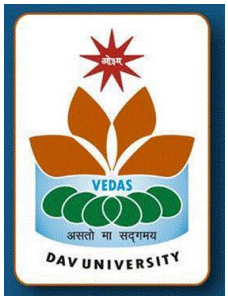
DAV UNIVERSITYJALANDHAR



Course Scheme & Syllabus

For

B. Tech. in Chemical Engineering
(Hons. /Pass)

1st TO 8th SEMESTER
Examinations 2013–2014 Session

Syllabi Applicable For Admissions in 2013

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 1

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH151/ MTH152	Mathematics-I (For odd Sem)/ Mathematics -II For (even semester)	4	1	0	4	25	25	25	25	100
2	CHE151	Chemistry	3	0	0	4	25	25	25	25	75
3	**CSE101**	Basic Computer Trends	4	0	0	4	25	25	25	25	100
4	EVS101	Environment Education, Road Safety and Legal Awareness	4	0	0	4	25	25	25	25	100
5	SGS101	Human Values & Ethics	2	0	0	2	25	25	25	25	50
6	**MGT151**	Fundamentals of Management	2	0	0	2	25	25	25	25	50
7	MEC101	Engineering Drawing	2	0	4	4	25	25	25	25	100
8	**CSE102**	Basic Computer Trends - Lab	0	0	2	2	-	-	-	-	50
9	CHE152	Chemistry-Lab	0	0	2	1	-	-	-	-	50
			21	**1**	**8**	**27**					**675**
	SGS104	Stenography				**1**					
	SGS105	Stenography Lab				**1**					

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 2

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH151/ MTH152	Mathematics-I (For odd Sem)/ Mathematics -II For (even semester)	4	1	0	4	25	25	25	25	100
2	PHY151	Engineering Physics	3	0	0	3	25	25	25	25	75
3	MEC102	Fundamentals of Mechanical Engineering	4	0	0	4	25	25	25	25	100
4	ELE101	Electrical & Electronics Technology	4	1	0	4	25	25	25	25	100
5	ENG151	Basic Communication Skills	3	0	0	3	25	25	25	25	75
6	SGS102	General knowledge & Current affairs	2	0	0	2	25	25	25	25	50
7	MEC104	Manufacturing Practice	0	0	4	2	-	-	-	-	50
8	ELE102	Electrical & Electronics Technology -Lab	0	0	2	2	-	-	-	-	50
9	ENG152	Basic Communication Skills -Lab	0	0	2	1	-	-	-	-	25
10	PHY152	Physics-Lab	0	0	2	2	-	-	-	-	50
			20	**2**	**10**	**27**					**675**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 3

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH252	Engineering Mathematics III	4	1	0	4	25	25	25	25	**100**
2	CSE201	Object Oriented Programming	4	0	0	4	25	25	25	25	**100**
3	CHL201	Mechanical Operations	4	0	0	4	25	25	25	25	**100**
4	CHL202	Chemical Process Calculations	4	0	0	4	25	25	25	25	**100**
5	CHL203	Fluid flow	4	0	0	4	25	25	25	25	**100**
6	CSE205	Object Oriented Programming ab	0	0	4	2		20		80	50
7	CHL221	Mechanical Operations Lab	0	0	2	1	20			80	25
8	CHL223	Fluid Flow lab	0	0	3	2	20			80	**50**
			20	**1**	**9**	**25**					**625**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 4

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	PHY257	Material Science	4	0	0	4	25	25	25	25	**100**
2	CHL204	Chemical Technology- I (Inorganic)	4	0	0	4	25	25	25	25	**100**
3	CHL205	Chemical Engineering Thermodynamics	4	0	0	4	25	25	25	25	**100**
4	CHL206	Heat Transfer	4	0	0	4	25	25	25	25	**100**
5	CHL207	Chemical Process Instrumentation	4	0	0	4	25	25	25	25	**100**
6	PHY258	Material Science Lab	0	0	2	1	20			80	**25**
7	CHL225	Chemical Engineering Thermodynamics Lab	0	0	3	2	20			80	**50**
8	CHL226	Heat Transfer Lab	0	0	3	2	20			80	**50**
			20	**0**	**8**	**25**					**625**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Note: *At the end of the examination of 4th Semester the students will undergo compulsory industrial training for a period of 4 weeks duration in reputed industries. Every student will submit the Training Report within two weeks from the start of teaching for 5thSemester. The marks for this will be included in the 5th semester.*

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 5

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	MTH256	Numerical Methods	4	1	0	3	25	25	25	25	**75**
2	CHL301	Mass Transfer-I	4	0	0	4	25	25	25	25	**100**
3	CHL302	Chemical Reaction Engineering - I	4	0	0	4	25	25	25	25	**100**
4	CHL303	Chemical Technology -II (Organic)	4	0	0	4	25	25	25	25	**100**
5	CHL304	Process Dynamics and Controls	4	0	0	4	25	25	25	25	**100**
6	MTH257	Numerical Methods Lab	0	0	2	1	20			80	**25**
7	CHL324	Process Dynamics and Controls Lab	0	0	3	2	20			80	**50**
8	CHL323	Chemical Technology lab	0	0	3	2	20			80	**50**
9	CHL300	Industrial Training	0	0	0	2	100				**50**
			20	**1**	**8**	**26**					**650**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 6

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	CHL305	Mass Transfer - II	4	0	0	4	25	25	25	25	**100**
2	CHL306	Chemical Reaction Engineering-II	4	0	0	4	25	25	25	25	**100**
3	CHL307	Process Plant Utilities	4	0	0	4	25	25	25	25	**100**
4	CHL308	Environmental Engineering	4	0	0	4	25	25	25	25	**100**
T	CHL309	Optimization Techniques	4	0	0	4	25	25	25	25	**100**
6	CHL325	Mass Transfer Lab	0	0	3	2	20			80	**50**
7	CHL326	Chemical Reaction Engineering Lab	0	0	3	2	20			80	**50**
8	CHL328	Environmental Engineering Lab	0	0	3	2	20			80	**50**
			20	**0**	**9**	**26**					**650**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Note:

At the end of the examination of 6th Semester the students will undergo compulsory industrial training for a period of 6 weeks duration in reputed industries. Every student will submit the Training Report within two weeks from the start of teaching for 7th Semester. The marks for this will be included in the 7th semester.

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 7

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	CHL401	Energy Technology	4	0	0	4	25	25	25	25	**100**
2	CHL402	Transport Phenomenon	4	0	0	4	25	25	25	25	**100**
3	CHL403	Plant Design and Economics	4	0	0	4	25	25	25	25	**100**
4	CHL404	Process Engineering Design-I	3	0	2	4	25	25	25	25	**100**
5		Department Elective -I	3	0	0	3	25	25	25	25	**75**
6	CHL421	Energy Technology Lab	0	0	3	2	20			80	**50**
7	CHL400	Industrial Training	0	0	0	2		100			**50**
8	CHL450	Seminar	0	0	2	2		100			**50**
			18	**0**	**7**	**25**					**625**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Note: *Department Elective-I should be from any one of the following four Elective Groups.*

Department Elective-I	
CHL451	Biochemical Engineering
CHL452	Membrane Separation
CHL453	Polymer Processing
CHL454	Fertilizer Technology

Scheme of Courses

B. Tech. in Chemical Engineering

Semester 8

S. No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	CHL405	Process Modeling and Simulation	4	0	0	4	25	25	25	25	**100**
2	CHL406	Industrial Safety and Hazardous Management	4	0	0	4	25	25	25	25	**100**
3	CHL407	Process Engineering Design - II	3	0	2	4	25	25	25	25	**100**
4		Department Elective-II	3	0	0	3	25	25	25	25	**75**
5		Open Elective	4	0	0	4	25	25	25	25	**100**
6	CHL425	Process Modeling and Simulation Lab	0	0	3	2	25	25	25	25	**50**
7	CHL500	Major Project	0	0	8	6	20			80	**150**
			18	**0**	**13**	**27**					**675**

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks
L: Lectures T: Tutorial P: Practical Cr: Credits

Note: *Department Elective-II and open elective should be from any one of the following four Elective Groups.*

Department Elective- II	
CHL455	Petrochemical Technology
CHL456	Corrosion Engineering
CHL457	Alternate Energy Technology
CHL458	Nanotechnology

Open Elective	
MGT451	Business Strategy
MGT453	Principles of Marketing
ELE455	MAT Lab Programming
CSE352	Software Engineering
MEC401	Robotics and Automation

DETAILED SYLLABUS

Course Title: Engineering Mathematics-I

Paper Code: MTH 151

L	T	P	Credits	Marks
4	1	0	4	100

Objective: The aim of this course is to familiarize the students with the theory of matrices which are used in solving equations in mechanics and the other streams. This course also provides a comprehensive understanding of the origin and development of ideas to exhibit the techniques origin and development of ideas to exhibit the techniques of solving ordinary differential equations.

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It willconsistof60 objective questions. All questions will be compulsory.
- Two pre-announced test will be conducted having a weightage of 25% each. Each pre-announced test will consist of 20 objective type, 5short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of40%of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive however, any other book may be followed.

UNIT-A **15 HOURS**

Rank of matrices, Inverse of Matrices, Gauss Jordan Method, reduction to normal form, Consistency and solution of linear algebraic system of equations, Gauss Elimination Method Eigen values and Eigen vectors, Diagonalisation of Matrix, Cayley Hamilton theorem. Orthogonal, Hermit ion and unitary matrices.

UNIT-B **14 HOURS**

Concept of limit and continuity of a function of two variables, Partial derivatives, Homogenous Function , Euler's Theorem, Total Derivative, Differentiation of an implicit function, chain rule, Change of variables, Jacobian, Taylor's and McLaurin's series.

Maxima and minima of a function of two and three variables: Lagrange's method of multipliers.

UNIT-C **14 HOURS**

Formation of ordinary differential equations, solution of first order differential equations by separation of variables, Homogeneous equations, Reduce to Homogenous, exact differential equations, equations reducible to exact form by integrating factors, equations of the first order and higher degree, clairaut's equation.

UNIT-D **13 HOURS**

Solution of differential equations with constant coefficients: method of differential operators. Non – homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, Simultaneously Linear differential equation.

Recommended Books

1. R K Jain and S R K Iyengar, Advanced Engineering Mathematics, 2nd Ed., Narosa Publishing House, New Delhi (2003).
2. G. B. Thomas, R. L. Finney : Calculus and Analytic Geometry, 11th Ed., Pearson Education.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd. N.Delhi.Revised Edition 2003.
4. B.S Grewal, Higher Engineering Mathematics, Khanna Publication, Edition 40th Edition.

Course Title: Engineering Mathematics-II
Course Code: MTH-152

Objective:

The objective of the course is to equip the students with the knowledge of concepts of vectors and geometry and their applications. A flavor of pure mathematics is also given to the readers.

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It willconsistof60 objective questions. All questions will be compulsory.
- Two pre-announced test will be conducted having a weightage of 25% each. Each pre-announced test will consist of 20 objective type, 5short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of40%of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive however, any other book may be followed.

Unit-A **14HOURS**

Infinite Series: Convergence and divergence of series, Tests of convergence (without proofs): Comparison test, Integral test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series, Uniform Convergence and Power Series.

Unit-B **15 HOURS**

Differential Calculus: Curve tracing: Tracing of Standard Cartesian; Parametric and Polar curves

Integral Calculus: Rectification of standard curves; Areas bounded by standard curves; Volumes and surfaces of revolution of curves; Applications of integral calculus to find Centre of gravity and moment of inertia.

Multiple Integrals: Double and triple integral and their evaluation, change of order of integration, change of variable, Application of double and triple integration to find areas and volumes.

Unit-C **13 HOURS**

Functions of Complex Variables: Complex Numbers and elementary functions of complex variable De-Moivre's theorem and its applications. Real and imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables. Summation of trigonometric series. (C+iS method).

Unit-D **15 HOURS**

Vector Calculus: Scalar and vector fields, differentiation of vectors, velocity and acceleration.

Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Line, surface and volume integrals.

A**pplication of Vector Calculus:** Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem. Green's theorem in plane, Stoke's theorem (without proofs) and their applications.

References:

1. R K Jain and S R K Iyengar, Advanced Engineering Mathematics, 2nd Ed., Narosa Publishing House, New Delhi (2003).
2. Ravish R. Singh and M. Bhatt*Engineering Mathematics a Tutorial Approach*, McGraw Hill.
3. B.S Grewal, Higher Engineering Mathematics, Khanna Publication, Edition 40th Edition
4. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd. N.Delhi. Revised Edition 2003.

Course Title: Chemistry
Course Code: CHE151
Time: 03 Hours
Course Objectives:

L	T	P	Credits	Marks
3	0	0	3	75

The objective of the Engineering Chemistry is to acquaint the student with the basic phenomenon/concepts of chemistry for the development of the right attitudes by the engineering students to cope up with the continuous flow of new technology. The student will able to understand the new developments and breakthroughs efficiently in engineering and technology.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals as well as new technology in the field of chemistry.

PART A

Spectroscopy and its Applications (12 Hrs)

General Introduction: Introduction, electromagnetic spectrum, absorption and emission spectrum, atomic and molecular spectroscopy, types of molecular spectra, experimental techniques, selection rules, width and intensities of spectral lines.

UV/Visible Spectroscopy: types of electronic Transitions, Chromophores, Auxochromes, Effect of conjugation on Chromophores, Factors affecting λmax and intensity of spectral lines, effect of solvent on λmax, isobestic point, applications.

IR Spectroscopy: Infrared region, fundamental modes of vibrations and types, theory of infrared spectra, vibrational frequency and energy levels, anharmonic oscillator, modes of vibrations of polyatomic molecules, characteristic signals of IR spectrum, finger print region, factors affecting vibrational frequency; applications.

NMR Spectroscopy: Principle and instrumentation, relaxation processes, proton magnetic resonance spectroscopy, number of signals, Chemical shift, Spin-Spin Splitting, coupling constant, applications.

PART B **(7 Hrs)**

Water and its treatment

Introduction, hardness of water, degree of hardness, units of hardness, boiler feed water: specification, scales and sludge formation; priming & foaming, boiler corrosion, caustic embrittlement, treatment of boiler feed water, internal treatment of water; softening of water by lime-soda, zeolite and ion exchange methods, desalination of water; Water for domestic use: purification of water for domestic use.

Corrosion and its Prevention **(7 Hrs)**

Introduction; different types of corrosion - wet and dry corrosion; mechanism of wet corrosion; comparison of dry and wet corrosion, Types of electrochemical corrosion: galvanic corrosion, concentration cell corrosion or differential aeration corrosion, waterline corrosion, pitting corrosion, crevice corrosion, stress corrosion, intergranular corrosion; other forms of corrosion: atmospheric corrosion, soil corrosion, microbiological corrosion, erosion corrosion, filiform corrosion, stray current corrosion, passivity, galvanic series, factors influencing corrosion, various methods of corrosion control.

PART C

Chemistry in Nanoscience and Technology **(7 Hrs)**

Introduction, Materials self-assembly, molecular vs. material self-assembly, hierarchical assembly, self-assembling materials, two dimensional assemblies, mesoscale self assembly, coercing colloids, nanocrystals, supramolecular structures, nanoscale materials, future perspectives applications, nanocomposities and its applications.

Part D

Polymers and polymerization **(7 Hrs)**

Introduction, monomer and repeating unit, degree of polymerization, functionality, classification of polymers: based on origin, monomers, structure, method of synthesis, tacticity or configuration, action of heat, chemical composition, ultimate form; types of polymerization, specific features of polymers, regularity and irregularity, tacticity of polymers, average molecular weights and size, determination of molecular weight by number average methods, effect of molecular weight on the properties of polymers, introduction to polymer reinforced composites.

Suggested Books:

1. William Kemp, Organic Spectroscopy, Palgrave Foundations, 1991.

2. D. A. Skoog, F. J. Holler and A. N. Timothy, Principle of Instrumental Analysis, 5th Edition., Saunders College Publishing, Philadelphia, 1998.

3. C. P. Poole, Jr., F. J. Owens, Introduction to Nanotechnology, Wiley Interscience, 2003.

4. L.E. Foster, Nanotechnology, Science Innovation & Opportunity, Pearson Education, 2007.

5. P. Ghosh, Polymer Science and technology (2nd Edition), Tata McGraw Hill, 2008.

6. Wiley Engineering Chemistry, Second Edition, 2013.

L	T	P	Credits	Marks
0	0	1	2	50

Course Title: Chemistry Lab
Course Code: CHE152

Course Objectives:

This course is intended to learn the basic concepts of Engineering Chemistry Laboratory. The present syllabus has been framed as per the recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in Engineering chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals.

List of Practicals:

1. Verify Lambert Beer's law using spectrophotometer and $CoCl_2$ or $K_2Cr_2O_7$ solution.
2. Determine the strength of HCl solution by titrating against NaOH solution conductometerically.
3. Determination of the strength of HCl solution by titrating against NaOH using pH meter.
4. Determination of total hardness of water (tap) using standard EDTA solution and Eriochrome black T indicator.
5. Determination of alkalinity of water.
6. Determination of surface tension of given liquid by using Stalagmometer.
7. Determination of residual chlorine in a water sample.
8. Determination of Flash & Fire point of given a given lubricating oil by Pensky-Marten's apparatus.
9. Determination of the viscosity of given lubricating oil by using Redwood Viscometer.
10. Preparation of a polymer phenol/urea formaldehyde resin.
11. Determination of moisture, volatile matter and ash content in a given sample of coal by proximate analysis.
12. Determination of dissolved oxygen present in given sample of water.

Suggested Books:

1. Levitt, B.P. Findlay's Practical Physical Chemistry, 9th edition, Longman Group Ltd., 1973.

2. Yadav, J.B. Advanced Practical Physical Chemistry.

3. Vogel, A. I. A textbook of Quantitative Inorganic Analysis, Longman Gp. Ltd, 4^{th} edition (2000).

Course Title: Basic Computer Trends
Course Code: CSE-101

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To get basic knowledge of computers (hardware and software), its components and Operating systems. To acquire programming skills in C, basic knowledge of Internet.

Expected Outcome: Students will feel comfortable working with computers and will have practical knowledge about Internet and procedural programming language (C Language).

PART-A

Introduction to Computers (8)

Define a Computer System, Block diagram of a Computer System and its working, memories, Volatile and non-volatile memory, cache, virtual, secondary storage devices- Magnetic Tape, Hard Disk, CD-DVD, Magnetic Disk, Various input devices including keyboard. Mouse, Joystick, Scanners and Various output devices including Monitors, Printers, Plotters.

Operating Systems (7)

Computer Software and its types and Hardware, Operating Systems, their types and functions.

PART-B

Working Knowledge of Computer System (6)

Introduction to word processors and its features, creating, editing, printing and saving documents, spell check, mail merge, creating power point presentations, creating spreadsheets and simple graphs

Fundamentals of Internet Technology (8)

Local area networks, MAN and wide area network, Internet, WWW, E-mail, Browsing and Search engines, Internet Connectivity, Network Topology, Hub, Switches, Router, Gateway.

PART-C

Basic Constructs of C (8)

Keywords, Identifiers, Variables, Data Types and their storage, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Increment & Decrement

Operators, Expressions, Conditional Expressions, Assignment Operators and Expressions, External Variables and Scope of Variables, Structure of C Program.

Control Structures (8)

Decision making statements: if, nested if, if – else ladder, switch, Loops and iteration: while loop, for loop, do – while loop, break statement, continue statement, goto statement.

PART D

Functions (6)

Advantages of using functions, structure of a function, declaring and definingfunctions, return statement, call by value and call by reference, recursion, and storage classes.

Arrays and Strings (7)

Declaration of arrays, initialization of array, accessing elements of array, I/O of arrays, passing arrays as arguments to a function, strings, I / O of strings, string manipulation functions (strlen, strcat, strcpy, strcmp).

REFERENCES:

1. V.K. Jain: "Fundamentals of Information Technology and Computer Programming", PHI. Latest Edition.
2. Anita Goel: "Computers Fundamentals", Pearson Publications
3. Brian Kernighan and Dennis M. Ritchie: "The C Programming Language", Prentice Hall, 2nd Edition 2007.
4. K.N.King : "C Programming : A Modern Approach", W.W. Norton Company 2nd edition (2008).
5. Herbert Schildt : "C: The Complete Reference", Tata Mcgraw Hill Publications 4th edition.
6. Gottfired : "Programming in ANSI C, Schaum Series", TMH publications, 2nd Edition (1996).

Course Title: Basic Computer Trends Lab
Course Code: CSE-102

L	T	P	Credits	Marks
0	0	2	2	50

Instruction for Students: The students will be attending a laboratory session of 2 hours weekly and they have to perform the practical related to the following list.

1. Practical know-how of various internal and external Hardware components of a computer (including basic working of peripheral devices).
2. Introduction to Operating Systems; installing Windows; basics of windows.
3. Working knowledge of Internet.
4. Introduction to word processor and mail merge.
5. Introduction to MS-Excel.
6. Working on MS-PowerPoint.
7. Introduction to basic structure of C program, utility of header and library files.
8. Implementation of program related to the basic constructs in C
9. Programs using different data types in C
10. Programs using Loops and Conditional Statements in C
11. Programs using arrays single dimension in C.
12. Programs using functions by passing values using call by value method.
13. Programs using functions by passing values using call by reference method.
14. Program to implement array using pointers

Programs related to string handling in C

L	T	P	Credits	Marks
4	0	0	4	100

Course Title: Environment Education, Road Safety and Legal Awareness
Paper Code: EVS101

Course Objective: This course aims at understanding the students in aspects of environmental problems, its potential impacts on global ecosystem and its inhabitants, solutions for these problems as well as environmental ethics which they should adopt to attain sustainable development.

Unit 1

The multidisciplinary nature of environmental studies **(2 Hours)**

Definition, scope and importance, Need for public awareness

Natural Resources: Renewable and non-renewable resources: **(8 Hours)**

Natural resources and associated problems.

(a) **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests 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.

Ecosystem: **(4 Hours)**

- 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, ocean estuaries)

Unit II

Biodiversity and its conservation **4 Hours**

- Introduction – Definition: Genetic, Species and Ecosystem Diversity
- Bio-geographical 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-spots 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, global and national efforts.
- Genetically modified crops
- Cartagena Protocol
- Biodiversity Act

Environmental Pollution **8Hours**

- Definition,causes, 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 pollution

- 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

Indoor Pollution: 2 Hours

- Practical tips on how to save the self from self-inflicted pollution.
- Basics of toxicity.
- Problems of lifestyle based diseases.
- Solutions needed for safety.

Unit III

Social Issues and the Environment 7 Hours

- Population growth, variation among nations, Population explosion – Family Welfare Programmes.
- Environment and human health,
- From unsustainable to sustainable development
- Urban problems and 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
- Environmental Laws: The Environment Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and control of Pollution) Act 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980.
- Issues involved in enforcement of environmental legislation
- Public Awareness

Human Population and Environment5 Hours

- Population Growth and Variations among Nations
- Population Explosion
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

Global environmental issues **5 Hours**

- Stockholm Conference
- Brundtland Commission
- Montreal Protocol
- Kyoto protocol
- Earth Summit
- World Summit

Unit IV

Road Safety **6 Hours**

- Road safety: Concept and its importance.
- Attitude of people towards road safety
- Role of traffic police in road safety
- Traffic rules, Traffic signs, How to obtain driving license, Traffic offences, penalties and procedures,
- Common driving mistakes, Significance of first-aid in road safety
- Role of civil society in road safety and Traffic police-public relationship
- Motor Vehicle Act 1998 (2010)

Legal Awareness **4 Hours**

- Legal literacy
- Child labour
- Domestic Violence
- Right to Education

Field Work **5 Hours**

- 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)

Suggested Readings:

1. Odum, E.P. (1983). Basic Ecology. Halt Saundurs, International Edition, Japan.
2. Botkin, D.B. and Kodler, E.A. (2000). Environmental Studies: The Earth as a living planet. John Wiley and Sons Inc., New York.
3. Singh, J.S., Singh, S.P and Gupta S.R., (2006). Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.
4. De, A.K. (1990). Environmental Chemistry. Wiley Eastern Ltd. New Delhi.
5. Sharma, P.D. (2004). Ecology and Environment. Rastogi Publications, Meerut.
6. Uberoi, N.K.: Environmental Management, Excel Books, 2nd Edition, New Delhi.

Course Title : Human Values and Ethics
Course Code : SGS - 101

L	T	P	Credits	Marks
2	0	0	2	50

Course Objectives

- To sensitize students about the role and importance of human values and ethics in personal, social and professional life.
- To encourage students to read and realize the values of enlightened human beings.
- To enable students to understand and appreciate ethical concerns relevant to modern lives.

Learning Outcomes:

Students becoming responsible citizens and better professionals who practise Values and Ethics in every sphere of life.

Unit - A

Human Values

1. **Concept of Human Values:** Meaning, Types and Importance of Values. **2 hours**
2. **Human Values :** Lessons from the lives and teachings of great thinkers. 3 **hours**
3. **Value Education :** The content of value education **2 hour**
4. **Value crisis and its redressal.** **1 hour**

Unit - B

Being Good and Responsible

1. Self Exploration and Self Evaluation **2 hour**
2. Acquiring Core Values for Self Development **2 hour**
3. Living in Harmony with Self, Family, Society and Nature **3 hours**
4. Values enshrined in the Constitution : Liberty, Equality Fraternity and Fundamental Duties. 3 **hours**

Unit - C

Value – based living

1.	Vedic values of life	**2 hour**
2.	*Karma Yoga* and *Jnana Yoga*	**2 hours**
3.	*Ashta Marga* and *Tri-Ratna*	**2 hours**
4.	Truth, Contentment and Wisdom	**2 hours**

Unit – D

Ethical Living:

Ethics: Difference between Ethics and Values

1.	Personal Ethics	**2 hours**
2.	Professional Ethics	**3 hours**
3.	Ethics in Governance	**2 hours**
4.	Ethics in Education	**2 hours**
		Total = 35 hours

Suggested Readings:

1. Restoring Values (ed.) E. Sreedharan and Bharat Wakhlu, Sage Publications Ltd., New Delhi 2010.
2. Indian Ethos and Values by Nagarajan K, Tata McGraw Hill, 2011
3. Human Values, A N Tripathi, New Age International Publishers, New Delhi, Third Edition, 2009
4. Indian Ethos and Values in Management, 1st Edition by Sankar, Tata McGraw Hill Education Pvt. Ltd.
5. Values and Ethics, Osula, Asian Books, 2001.
6. Professional Ethics, R. Surbiramanian, Oxford University Press, New Delhi, 2013.
7. Human Values and Professional Ethics, Rishabh Anand, Satya Prakashan, New Delhi, 2012
8. Human Values and Professional Ethics, Sanjeev Bhalla, Satya Prakashan, New Delhi, 2012.
9. Human Values and Professional Ethics, Ritu Soryan Dhanpat Rai & Co. Pvt. Ltd., First Edition, 2010.
10. Human Values and Professional Ethics by Suresh Jayshree, Raghavan B S, S Chand & Co. Ltd. , 2007.

11. Human Values and Professional Ethics, Dr. R K Shukla, Anuranjan Misra, A B Publication 2010.
12. Human Values and Professional Ethics, Sharma, Vayu Education of India Language publishers, 2012.
13. Human Values and Professional Ethics, S. Kannan, K. Srilakshmi, Taxmann Publication, Pvt. Ltd., 2009
14. Human Values and Professional Ethics, Smriti Srivastava, S K Kataria & Sons, 2001
15. Human Values and Professional Ethics, Yogendra Singh, Ankur Garg, Aitbs publishers, 2011.
16. Human Values and Professional Ethics, Vrinder Kumar, Kalyani Publishers, Ludhiana, 2013.
17. Human Values and Professional Ethics, R R Gaur, R. Sangal, GP Bagaria, Excel Books, New Delhi 2010.
18. Values and Ethics, Dr. Bramwell Osula, Dr. Saroj Upadhyay, Asian Books Pvt. Ltd., 2011.
19. Complete works of Swami Vivekanand, Advaita Ashram, Calcutta – 1931.
20. Indian Philosophy, S. Radhakrishnan, George Allen & Unwin Ltd., New York: Humanities Press INC, 1929.
21. Essentials of Hinduism, Jainism and Buddhism, A N Dwivedi, Books Today, New Delhi – 1979
22. Light of Truth : Satyarth Parkash, Maharishi Dayanand Saraswati, Arya Swadhyay Kendra, New Delhi, 1975.
23. Dayanand : His life and work, Suraj Bhan, DAVCMC, New Delhi – 2001.
24. Moral and Political Thoughts of Mahatma Gandhi, V. Raghavan, N Iyer, Oxford University Press India, New Delhi, 2000.
25. Guru Nanak Dev's view of life, Amplified by Narain Singh, Published by Bhagat Puran Singh All India Pingalwara Society, Amritsar 2010.
26. Esence of Vedas, Kapil Dev Dwivedi, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
27. Vedic Concepts, Prof. B B Chaubey, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
28. Mahatma Gandhi : Essays and Reflections on his life and work by Saravapalli Radhakrishnan, Zaico Publication, Mumbai, 1977.
29. Lala Har Dayal, Hints for Self Culture, Jaico Publishing House, Mumbai, 1961.
30. Maharishi Swami Dayanand Saraswati, The Light of Truth (The Satyartha Prakashan), available at URL :

www. aryasamajjamnagar.org/download/satyarth_prakash_eng.pdf

31. Krishnamurti J, The First and Last Freedom, available at URL : http://www.jiddu-krishanmurti.net/en/th-first-and-last-freedom/
32. Sri Raman Maharishi, Who Am I, available at URL : http://www.sriramanamaharshi.org/resource_centre/publicatins/who-am-i-books/
33. Ramesh S Balsekar, Peace and Harmony in Daily Living, Yogi Impressions; 1st edition

L	T	P	Credits	Marks
2	0	0	2	50

Course Title: Fundamentals of Management
Course Code: MGT151

Course Objective: The course aims at developing an appreciation about the principles, functions of management and functioning of professional organisations.

Learning Outcomes: After completion of course students will be able to work professionally in organizations. They should be able to apply the principles and theories of management in the work context.

Unit – A

- Introduction to business management- Definition of management, characteristics of management, management as an art, science and profession, universality of management, levels of management, management process, managerial roles and skills, functional areas of management. — 4 hours
- Planning- Introduction, planning and plan, strategy and strategic planning, main components of plan, vision, mission, purpose, objectives, goals and targets, Management by Objectives (MBO), — 3 hours

Unit – B

- Forecasting: Meaning, process and importance, Decision-Making Process and types of decisions. — 3 hours
- Organizing- Definition, characteristics, organizing process, authority, responsibility, power, delegation, decentralization, departmentation, span of control, organization chart and manuals. Forms of Organization Structure — 4 hours

Unit – C

- Staffing- Introduction, factors affecting and qualities of good staffing, manpower planning, recruitment and selection. — 3 hours
- Leadership- Characteristics, importance, style, role, quality and skills of leader. — 2 hours
- Directing and Co-ordination- meaning, Fundamentals of motivation, motivation theories : Maslow's need hierarchy, Herzberg's Two-Factor Theory of Motivation, McGregor's Theory X and Theory Y. — 4 hours

Unit – D

Communicating- Definition, Characteristics, Communication process, importance and types of communication, barriers to communication. — 4 hours

- Controlling- Meaning, characteristics, scope, control process, types of control, designing effective control systems. 3 hours

30 hours

Text Book:

1. Rudani Ramesh, Principles of Management, Tata, McGraw-Hill Education, 1st Edition

Reference Books:

1. Koontz H & Weihrich, Essentials of Management, 9th Edition 2013
2. Prasad L M, Principles and Practices of Management, Sultan Chand & Sons, New Delhi
3. Stoner J A F, Freeman R E and Gilbert D R, Management, Pearson Education, 6th Edition

Course Title: **Engineering Drawing**
Course Code: MEC-101

Total Lectures: 90

L	T	P	CREDITS	Marks
2	0	4	4	100

Course Objectives: Students will get knowledge of various lines and dimension system, knowledge the concepts of orthographic projections, knowledge of developing the surfaces.

Part - A

Drawing Techniques **(12)**

Introduction to drawing instruments, various types of lines, principles of dimensioning, size and location dimensions, symbols, lettering in single stroke as per SP-46 code

Scales **(6)**

Concept of Reduced and Enlarge scale, Construction of plane and diagonal scales

Part - B

Projection of Points **(6)**

Concept of horizontal and vertical planes (Principle planes). First and third angle projections; projection of points in all four quadrants, shortest distance from reference line

Projection of Lines and Planes **(18)**

Projection of line perpendicular to one plane, inclined to one and both the reference planes and their traces. Plane perpendicular to one plane inclined to one and both the reference planes. Profile plane. Auxiliary planes

Part - C

Projection of Solids **(12)**

Right and oblique solids; solids of revolution and polyhedrons etc. and projection of solid with axis perpendicular to one plane and parallel to one or both reference planes. Projection of solid with axis inclined to one or both reference axis.

Sectioning of Solids **(9)**

Theory of sectioning, types of sectioning, and their practice on projection of solids, sectioning by auxiliary planes

Part - D

Interpretation of Views **(9)**

Draw orthographic views from isometric view, Missing line and missing view

Development of Surfaces **(18)**

Method of Development, Development of surfaces (pyramids, prisms, cylinders and cones). Development of oblique solids

Reference:

1. Jolhe, A.J., "**Engineering Drawing**", Tata McGraw-Hill, New Delhi.
2. Gill, P.S., **"Engineering Drawing",** S.K. Kataria and Sons, Ludhiana
3. French, T.E. and Vierck, C.J., **"Graphic Science**", McGraw-Hill, New York
4. Zozzora, F, "**Engineering Drawing"**, McGraw Hill, New York

PHY-151 ENGINEERING PHYSICS

L	T	P	Credits	Marks
3	1	0	3	75

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of Four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed

Unit-1

PHYSICAL OPTICS: (14)

Interference: Division of wave front, Fresnel's biprism, division of amplitude, Newton's rings and applications.

Diffraction: Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction through a slit, plane transmission diffraction grating, its dispersive and resolving power.

Polarization: Polarised and unpolarised light, double refraction, Nicol prism, quarter and half wave plates.

Unit-2 (12)

LASER: Spontaneous and stimulated emission, Laser action, Characteristics of laser beam, concept of coherence, He-Ne laser, Semiconductor lasers and applications

FIBRE OPTICS: Propagation of light in fibres, numerical aperture, single mode and multimode fibres, applications

Unit-3 (9)

DIELECTRICS: Molecular Theory, polarization, displacement, susceptibility, dielectric coefficient, permittivity, relations between electric vectors, Gauss's law in the presence of a dielectric, energy stored in an electric field, behaviour of dielectric in alternating field and Clausius Mosotti equation.

Unit-4

(10)

QUANTUM MECHANICS: Difficulties with Classical physics, Introduction to quantum mechanics-simple concepts, Black Body radiation, Planck's Law of radiation and its limitations, Group velocity and phase velocity, Schrodinger's wave equations and their applications.

SUPER CONDUCTIVITY: Introduction (experimental survey), Meissner effect, Type I and type II superconductors, London equation, Elements of BCS theory, Applications of superconductors.

REFERENCE BOOKS:

1. Electricity and Magnetism – F.W. Sear (Narosa)
2. Physics Vol. 1 & 2 – Resnick & Halliday (Wiley Eastern)
3. A Text Book of Optics – Brij Lal and Subramanyam
4. Physical Optics – Jenkin's and White
5. Electromagnetism – David J. Griffiths
6. Perspective of Modern Physics – Arthur Beiser (TMH)

Course Code: PHY152:
ENGINEERING PHYSICS LABORATORY
Max Marks: 50
Objective: The laboratory exercises have been so designed that the students learn to verify some of the concepts learnt in the theory courses. They are trained in carrying out precise measurements and handling sensitive equipment.

Note:

- Students are expected to perform at least eightten experiments out of following list. Theexperimentsperformedin firstsemestercannotbe repeatedinsecond Semester.
- Theexaminationforboththecourseswill beof3hoursduration.
- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test**.**

List of Experiments:

Experimental skills: General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine the Dispersive Power and resolving power of the Material of a given Prism using Mercury Light.
2. To determine wavelength of sodium light using Fresnel Biprism.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determination Wavelength of Sodium Light using Michelson's Interferometer.
5. To determine the wavelength of Laser light using Diffraction of Single Slit.
6. To determine the wavelength of (1) Sodium and (2) Mercury Light using Plane Diffraction Grating.
7. To determine the (1) Wavelength and (2) Angular Spread of HeNe Laser using Plane Diffraction Grating.
8. To study the wavelength of spectral lines of sodium light using plane transmission grating.
9. To study the specific rotation of sugar solution Laurent's half shade polarimeter method
10. To study the numerical aperture and propagation losses using HeNe laser Optical fibre set up .
11. To compare the focal length of two lenses by Nodal slide method.
12. To find the unknown low resistance by Carey Foster bridge.
13. To determine the beam divergence of the HeNe laser.
14. To study the Meissner's effect insuperconducting sample.
15. To study the Faraday law of electromagnetic induction.
16. To study the capacitance by flashing/quenching of Neon bulb kit
17. To compare the two unknown capacitances of two capacitors by using DeSauty's bridge.
18. To find our out the unknown inductance by using the Anderson's bridge method.
19. To study the numerical aperture and propagation losses for HeNelaserby using the optical fiber set up for
20. To study the Planck's constant by using photoelectric cell method.

Course Title: Electrical and Electronics Technology
Course Code: ELE-101

L	T	P	Credits	Marks
4	0	0	4	100

UNIT 1: D.C Circuit Analysis

Voltage source, current source, dependent and independent sources, analysis of D.C circuit by KCL and KVL , Nodal and Mesh analysis, The venin theorem , Norton theorem, superposition theorem, Maximum Power Transfer Theorem

UNIT 2: A.C Circuit Analysis

Review of single phase A.C. circuit under sinusoidal steady state, solution of R.L.C. Series circuit, the j operator, complex representation of impedance, solution of series and parallel circuit, series and parallel resonance, 3 phase A.C. Circuit, star and delta connections, line and phase quantities solution of 3 phase circuits, balance supply voltage and balanced supply voltage and balance load, phasor diagram, measurement of power and power factor by two wattmeter method.

UNIT 3: Magnetic Circuit:

Review of laws of electromagnetism, Flux, MMF and their relation. Comparison of electrical and magnetic circuit, B-H Curve, saturation leakage and fringing. Analysis of series and parallel magnetic circuit, AC Excitation in magnetic circuits, Hysteresis and eddy currents.

UNIT 4: Transformers

Single phase transformer, basic concepts constructional detail, type, voltage current and impedance Transformation, phasor diagram, equivalent circuit, voltage regulation, oc/sc test, losses and efficiency concept of All day efficiency , autotransformer.

UNIT 5: Rotating Electrical Machines

Basic concepts, working principle and general construction of DC machines (motor/generators), torque and EMF expression.

UNIT 6: Basic Electronics:

P-Type and N-Type semiconductor, concept of diode, transistor and their application, introduction to OPAMP, application of op amp as a subtractor , summer, differentiator, integrator, logic gates AND ,OR, NOT, NOR, NAND etc.

Suggested Books:

1. M.S. Sukhija, T.K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford University Press, 2012.
2. Ashfaq Husain, Harsoon Ashfaq, " Fundamentals of Electrical Engineering, 4th Edition, Dhanpat Rai and Co., 2013
3. V.N. Mittle, "Basic Electrical Engineering", 2nd Edition, Tata McGraw Hill Publication.
4. B.L. Theraja, A.K. Theraja, " A Text Book of Electrical Technology, