KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Engineering

(Chemical Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

SYLLABUS

Semester - III

W.E.F. 2019 – 20

Syllabus Structure for Second Year Engineering (Semester – III) Chemical Engineering
(With effect from 2019-20)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Industrial Chemistry	B	3	1	-	4	40	60	-	-	100	4
Thermodynamics-I	C	3	-	-	3	40	60	-	-	100	3
Engineering and Solid Mechanics	C	3	-	-	3	40	60	-	-	100	3
Fluid Mechanics	D	3	-	-	3	40	60	-	-	100	3
Industrial Organization and Management	A	3	-	-	3	40	60	-	-	100	3
Thermodynamics-I Lab	C	-	-	2	2	-	-	25	25 (OR)	50	1
Fluid Mechanics Lab	D	-	-	2	2			25	25 (OR)	50	1
Chemical Engineering Lab-I	D	1	-	2	3	-	-	25	25 (PR)	50	2
		16	**1**	**6**	**23**	**200**	**300**	**75**	**75**	**650**	**20**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

Syllabus Structure for Second Year Engineering (Semester – IV) Chemical Engineering
(With effect from 2019-20)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Biology	B	3	1	-	4	40	60	-	-	100	4
Material Science	C	3	-	-	3	40	60	-	-	100	3
Thermodynamics - II	D	3	-	-	3	40	60	-	-	100	3
Material and Energy Balance Computations	D	3	-	-	3	40	60	-	-	100	3
Project Management and Entrepreneurship	A	3	-	-	3	40	60	-	-	100	3
Material Science Lab	C	-	-	2	2	-	-	-	-	-	1
Thermodynamics – II Lab	D	-	-	2	2	-	-	25	25 (OR)	50	1
Material and Energy Balance Computations Lab	D	-	-	2	2	-	-	25	25 (OR)	50	1
Chemical Engineering Lab-II	D	1	-	2	3	-	-	25	25 (PR)	50	2
Environmental Studies	H	-	-	-	-	-	60	40	-	-	-
Internship – I*	H	-	-	-	-	-	-	-	-	-	-
		16	**1**	**8**	**25**	**200**	**300**	**75**	**75**	**650**	**21**

ISE: Internal Sessional Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

* Internship – I is a mandatory and non-credit course. It shall be during summer vacation after Semester – IV. The satisfactory completion of Internship – I should be submitted to University at the end of Semester – VIII.

Industrial Chemistry					
COURSE OUTLINE					
Course Title:	**Industrial Chemistry**	**Short Title:**	**IC**	**Course Code:**	

Course description:

The objective of the course is to strengthen the fundamentals of basic industrial chemistry to undergraduate engineering students, so that they can apply the knowledge in the manufacturing of different types of industrially important chemical products. It is designed to provide students with the skills, knowledge and learning tools required to carry out professional research& development for the production activities in chemical industries.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3
Tutorial	1	14	14	1

Prerequisite course(s):

Chemistry

Course objectives:

1. To introduce the basics of chemistry and its significance in chemical process industry.
2. To learn the basic mechanism of electrophilic substitution reactions and its significance in industrially important product preparations.
3. To know the basics of manufacturing of chemicals and work of chemical engineer in chemical process industries.
4. To learn the unit processes and unit operations with symbols involved in manufacturing of useful chemical products.
5. To understand the techniques of drawing of flow diagram for the conversion of reactants into finished valuable products.

Course outcomes:

After successful completion of this course the student will be able to:

1. Draw symbols and flow diagrams for the manufacturing of chemical products.
2. Understand the importance of unit operations and unit processes in chemical process Industries.
3. Understand the working of process equipments in the manufacture of chemicals.
4. Analyze the process parameters in the manufacture of petrochemicals.
5. Demonstrate the basics of conversion of raw materials into finished products.

COURSE CONTENT

Industrial Chemistry		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
Tutorial:	**1 hours/week**		
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

General Aspects of industrial Chemistry **:** Introduction, chemical processing, chemical conversion & yield, characteristics of chemical conversions, unit process and unit operations,

flowcharts, batch and continuous processes, role of chemical engineer in chemical process industries.
Petroleum: Origin and composition , Petroleum mining, refining, compositions and uses of main petroleum fractions., Cracking & its importance in chemical industries, Octane number , Improving octane number, Chemicals from petroleum.

Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**

Industrial Synthesis from Petroleum: Manufacture of methanol from synthesis gas, Isopropanol from propylene, Glycerol from propylene via allyl chloride, Acetone by catalytic dehydrogenation of isopropanol.
Alkylation & Acylation, alkylation of benzene, phenol, hydrogenation, hydrogenation of nitrobenzene, reductive alkylation

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Oxidation: Types of oxidative reactions, oxidation of acetylene, oxidation of toluene, oxidation of xylene, oxidation of methanol.
Nitration: Nitrating agents, Mechanism of nitration of benzene, working of Schmid nitrator, Biazzi nitrator., Typical industrial nitration processes: Nitration of benzene with HNO_3-fortified spent acid, Manufacture of p-nitroacetanilide, Manufacture of α-nitronaphthalene

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Sulphonation: Mechanism of sulphonation of benzene, working of batch sulfonation kettle, ball-mill sulfonator. Technical indusrial sulphonation processes: Continuous partial pressure sulphonation of benzene,Sulfation of lauryl alcohol, dimethyl ether.
Halogenation: mechanism of halogenation.
Manufacture of chloral, monochloroacetic acid, chlorination of toluene, vinyl chloride from acetylene.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Manufacturing of Industrial Gases**:** Hydrogen, Oxygen, Nitrogen, Carbon Dioxide, Acetylene.
Manufacturing of Fuels and Fuel gases: Producer gas, Water gas, Natural gas, Synthesis gas

Text Books:

1. George T. Austin, Shreve's Chemical Process Industries 5 th Edition
2. C.E. Dryden, Outline of Chemical Technology, Affiliated East WestPress.1973
3. P. H. Groggins, Unit Processes in Organic Synthesis- , Tata McGraw-Hill
4. Arun Bahl &B.S.Bahl, Textbook of organic chemistry: S.Chand & Co.Ltd. New Delhi

Reference Book:

1. 1.Chris A Clausen III and Guy Mattson, Principles of Industrial Chemistry, A Wiley – Inter Science Publication .John Wiley and sons, New York
2. B.K.Sharma, Industrial Chemistry, GOEL Publishing House
3. Satyaprakash, Engineering Chemistry, Khanna Book Publishing, Delhi
4. Shashi Chawla, A Text Book of Engg. Chemistry, Dhanpat Rai& Co. (P) Ltd.

Thermodynamics-I					
COURSE OUTLINE					
Course Title:	**Thermodynamics-I**	**Short Title:**	**THD-I**	**Course Code:**	

Course description:

The purpose of this course is to introduce thermodynamics – I and its importance to study the phase behavior of fluids with applications. The course covers the application of the first and second law of thermodynamics.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3

Prerequisite course(s):

Chemistry

Course objectives:

1. To revise principles and applications of first, second and third law of thermodynamics.
2. To understand the various thermodynamic systems.
3. To learn the Gibb's phase rule and its importance in phase transition.
4. To study the thermodynamic properties of fluids and phase equilibria.
5. To accustom Le-Chateliers principle, its importance and applications.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the aspects of chemical classical thermodynamics.
2. Apply mass and energy balances to different type of systems.
3. Solve problems involving liquefaction, refrigeration.
4. Apply the knowledge of Le-Chateliers principle in finding optimum parameters in the manufacture of important chemical products.
5. Identify the critical constant parameters for liquefaction of gases.

COURSE CONTENT

Thermodynamics-I		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction – scope & limitations of thermodynamics, basic definitions and terms, dimensions and units, Temperature, Pressure, Work, Energy, heat energy conservation, First law of thermodynamics; state functions; equilibrium; reversible process; Constant P,V,T processes, adiabatic expansion of an ideal gas, Mass and energy balances for open systems, Types of heat of reactions, standard heats of formation, Hess's law of constant heat summation.

Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**

Gibb's Phase Rule; hases, single component water system, 2-phase systems, phase transitions, phase diagrams: classification and usefulness, PVT behavior, General characteristics of gases, gas laws, Ideal gas law, compressibility factor, Vander Waals virial

and cubic equations of state; Reduced conditions & corresponding states theories, Heat effects-latent heat, sensible heat.

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Limitations of first law, spontaneous processes, criteria of spontaneity, statements of the second law, significance of entropy, mathematical statement of the second law; Entropy; entropy changes, entropy changes of an ideal gas and for a chemical reaction, Carnot's cycle, calculation of efficiency, entropy balance for open systems.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Thermodynamic property of fluids, Application of thermodynamics, flow processes pumps, compressors and turbines, Rankine cycle, Enthalpy & free energy, Effect of temperature on enthalpy change, Gibbs Helmholtz equation. Chemical equilibrium: criteria, characteristics, equilibrium constant, Le-Chateliers principle and its applications in manufacture of ammonia, sulphuric acid & nitric acid.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Third law of thermodynamics, absolute entropy, evaluation of absolute entropy, use of absolute entropy, Vapor-compression cycle; Absorption refrigeration; Heat pump, Liquefaction of gases, critical constants, liquefaction methods, Heat capacity of gases: C_p & C_v, Zeroth law of thermodynamics.

Text Books:

1.B.S.Bahl,G.D.Tuli, Arun Behl, ,Essentials of Physical Chemistry: S.Chand & Co. Ltd. Delhi.
2.Puri, Sharma, Pathania, Principles of Physical Chemistry, Vishal Publishing Company

Reference Books:

1.M.J. Moran, H.N. Shapiro, D.D. Boettner and M.B. Bailey, Principles of Engineering Thermodynamics, 8th Edition, Wiley.
2.Peter Atkins, Physical Chemistry, Oxford University Publication
3.Rao, An Introduction to Thermodynamics, John Wiley.

Engineering and Solid Mechanics					
COURSE OUTLINE					
Course Title:	**Engineering and Solid Mechanics**	**Short Title:**	**ESM**	**Course Code:**	

Course description:

The purpose of this course is to provide basic infra structure for various activities and to know about the behavior of the material under given load.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3

Prerequisite course(s):

Physics, Mathematics – I and II

Course objectives:

1. To study the resultant of coplanar forces and Equilibrium of coplanar force system
2. To learn the Plane Truss types, analytical methods and laws of friction
3. To accustom the kinematics of rectilinear motion of particle and Concept of stress and strain
4. To know bending moment and shear force diagrams and flexural stresses-theory of simple bending
5. To understand the torsion and its application and combined loading of bending and torsion

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the use of basic concepts of resolution and composition of forces
2. Analyse beams, truss or engineering component by applying conditions of equilibrium
3. Understand the different stresses and strains occurring in components of structure
4. Calculate the deformations such as axial, normal deflections under different loading conditions
5. Display knowledge of torsion and its application.

COURSE CONTENT

Engineering and Solid Mechanics		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Resultant of coplanar forces: Introduction, basic concepts, principle of mechanics, force systems, composition and resolution of forces, resultant of concurrent force system in plane, moment of forces, couples, Varignon's theorem, equivalent force couple systems, resultant of non-concurrent force system in plane.

Equilibrium of coplanar force system : Introduction, body constraints, types of supports and loads, free body diagram, conditions of equilibrium, equilibrium of forces in a plane , Lami's theorem, reactions of determinate beams, (simple beams).

Unit–II:	No. of Lectures: 08 Hours	Marks: 12
Plane Truss: Types of plane trusses (Perfect and Imperfect) Analysis of plane trusses by method of joints and method of sections. Friction: Introduction, laws of friction, application of friction on horizontal and inclined plane, ladder friction		

Unit–III:	No. of Lectures: 08 Hours	Marks: 12
Kinematics of rectilinear motion of particle: - Introduction, basic concepts, types of rectilinear motions, motion under gravity , Simple Stresses and Strains- Concept of stress and strain, Types of stresses and strains, Hooke's law,– stress – strain diagram for mild steel – Working stress –Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.		

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12
Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I section,T section, Angle and Channel sections – Design of simple beam sections.		

Unit–V:	No. of Lectures: 08 Hours	Marks: 12
Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections		

Text Books:

1. B.C.Purnia , A.K.Jain and A.K.Jain Mechanics of Material, Laxmi Publication.
2. S. Ramamrutham, Strength of Material Dhanpat Rai Publication.
3. S.S.Bhavikatti, K.G. Rajashekarappa,Engineering Mechanics New Age International Publications.
4. R.S.Kurmi, A Text Book of Engineering Mechanics S .Chand and Co.Ltd Publication

Reference Books:

1. Ferdinand P. Beer, E. Russell Johnston, Jr, John T. Dewolf, David F. Mazurek, Mechanics of Materials McGraw Hill Publication

Fluid Mechanics					
COURSE OUTLINE					
Course Title:	**Fluid Mechanics**	**Short Title:**	**FM**	**Course Code:**	

Course description:

This course provides the students basic understanding of fluids (liquids and gases) and the forces on them. Fluid mechanics can be divided into fluid statics, the study of fluids at rest; fluid kinematics, the study of fluids in motion; and fluid dynamics, the study of the effect of forces on fluid motion. It includes fluids transportation, filtration and solids fluidization.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3

Prerequisite course(s):

Chemistry, Physics, Mathematics I and II

Course objectives:

1. To understand fluid properties
2. To analyze velocity concept, the continuity equation, Euler's equation of motion along streamline, Bernoulli's equations for different conditions.
3. To study flow through pipeline system, Reynolds experiment, Laws of friction, Major and minor losses.
4. To understand flow of compressible fluids, flow past immersed bodies, drag coefficient, boundary layer theory.
5. To apply flow and pressure measurement and pumping of fluids

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the role of mechanical and hydro dynamical unit operations in the field of chemical engineering.
2. Analyze key concepts and fundamental principles, together with the assumptions made in their development, pertaining to fluid behavior, both in static and flowing conditions.
3. Demonstrate to deal effectively with practical engineering situations, including analysis and design of engineering systems and devices involving fluids and flow.
4. Understand the knowledge of pipe fittings and pumping system important in chemical industries
5. Identify, formulate, design and provide the solution to various chemical engineering problems.

COURSE CONTENT

Fluid Mechanics		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12
Fundamental concepts of fluid flow, mechanism of compressible and non compressible fluid flow, equation of continuity, Reynolds number, significance, Bernoulli's theorem, distribution of velocities and fluid flow profiles, friction factor and friction losses in pipes, roughness factor and its significance, pipe fittings, equivalent length of fittings etc. Energy losses due to sudden contraction and expansion.		
Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**
Boundary layer theory, Velocity profile and boundary layer growth along a flat plate, thickness of boundary layer (definition and formulae only), separation of boundary, boundary layer calculations for turbulent flows. Dimensional analysis and model studies: Dimensional analysis, Buckingham's PI theorem, dimensionless numbers, application to fluid flow problem.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Flow measuring devices for incompressible and compressible fluids: orificemeter, venturimeter, pitot tube, rotameters, notches and weirs, gas flow meters, coefficient of discharge and calculations.		
Unit–IV:	**No. of Lectures: 09 Hours**	**Marks: 12**
Transportation of fluids, reciprocating and centrifugal pumps, pump characteristics, Diaphragm pumps, rotary pumps, screw pumps, gear pumps, pump power calculations, pump selection and trouble shooting of pumps, priming, cavitation, NPSH of pumps.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Fluidization, aggregate and particulate fluidization, minimum fluidization velocity, entrainment in fluidization. Packed Bed, pressure drop in packed beds, packing materials and their selection criteria, Loading and flooding in packed beds, Kazenger karma equation,- Industrial application.		

Text Books:

1. Dr.R.K. Bansal, Fluid Mechanics: Laxmi Publications, New Delhi.
2. Coulson J.M. and Richardson J.F.; Backhurst J.R. and Harker J.H.; Chemical Engineering, Vol. I , II & IV, Publishers: Butterworth - Heinmann, 2001-2002.
3. W.L. McCabe & J.C. Smith, Unit operations in chemical engineering: McGraw Hill/Kogakusha Ltd
4. I P. Chattopadhyay Unit operations of chemical engineering-volume I: Khanna Publication New Delhi, 2nd edition 1996.

Reference Books:

1. R.P.Vyas, Fluid Mechanics, Denett Publication.1.M.White Fluid Mechanics Eighth Edition Tata McGraw Hill, 2016
2. Perry's Handbook of chemical engineers McGraw-Hill: New York

Industrial Organization and Management					
COURSE OUTLINE					
Course Title:	**Industrial Organization and Management**	**Short Title:**	**IOM**	**Course Code:**	

Course description:

This course provides basic understanding and importance of organization and organization structure and different management aspects and the importance of different management types in industrial development. The course intents to develop ability to create lead and coordinate different section of Organization among students using managerial skills.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	14	42	3

Prerequisite course(s):

English

Course objectives:

1. To understand Management and Administration, types and structure of organization.
2. To study concepts of personnel management, importance of communication.
3. To learn concepts of sales management and marketing management.
4. To know importance of Inventory Control, purchasing and materials management.
5. To identify the importance of plant maintenance, leadership, importance of motivation.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand and apply the principles of management with scientific view, and will contribute to the profitable growth of industry.
2. Study various managerial skills which will help them to share responsibilities and will make them able to work effectively in diverse, multicultural environments.
3. Demonstrate ability to work in multidisciplinary team and will display communication skills.
4. Design sound purchasing skill ability and Inventory Control strategies , and simplistic materials management system.
5. Develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy and will provide engineering solutions in a global, economic, environmental, and societal context.

COURSE CONTENT

Industrial Organization and Management		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Management, its growth, concepts of Administration, Management and Organization. Definition of management, importance and characteristics and functions of Management, authority and responsibility, unity of command and direction decision making in management by objectives.

Business organization, Different forms of organization, their formation and working,

different organization structure- line organization, functional organization, line and staff organization.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Personnel Management, Manpower Planning, Recruitment, Selection & Training, Job Evaluation Methods, Merit Rating, Industrial Safety.
Communication: Principles, Types, Characteristics and Role of Communication in Management

Unit–III:	No. of Lectures: 09 Hours	Marks: 12

Sales and Marketing Management, Sales Management and functions of sales Manager, Salesman's quota. Selling Vs Marketing Concept, Principle and Functions of Marketing. Management, Marketing Research and Techniques, The Marketing Mix, Channels of Distribution, Advertising

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Inventory Control and Management, Objectives, Functions of Inventories, Inventory Models. Materials Management and its Functions, Importance of Materials Management, Purchasing Techniques and Purchasing Cycle.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Plant Maintenance, Objective and Importance of Plant Maintenance, Duties, Functions and Responsibilities of Maintenance Department, Types of Maintenance.
Leadership in Business and Qualities, Morale, Motivation: Definition, Need, Principle, Factors. Industrial fatigue.

Text Books:

1. O.P.Khanna, Industrial Engineering & Management, DhanpatRai Publications (P) Ltd New Delhi
2. Banga & Sharma, Industrial Engineering Science & Management, Khanna Publishers New Delhi.
3. C.R.Basu, Business Organisation and Management, Tata McGraw Hill Publishing CompanyLtd. New Delhi.

Reference Books:

1. L.M.Prasad, Principles of Management , Himalaya Publications Ltd
2. Philip Kotler, Marketing Management, Tata McGraw Hill
3. Savita Sharma,S.K.Sharma, Industrial Engineering & Operations Management, S. K. Kataria & Sons (Publishers)

Thermodynamics-I Lab					
LAB COURSE OUTLINE					
Course Title:	**Thermodynamics-I Lab**	**Short Title:**	**THD-I Lab**	**Course Code:**	

Course description:

This laboratory course is intended to develop understanding of fundamental aspects of first and second laws of thermodynamics and basic themochemistry principles.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1

End Semester Exam (ESE) Pattern: **Oral (OR)**

Prerequisite course(s):

Chemistry, Physics

Course objectives:

1. To induce knowledge of fundamental principles of first and second law of thermodynamics through experimentation.
2. To impart practical knowledge of heat, work and energy conversion.
3. To teach the students about the aspects of themochemistry.
4. To train the students for calculating enthalpy change, entropy change and free energy change of a reaction.
5. To educate the students for applying the practical knowledge of thermodynamics in chemical industries.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Accustom concepts of heat, work, and energy and their interrelations.
2. Understand basic thermodynamic properties and units.
3. Demonstrate the ability for calculating heat of solution, heat of neutralization, heat of hydration of a chemical reaction.
4. Execute the knowledge for determining enthalpy change, entropy change and free energy change of a particular reaction.
5. Apply the knowledge of fundamental thermodynamic properties and thermochemistry principles in chemical industries**.**

LAB COURSE CONTENT

Thermodynamics-I Lab		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

(Amongst the following any eight experiments / assignments are to be performed)

1. Determination of heat of solution of KNO_3./NH_4Cl
2. Determination of water equivalent of copper calorimeter
3. To determine heat of neutralization of strong acid & strong base by calorimeter.
4. To determine the gas constant R by Eudiometer method.
5. To determine the heat of hydration of $CuSO_4$
6. Determination of critical solution temperature of phenol-water system.

7. Determine the integral heat of dilution of H_2SO_4 starting with solution of different concentration.
8. To determine ΔH, ΔG, ΔS of a reaction.
9. Determination of ΔG, ΔH, ΔS of silver benzoate by solubility product and by Conductometery
10. Determination of partial molar volume of ethanol in dilute aqueous solutions.
11. To study first law of thermodynamics
12. To study second law of thermodynamics

Text Books:

1. J.B.Yadav , Advanced Practical Physical Chemistry, Goel publishing House Meerut.
2. Rajbhoj&Chondekar, Systematic experimental Physical Chemistry, Anjali Publication.
3. R.C. Das &B.Behhra, Experimental Physical Chemistry, Tata McGraw Hill.

Reference Books:

1. Wilson, Experiments of Physical Chemistry by, NewCombe, Denaro Pergaman Press Rickett.
2. Anupma Rajput, Laboratory Manual Engg. Chemistry, Dhanpat Rai& Co.

Guide lines for ICA:

Internal Continuous Assessment shall be based on continuous evaluation of Student performance throughout semester and practical / assignments submitted by the student in the form of journal

Guidelines for ESE: End Semester Examination shall be based on practical / oral evaluation of Student performance and practical / assignments submitted by the student in the form of journal.

Fluid Mechanics Lab					
LAB COURSE OUTLINE					
Course Title:	**Fluid Mechanics Lab**	**Short Title:**	**FM Lab**	**Course Code:**	

Course description: This course intended to fulfill the need for comprehensive laboratory course in. Fluid Mechanics

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1

End Semester Exam (ESE) Pattern:	**Oral (OR)**

Prerequisite course(s):

Physics

Course objectives:

1. To learn Bernouillis theorem
2. To analyze measurement of coefficient of discharge for venturimeter, orificemeter and notch.
3. To understand importance of nature of flow using Reynolds experiment
4. To know about pressure drops through manometer.
5. To determine the characteristics of various types of pumps

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Analyze potential head, kinetic head and pressure head using Bernouillis theorem.
2. Demonstrate how to measure flow rates of fluids.
3. Analyze laminar or turbulent or transient nature of flow.
4. Apply the knowledge of characterization of pumps.
5. Apply the knowledge fluid mechanics.

LAB COURSE CONTENT

Fluid Mechanics Lab		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

(Amongst the following any eight experiments / assignments are to be performed)

1. Study of Bernouillis theorem
2. Measurement of coefficient of discharge for venturimeter
3. Measurement of coefficient of discharge for orificemeter
4. Measurement of coefficient of discharge for notch
5. Study of Rotameter
6. Study of manometers
7. Study of Reynolds experiment
8. Study of characteristics of centrifugal pump
9. Study of characteristics of reciprocating pump
10. Study of characteristics of diaphragm pump

Text Books:

R.K.Bansal "A textbook of fluid mechanics and hydraulic machines"Firewall Media, 2005

Reference Books:
Perry's Handbook of Chemical Engineers
Guide lines for ICA:
Internal Continuous Assessment shall be based on continuous evaluation of Student performance throughout semester and practical / assignments submitted by the student in the form of journal.
Guidelines for ESE: End Semester Examinationshall be based on practical / oral evaluation of Student performance and practical / assignments submitted by the student in the form of journal.

Chemical Engineering Lab-I					
LAB COURSE OUTLINE					
Course Title:	**Chemical Engineering Lab-I**	**Short Title:**	**CEL – I**	**Course Code:**	

Course description:

This course applies theoretical principles, learnt in earlier and concurrent chemical engineering course, in a laboratory programme. The laboratory covers most aspects of analysis, estimations & purification techniques which are the backbone of chemical process industries.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1
Theory	1	14	14	1

End Semester Exam (ESE) Pattern:	**Practical (PR)**

Prerequisite course(s):

Chemistry Lab

Course objectives:

1. To provide firsthand experience of verifying various theoretical concepts learnt in theory courses.
2. To study laboratory techniques for analysis and estimations.
3. To learn purification techniques for solid and liquid substances.
4. To develop the skills for analysis of oil and petroleum samples.
5. To induce skills for qualitative & quantitative chemical analysis.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Gain knowledge of experimental techniques for verifying theoretical concepts.
2. Apply experimental skills for purification of impure substances.
3. Display the ability to carry qualitative & quantitative chemical analysis.
4. Apply the basics of experimentation in analysis of oil and petroleum samples.
5. Demonstrate the analytical skills for solving problems arising during chemical analysis.

LAB COURSE CONTENT

Chemical Engineering Lab-I		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

(Amongst the following any eight experiments / assignments are to be performed)

1. 2–3 experiments on purification techniques for solid & liquid substances by crystallization & distillation.
2. 3-4 experiments on sample analysis by volumetric estimations methods.
3. 2-3 experiments on analysis of petroleum products / oil samples.

Text Book:
S.K.Bhasin, Laboratory manual on engg. Chemistry: DhanpatRaiPub.New Delhi
Reference Books:
1. Vogel's,Text book of Quantitative Chemical Analysis : ELBS with Longman 2. Practical Chemistry : Manali Publications, Pune
Guide lines for ICA:
Internal Continuous Assessment shall be based on continuous evaluation of Student performance throughout semester and practical / assignments submitted by the student in the form of journal.
Guidelines for ESE:
End Semester Examination shall be based on practical / oral evaluation of Student performance and practical / assignments submitted by the student in the form of journal.

KAVAYITRI BAHINABAI CHAUDHARI
NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Second Year Engineering

(Chemical Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

SYLLABUS

Semester - IV

W.E.F. 2019 – 20

Biology					
COURSE OUTLINE					
Course Title:	**Biology**	**Short Title:**	**BIO**	**Course Code:**	

Course description:

This course is introduced for learning the basic fundamentals of Lifesciences (zoology & Botany) to undergraduate students. The prospectus includes a prior knowledge of Biotechnology. The goals of the course are to understand the basic principles of Biology and its applications in the field of Engineering.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
Lecture	03	14	42	04
Tutorial	01	14	14	

Prerequisite course(s):

12^{th} STD

Course objectives:

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. To make the students know about role of phytohormones in regulation of plant development.
3. To demonstrate essentiality of plant regeneration techniques in crop improvement and production of secondary metabolites of economic importance.
4. To make the students know how microbes can be grown and preserved and used for benefit of mankind.
5. To make the students know the underlying mechanisms of gene cloning.

Course outcomes:

After successful completion of this course the student will be able to:

1. Explain the structure and importance of different biomolecules for different cellular functions and metabolic activities in the living organisms
2. Explain the conditions required for growth, characteristics of growth and development.
3. Explain major components of cell and tissue culture media, e.g. minerals, growth factors, hormones, and what governs the choice of components.
4. Explain various techniques for isolation and identification of microorganisms with their role in various fields.
5. Explain the significance of model organisms in recombinant DNA technology

COURSE CONTENT

Biology		Semester:	IV
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
Tutorial	**1 hours/week**		
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Diversity of Organism and Cell Biology

Introduction: Living systems, Bio-mimicry, Metabolism, Taxonomy, Concept of species,Structural organization of life, Concepts of modern cell, history of cell, Cell theory, Structure of cell:- Cell shape, size and cell number, Types of cells:- Prokaryotic cells and Eukaryotic cells, Chemistry of cells.
Cell Division:Cell cycle, mitosis, meiosis, mitotic cell division, cell cycle check points, meiotic cell division, embryonic cell division, cell death.

Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**

Plant and Animal Kingdom
Plant Kingdom:Introduction to plants, Salient features of major plant groups: Bryophyta, Pteridophyta, Gymnospermae, Angiospermae,
Plant Growth & Development: Introduction, Seed Dormancy, Seed Germination, Phases of growth, Plant growth hormones.
Animal Kingdom:Animal Classification, Salient features of non-chordates upto phylum level: Phylum porifera, phylum Cnidaria, Phylum Ctenophora, Phylum Platyhelminthes.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Plant Cell and Animal cell culture and Applications
Plant Cell Culture:
Brief introduction to cell culture with respect to the properties of plant cells, Media requirements, Typical media used, Classification of tissue culture, callus culture, cell suspension culture, Application of callus culture and cell suspension culture, Plant cell cultivation Bioreactors
Animal Cell Culture:
Brief introduction to animal cell culture, Culture medium: Natural and Artificial media, introduction to balanced salt solutions and simple growth medium, Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, Animal Bioreactors.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Microbial Culture and Applications:
Introduction, Microbial Culture Techniques, growth curve, Pure culture techniques – microbial culture media, isolation, identification and maintenance of cultures, incidences of microorganisms in soil, water, air, food and sewage, food spoilage organisms, Applications of Microbial Culture Technology.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Biotechnology and its Applications:
Definitions, scope of Biotechnology, Recombinant DNA Technology:Making Recombinant DNA, Tools in Genetic Engineering, Polymerase Chain reaction (PCR).
Applications of Biotechnology:
Bioinformatics, Biomechanics, Biotechnology of waste treatment, Biosensors, Forensic science, Food Biotechnology, Fermentation Technology.

