic Acid over a range of temperature and hence Heat of solution.
5.	To determine the energy of activation of hydrolysis of methyl acetate catalysed by hydrochloric acid.