Text Books:

1. B.D. Singh " Genetics" Kalyani Publications Third Edition.
2. C.B. Pawar"Cell Biology" Himalaya Publications, Third Edition.
3. C.B. Pawar"Cell and Molecular Biology" Himalaya Publications.
4. V.K. Agrawal, Text book of Zoology,S. Chand Publication.

5. Dr. B.P. Pandey, Text book of Botany, S. Chand Publication.
6. R.C. Dubey,Text book of Biotechnology, S. Chand Publications.

Reference Books:

1. P. K Gupta, Introduction to Biotechnology, Rastogi Publications.
2. B.D.Singh, Biotechnology: Expanding Horizons, Kalyani Publishers, New Delhi, Second Revised Edition, 2008.
3. S.S.Purohit, Biotechnology: Fundamentals and Applications, Agrobios (India), 4th Edition, 2005.

Material Science					
COURSE OUTLINE					
Course Title:	**Material Science**	**Short Title:**	**MS**	**Course Code:**	

Course description:

The objective of the course will be to give the students a basic introduction to the different classes of materials relevant to engineering in general, and chemical engineering in particular. The intent of the course will be to relate the underlying molecular structure of the materials to their physical and chemical properties, and their processing and performance characteristics.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	14	42	3

Prerequisite course(s):

Chemistry, Physics, Industrial Chemistry

Course objectives:

1. To know the essential parameters for the formation of covalent, ionic and metallic bond.
2. To understand the structure-properties relationship for engineering materials.
3. To learn basics for creating desired structure.
4. To study the inorganic engineering materials & composites.
5. To learn the fundamental principles underlying and connecting the structure, processing, properties, and performance of materials systems.

Course outcomes:

After successful completion of this course the student will be able to:

1. Learn contemporary issues relevant to materials science.
2. Analyze the particular material for specific engineering application.
3. Understand the core parameters of engineering composites.
4. Apply core concepts to solve engineering problems.
5. Possess the skills and techniques necessary for modern materials engineering practice.

COURSE CONTENT

Material Science		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to materials, classification of engineering materials, bonding between atoms: metallic bonding, electron sea model, ionic bonding, Born-Haber cycle, covalent bonding, Vander Waals bond, variation in bonding character & properties, thermal expansion, melting point, elasticity of materials. Factors affecting the selection of materials for engineering purposes, levels of structure, space lattices & crystal structure, miller indices, close packing structures.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
Imperfections in solids: vacancies, equilibrium concentration of vacancies, interstitial and substitutional impurities in solids, dislocations, types and characteristics of dislocations, interfacial defects, stacking faults. Structure of materials and Strength of Materials: Yield strength, tensile strength and ductility of materials: stress strain behaviour of metals, ceramics and polymers, tensile test, plastic deformation, necking, creep behaviour and fatigue.		

Unit–III:	No. of Lectures: 08 Hours	Marks: 12
Semi-crystalline materials, Ceramics: classification, basic raw materials, chemical conversion, glazing, whitewares, structural clay products. Polymers: Basic concept, classification, types of polymerization, effect of polymer structure on properties, mechanical properties of polymers, Plastics: properties &applications. copolymers, liquid crystals and amphiphiles, silicates.		

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12
Composites: Introduction & constituents, Types of composites, Processing of fiber-reinforced composites. Polymer nano-composite materials, role of reinforcement-matrix interface strength on composite behavior. Glass: Introduction, Manufacture of glass, Types of glasses & their applications. Abrasives: Introduction, Natural abrasives & synthetic abrasives		

Unit–V:	No. of Lectures: 08 Hours	Marks: 12
Corrosion: Dry & wet corrosion, Pilling & Bedworth rule, formation & growth of films, pitting corrosion, hydrogen embrittelement, hydrogen evolution, oxygen absorption, corrosion control by proper selection of materials, proper design & fabrication procedures. Introduction to experimental techniques: XRD, NMR,IR etc. for material characterization		

Text Books:

1. V. Raghavan, Materials Science and Engineering: A First Course, 5 th Edition Prentice Hall India, 2004. Jain & Jain, Engineering Chemistry :DhanpatRai& Sons, New Delhi.
2. S. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007.
3. V.D.Kotgire,S.V.Kotgire, Material Science and Metallurgy for Engineers, , Everest Publishing House
4. Jain & Jain, Engineering Chemistry, Dhanpat Rai Publishing Company

Reference Book:

1. William D. ,Callister, David G. Rethwisch, Material Science and Engineering: An Introduction,Wiley Publisher.
2. Suryanarayanan, A.V.K., Testing of Metallic Materials, Tata McGraw

Thermodynamics - II					
COURSE OUTLINE					
Course Title:	**Thermodynamics - II**	**Short Title:**	**THD-II**	**Course Code:**	

Course description:

The purpose of this course is to introduce thermodynamics – II and its importance to study the phase behavior and properties of pure fluids with applications. The course covers the application of the first and second law of thermodynamics to non-flow and steady-flow processes.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	14	42	3

Prerequisite course(s):

Physics, Chemistry, Thermodynamics-I

Course objectives:

1. To understand the laws of thermodynamics and equations of state.
2. To apply concept of entropy and Vapour-Liquid Equilibria (VLE).
3. To study the determination of partial molar quantities, fugacity and fugacity coefficient.
4. To learn the chemical reaction equilibria.
5. To study the construction of pressure-composition and boiling point diagrams.

Course outcomes:

After successful completion of this course the student will be able to:

1. Execute knowledge of basic science and engineering after study of the laws of thermodynamics and state functions.
2. Capable of identifying, formulating, designing and providing the solution to chemical engineering problems by study of calculations of entropy changes, Vant' Hoff equation.
3. Capable of evaluating chemical reaction equilibrium
4. Display the research ability by designing, conducting, interpreting and analyzing to experimental data for preparing reports by study of the thermodynamic consistency test of VLE data.
5. Exhibit the skill of construction of pressure-composition and boiling point diagrams.

COURSE CONTENT

Thermodynamics - II		Semester:	IV
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Introduction to the subject, The laws of Thermodynamics, Cyclic rule, Coefficient of Thermal Expansion, Compressibility Coefficient,Law of corresponding state, Heat Capacities, Enthalpy as a function of Temperature & Pressure, Joule-Thomson Coefficient , Relation between C_p & C_v, Thermodynamic relations, Generalized Equation of State, Redlich-kwong equation of state, Soave-Redlich-Kwong equation of state.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12
The Second Law of Thermodynamics, Mathematical Treatment of Entropy Concept, Combined form of First and Second Law of Thermodynamics, Thermodynamic Relations based on Second Law of Thermodynamics, Calculations of Entropy Changes, Third Law of Thermodynamics.		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Partial Molar Quantities: General Aspects, Determination of Partial Molar Volume and Enthalpy, Fugacity and Fugacity Coefficient, Fugacity coefficient through equation of state, Fugacity coefficient through virial coefficient correlation. Ideal solution: General Aspects, Phase equilibrium: General Aspects, Gibbs-Duhem Equation, Gibbs-Duhem-Margules Equation, Application of Gibbs-Duhem Equation.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Vapour-Liquid Equilibria (VLE): Basic equations for VLE, Reduction of VLE data, Excess Gibbs free energy Model, Margules Equation & Van Laar Equation, Thermodynamic consistency test of VLE data Phase Equilibria for Single Component System: Gibbs-Helmholtz Equation, The Clapeyron Equation, Clausious-Clapeyron Equation, Application of Clapeyron Equation.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Chemical Reaction Equilibria : The criteria for chemical equilibrium, Equilibrium constant, Law of chemical equilibrium, Relations between equilibrium constant, Homogeneous gaseous equilibria, Temperature dependence of the equilibrium constant (The Van't Hoff Equation), Integrated form of the Van't Hoff equation, Pressure dependence of the equilibrium constant. Applications of Phase Equilibrium in Ideal Solutions: To construct pressure-composition and boiling point diagrams.		

Text Books:

1. K.V. Narayanan, A Text book of Chemical Engineering Thermodynamic, Prentice Hall India Pvt. Ltd., New Delhi.
2. R.R.Rastogi and R.R.Mishra, An Introduction to Chemical Thermodynamics, Vikas Publishing House Pvt.Ltd, New Delhi
3. Smith,Vanness, Abbott, Introduction to Chemical Engineering Thermodynamics
4. Y.V.C. Rao, Chemical Engineering Thermodynamics, University Press (INDIA) Ltd., Orient Longman Ltd., Hyderabad
5. B.G.Kyle, Chemical and Process Thermodynamics, Prentice Hall India Pvt. Ltd., New Delhi

Reference Books:

1. G.N. Pandey and J.C.Chaudhari, Chemical Engineering Thermodynamics, Khanna Publishers, Delhi. Vth edition, McGraw Hill International Edition.

Material and Energy Balance Computations					
COURSE OUTLINE					
Course Title:	**Material and Energy Balance Computations**	**Short Title:**	**MEBC**	**Course Code:**	

Course description:

This course provide the students basic understanding of Material and Energy Balance Computations of Industrial Processes and to apply this in designing the various chemical process equipments.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3

Prerequisite course(s):

Physics, Chemistry, Industrial Chemistry , Thermodynamics-I

Course objectives:

1. To present fundamentals of chemical engineering in a simple manner.
2. To provide broad background for applying principles to industrial and theoretical problems.
3. To enable use of humidity charts for engineering calculations
4. To accustom about material balances and steady state energy balance for systems with and without chemical reactions
5. To understand heat and material balances of combustion processes.

Course outcomes:

After successful completion of this course the student will be able to:

1. Analyze a particular process in whole or part.
2. Evaluate the economics of the various processes, design the various equipments and help in identifying the losses in processes.
3. Exhibit the skill of material balances and steady state energy balance for various systems.
4. Apply the techniques for increasing the efficiency of the chemical processes.
5. Capable of use of humidity charts for engineering calculations.

COURSE CONTENT

Material and Energy Balance Computations		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Units their dimensions and conversions , Mass and volume relations, Stoichiometric and composition relations, Excess reactants, Degree of completion, Conversion, selectivity and yield.

Ideal gas law, Dalton's Law, Amagat's Law, and Average molecular weight of gaseous mixtures.

Effect of temperature on vapour pressure, Vapour pressure plot (Cox chart), Vapour pressures

of miscible and immiscible liquids and solutions, Raoult's Law and Henry's Law

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Humidity and saturation, Relative Humidity and percent saturation, Dew point, Dry and Wet bulb temperatures, Use of humidity charts for engineering calculations, problems on psychometric chart.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Material balances for systems with and without chemical reactions, species and elemental balance. Analysis of systems with by-pass, recycle and purge.

Unit–IV:	No. of Lectures: 09 Hours	Marks: 12

Energy capacity of gases, liquids and solutions, Heat of fusion and vaporization, Steady state energy balance for systems with and without chemical reactions. Calculations and application of heat of reaction, combustion, formation, neutralization and solution. Enthalpy-concentration charts. Combustion of solids, liquids and gaseous fuels, Calculation of theoretical and actual flame temperatures.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Heating value of fuels, calculations involving theoretical and excess air. Heat and material balances of combustion processes. Chemical, metallurgical and petrochemical processes.

Text Books:

1. Bhatt., B.I. and Vora S.M."Stoichiometry*"* IInd edition, Tata McGraw Hill.
2. O.A. Hougen, K.M. Watson and R.A. Ragatz "Chemical Process Principles" Part-I,CBS Publishers & distributors ,New Delhi.
3. K.A.Gavhane "Introduction to process calculations" Nirali Publications
4. ShekharPandharipande and Samir Musharaf "Process Calculations" Pune Vidyarthi Griha Prakashan, Pune
5. Himmelblau, D.M**.** *"*Basic Principles and Calculations in Chemical Engineering*"*, 6th edition. Prentice Hall.

Reference Books:

1. Perry's Handbook of chemical engineers McGraw-Hill: New York
2. Felder, R.M. &Rousseau, R.W**.** *"*Elementary Principles of Chemical Processes *",* 3rd edition. JohnWiley. (1999).
3. Narayanan and Lakshmikutty, "Stoichiometry and Process Calculations" , PHI

Project Management and Entrepreneurship					
COURSE OUTLINE					
Course Title:	**Project Management and Entrepreneurship**	**Short Title:**	**PME**	**Course Code:**	

Course description:

This course aims to provide entrepreneurs for systematic management of various projects and ventures. The course intents to develop entrepreneurs to take special challenges starting new projects and ventures for overall societal development.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3

Prerequisite course(s):

English, Industrial Organization and Management

Course objectives:

1. To understand Conceptualizing the Project, Project Planning and Project Management.
2. To study Project Planning and Design, preparation of Project Report.
3. To learn Theories and Models of entrepreneurship, characteristics of successful entrepreneur.
4. To know financial requirements of a new Enterprise, study and identify sources of finance.
5. To identify Challenges of small Enterprises.

Course outcomes:

After successful completion of this course the student will be able to:

1. Understand the importance of project planning and management of the project to become successful entrepreneur.
2. Display ability to design and develop newer products.
3. Demonstrate ability to work in multidisciplinary teams and understand the impact of engineering solutions in a global, economic, environmental, and societal context.
4. Demonstrate capability about customer relationship management
5. Exhibit skill about industrial policies for development of enterprise.

COURSE CONTENT

Project Management and Entrepreneurship		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Meaning of Projects, Product Planning and Development, Concepts of Projects, Importance, Dimensions and Aspects of Project, Project Classification, Conceptualizing the Project, Project Life Cycle, Characteristics of Project, Project Identification, Project formulation, Feasibility Report.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12
Project Analysis, Project Risks, Project Planning: Selection, Infrastructure, Machinery, Raw Materials, Finance, Marketing, Incentives, Project Design and Network Analysis, Project Report, Project Appraisal, Location of an Enterprise		
Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**
Introduction, Concept of entrepreneurship: Significance of entrepreneurship, Theories of entrepreneurship, Models of entrepreneurship development, Definition of entrepreneur: Traits and characteristics of successful entrepreneur , Functions of an entrepreneur, Types of entrepreneurs, Factors influencing entrepreneur, Professional vs. family entrepreneurs, Entrepreneurial leaders vs. managers, Entrepreneurial process: Entrepreneurial motivation, Entrepreneurial barriers, Women as entrepreneur, Role of woman entrepreneurs in society, Barriers to women entrepreneurs, Myths of entrepreneurship, Problems faced by entrepreneurs and capacity building for entrepreneurship, Profiles of successful entrepreneurs.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Financial requirements of a new Enterprise: Estimating financial requirements, Estimation of fix capital requirements, Estimation of working capital requirements Identifying the sources of finance –sources of long-term financing: Sources of medium term financing , Sources of short-term financing Institutions providing financial assistance: Venture capital funding-venture capital funding in the Indian scenario, Venture capital funding process, Importance of financial management, Working capital management, Accounting and book keeping, Financial statement, Financial ration analysis.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Challenges for small Enterprises Problem faced by small enterprises: Managerial problems, Marketing management, Human resource, Production management, Technological problems Role of central and state governments in promoting small enterprises: Fiscal and tax concessions for small enterprises, Industrial policies for small enterprises, Importance of marketing, Customer relationship management (CRM), Marketing services		

Text Books:

1. Vasant Desai, Project Management, Himalaya Publishing House, New Delhi.
2. Alpana Trehan, Entrepreneurship, Dreamtech Press.
3. O.P.Khanna, Industrial Engineering & Management, DhanpatRai Publications (P) Ltd New Delhi
4. Poornima M. Charantimath, Entrepreneurship Development –Small Business Enterprises, Pearson Publication.

Reference Books:

1. Jack M. Kaplan, Patterns of Entrepreneurship, Wiley.
2. K. Nagarajan, Project Management, New Age International Pvt. Ltd.

Material Science Lab					
LAB COURSE OUTLINE					
Course Title:	**Material Science Lab**	**Short Title:**	**MS Lab**	**Course Code:**	

Course description:

This laboratory course is intended to develop understanding of fundamental aspects of material science and testing of engineering materials.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1

End Semester Exam (ESE) Pattern: **Oral (OR)**

Prerequisite course(s):

Chemistry, Physics

Course objectives:

1. To provide firsthand experience of verifying various theoretical concepts learnt in theory course.
2. To induce essential knowledge of material science through experimentation.
3. To impart basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear, impact and torsion.
4. To impart practical knowledge of selection of engineering materials for specific applications on the basis of experimental data.
5. To accustom use of testing machines on fine aggregates, bricks, tiles and ceramics.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Understand the importance of testing of materials from engineering point of view.
2. Apply the knowledge for providing structural engineering solutions.
3. Accustom the testing machines for testing of engineering materials.
4. Analyze experimental data for providing technical solutions.
5. Display the ability in proper selection of materials for specific applications.

LAB COURSE CONTENT

Material Science Lab		**Semester:**	**III**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	--
		Internal Continuous Assessment (ICA):	--

(Amongst the following any eight experiments / assignments are to be performed)

1. Tension test on mild steel
2. Compression test on concrete, cement
3. Torsion test on mild steel
4. Shear Test on Mild steel- single and double shear
5. Impact test on Mild Steel (Charpy & Izod)
6. Tests on Bricks and Tiles and Ceramics
7. Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking

8. Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis
9. Bending test on steel sheets
10. Bending test on copper sheets

Text Books:

1. V.D.Kotgire, S.V.Kotgire, Material Science and Metallurgy for Engineers, , Everest Publishing House

Reference Books:

1. Suryanarayanan, A.V.K., Testing of Metallic Materials, Tata McGraw

Guide lines for ICA:

Student must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignment.

Thermodynamics - II Lab					
LAB COURSE OUTLINE					
Course Title:	**Thermodynamics - II Lab**	**Short Title:**	**THD-II Lab**	**Course Code:**	

Course description:

The purpose of this course is to study the phase behavior and properties of pure fluids with applications.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1

End Semester Exam (ESE) Pattern: **Oral (OR)**

Prerequisite course(s):

Physics, Chemistry, Thermodynamics-I

Course objectives:

1. To understand the laws of thermodynamics.
2. To learn concept of entropy and Vapour-Liquid Equilibria (VLE)
3. To know the determination of partial molar quantities, fugacity and fugacity coefficient.
4. To study Van't Hoff Equation.
5. To construct pressure-composition & boiling point diagrams.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Understand the fundamental laws of thermodynamics.
2. Understand Vapour-Liquid Equilibrium,
3. Display knowledge about partial molar properties, activity coefficient and the equilibrium constant in calculations.
4. Use Van't Hoff Equation
5. Demonstrate for construction of pressure-composition & boiling point diagrams.

LAB COURSE CONTENT

Thermodynamics - II Lab		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

(Amongst the following any eight experiments / assignments are to be performed)

1. To study Joule Thompson experiment.
2. To study second law of thermodynamics.
3. To study Vapour-Liquid Equilibrium
4. To determine partial molar enthalpy
5. To determine activity coefficient of liquid
6. To study Van't Hoff Equation
7. To determine the equilibrium constant of a chemical reaction
8. To determine the entropy changes in physical process
9. To construct Boiling Point diagram

10. To construct pressure composition diagram.
Text Books:
1. R.R. Rastogi and R.R. Mishra, An introduction to Chemical Thermodynamics, Vikas Publishing House Pvt. Ltd. New Delhi 2. J.M. Smith, H.C. Vanness, M.M. Abbott Introduction to Chemical Engineering Thermodynamics
Reference Book:
1. Perry's Handbook of Chemical Engineers
Guide lines for ICA:
Internal Continuous Assessment shall be based on continuous evaluation of Student performance throughout semester and practical / assignments submitted by the student in the form of journal
Guidelines for ESE:
End Semester Examinationshall be based on practical / oral evaluation of Student performance and practical / assignments submitted by the student in the form of journal.

Material and Energy Balance Computations Lab					
LAB COURSE OUTLINE					
Course Title:	**Material and Energy Balance Computations Lab**	**Short Title:**	**MEBC Lab**	**Course Code:**	

Course description:

This course provide the students basic understanding of Material and Energy Balance Computations of Industrial Processes.

Laboratory	Hours/week	No. of weeks	Total hours	Semester credits
	2	14	28	1

End Semester Exam (ESE) Pattern: **Oral (OR)**

Prerequisite course(s):

Physics, Chemistry, Industrial Chemistry , Thermodynamics-I

Course objectives:

1. To present fundamentals of chemical engineering in a simple manner.
2. To provide broad background for applying principles to industrial and theoretical problems.
3. To understand use of humidity charts for engineering calculations
4. To study material balances and steady state energy balance for systems with and without chemical reactions
5. To learn heat and material balances of combustion processes

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Analyze a particular process in whole or part.
2. Evaluate the economics of the various processes, design the various equipments and help in identifying the losses in processes.
3. Apply the techniques for increasing the efficiency of the chemical processes.
4. Capable of use of humidity charts for engineering calculations
5. Demonstrate the ability of calculating heat and material balances of combustion processes

LAB COURSE CONTENT

Material and Energy Balance Computations Lab		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

(Amongst the following any eight experiments / assignments are to be performed)

1. Solving material balance problems without chemical reaction
2. Material balances for systems with chemical reactions
3. Use of humidity charts for engineering calculations
4. Heat of fusion and vaporization
5. Analysis of systems with by-pass, recycle and purge
6. Calculations and application of heat of reaction, combustion, formation.
7. Calculations and application of heat of neutralization and solution.

8. Calorific Value of Coal.
9. Energy capacity of gases, liquids and solutions
10. Heat of fusion and vaporization

Text Book:

1. Bhatt., B.I. and Vora S.M."Stoichiometry*"* IInd edition, Tata McGraw Hill (1984)
2. O.A. Hougen, K.M. Watson and R.A. Ragatz "Chemical Process Principles" Part-I,CBS Publishers & distributors ,New Delhi.
3. K.A.Gavhane "Introduction to process calculations" Nirali Publications
4. ShekharPandharipande and Samir Musharaf "Process Calculations" Pune Vidyarthi Griha Prakashan, Pune
5. Himmelblau, D.M**.** *"*Basic Principles and Calculations in Chemical Engineering*"*, 6th edition. Prentice Hall.

Reference Books:

1. Perry's Handbook of chemical engineers McGraw-Hill: New York
2. Felder, R.M. &Rousseau, R.W**.** *"*Elementary Principles of Chemical Processes *",* 3rd edition. JohnWiley. (1999).
3. Narayanan and Lakshmikutty, "Stoichiometry and Process Calculations" , PHI

Guide lines for ICA:

Internal Continuous Assessment shall be based on continuous evaluation of Student performance throughout semester and practical / assignments submitted by the student in the form of journal

Guidelines for ESE:

End Semester Examination shall be based on practical / oral evaluation of Student performance and practical / assignments submitted by the student in the form of journal.

Chemical Engineering Lab-II					
LAB COURSE OUTLINE					
Course Title:	**Chemical Engineering Lab-II**	**Short Title:**	**CEL-II**	**Course Code:**	

Course description:

This course gives the students basic knowledge about the calculations of chemical reaction rates. The course also applies earlier learned knowledge for the preparation of chemical compounds on laboratory scale through single stage preparations.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1
Theory	1	14	14	1

End Semester Exam (ESE) Pattern:	**Practical (PR)**

Prerequisite course(s):

Chemical Engineering Lab-I

Course objectives:

1. To provide the students the firsthand experience of verifying various theoretical concepts learnt in theory courses.
2. To learn single stage preparations in stepwise manner.
3. To accustom the determination of rate constants for reactions.
4. To induce analytical skills in students for product preparations.
5. To expertise in experimental skills for solving problems arising during preparation of valuable products.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Verify various theoretical principles through experimentation.
2. Accustom the experimental skills in product preparations.
3. Visualize practical implementation of proper techniques for the conversion of raw materials into finished products.
4. Apply knowledge in investigating reaction rates of elementary reaction.
5. Demonstrate the ability for providing technical solutions in the manufacture of products.

LAB COURSE CONTENT

Chemical Engineering Lab-II		**Semester:**	**IV**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	**25 marks**
		Internal Continuous Assessment (ICA):	**25 marks**

(Amongst the following any eight experiments / assignments are to be performed)

1. 2–3 experiments on investigation of reaction rates for elementary reaction.
2. 5-6 experiments on single stage preparations.

Text Book:

F.G.Mann&B.C.Saunders, Practical Organic Chemistry, Orient Longman

Reference Books:
1. S.K.Bhasin, Laboratory manual on engg. Chemistry: DhanpatRaiPub.New Delhi 2. Practical chemistry : Manali publications, Pune
Guide lines for ICA:
Internal Continuous Assessment shall be based on continuous evaluation of Student performance throughout semester and practical / assignments submitted by the student in the form of journal
Guidelines for ESE:
End Semester Examinationshall be based on practical / oral evaluation of Student performance and practical / assignments submitted by the student in the form of journal.

Environmental Studies					
COURSE OUTLINE					
Course Title:	**Environmental Studies**	**Short Title:**	**EVS**	**Course Code:**	**Non Credit**
Course description:					
The course aims to percolate the importance of environmental science and environmental studies.					

COURSE CONTENT			
Environmental Studies	**Semester:**	**IV**	
	Examination scheme		
	End Semester Exam (ESE):		**60 Marks**
	Duration of ESE:		**03 Hours**
	Internal Continuous Assessment (ICA):		**40 Marks**

Unit–I:	**No. of Lectures: 02 Hours**	

Multidisciplinary nature of environmental studies
Definition, scope and importance
Need for public awareness.

Unit–II:	**No. of Lectures: 08 Hours**	

Natural Resources :
Renewable and non-renewable resources
Natural resources and associated problems.

a. Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b. Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c. Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d. Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e. Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
f. Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

• Role of an individual in conservation of natural resources.
• Equitable use of resources for sustainable lifestyles.

Unit–III:	**No. of Lectures: 06 Hours**	

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following

ecosystem :-

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit–IV:	No. of Lectures: 08 Hours	

Biodiversity and its conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographic classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit–V:	No. of Lectures: 08 Hours	

Environmental Pollution

Definition

- Cause, effects and control measures of :-
  a. Air pollution
  b. Water pollution
  c. Soil pollution
  d. Marine pollution
  e. Noise pollution
  f. Thermal pollution
  g. Nuclear hazards
- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

Unit–VI:	No. of Lectures: 07 Hours	

Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear
- accidents and holocaust. Case Studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act

- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Unit–VII:	No. of Lectures: 06 Hours	

Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Program
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Unit–VIII:	No. of Lectures:	

Field work

- Visit to a local area to document environmental assets, river / forest / grassland / hill / mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

Guide lines for ICA:

Students must submit ICA in the form of journal. Each assignment should be well documented. Faculty in charge will assess the assignments continuously and grade or mark each assignment on completion date declared for each assignments.

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

12. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)
19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. ErachBharucha, Textbook of Environmental Studies, University Press
21. MP Poonia& SC Sharma, Environmental Studies, Khanna Publishing House
22. Rajagopalan, Environmental Studies, Oxford University Press

Internship

Internship is a mandatory and non-credit course. It is mandatory for all admitted students to undergo Internship during the degree course. The course Internship – I shall be during summer vacation after Semester - IV of THREE weeks duration. Following are the intended objectives of internship training:

- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' will be used in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job.

Students shall choose to undergo Internship / Innovation / Entrepreneurship related activities for Internship. Students shall choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/ NGO's/ Government organizations / Micro / Small / Medium enterprises / academic institutions / research institutions. In case student want to pursue their family business and don't want to undergo internship, a declaration by a parent may be submitted directly to the Department Head / TPO.

During the last year of FOUR year Bachelor of Engineering course the student should take project work, as specified in the curriculum, based on the knowledge acquired by the student during the degree course and during Internship. The project work provides an opportunity to build a system based on area where the student likes to acquire specialized skills. The work may also be on specified task or project assigned to the student during Internship.

The internship activities and list of sub-activities for Internship – I are as under.

 Inter/ Intra Institutional Activities

o Training with higher Institutions;
o Soft skill training organized by Training and Placement Cell of the respective institutions;
o Participation in conferences/ workshops/ competitions etc.;
o Learning at Departmental Lab/Tinkering Lab/ Institutional workshop;
o Working for consultancy/ research project within the institutes;
o Participation in all the activities for eg. Leadership Talks / Business Competition/ Technical Expos etc.

 Internship:

o Internship with Industry /Govt. / NGO / PSU / Any Micro/ Small / Medium enterprise/ academic institutions / research institutions
o Online Internship

Every student is required to prepare a file for Internship – I containing documentary proofs (daily training diary, comprehensive report and completion certificate) of the activities done by him/her. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily training diary should include Date, Time of Arrival, Time of Departure, Main points of the day. The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working.

After completion of Internship, the student should prepare a comprehensive report to indicate what he / she has observed and learnt in the training period. The report should include Internship Objectives (in measurable terms), Internship Activities, and Internship Outcome.
The completion certificate should be signed by the supervisor / in charge of the section where the student has been working with performance remark as Satisfactory / Good / Excellent.
The evaluation of Internship – I shall be in Semester – VII. The evaluation shall be done by expert committee constituted by the concerned department including Department Head/ TPO/ faculty mentor or guide. It should be evaluated on the basis of the following criteria:

Regularity in maintenance of the diary.

- Adequacy & quality of information recorded.
- Originality.
- Adequacy and purposeful write-up.
- Practical applications, relationships with basic theory and concepts taught in the course.
- Skill / knowledge acquired

Hence the satisfactory completion of Internship – I shall be submitted to the university at the end of Semester - VIII of FOUR year Bachelor of Engineering course. Only after successfully completion of Internship- I, Internship should be printed in the final year mark sheet as COMPLETED.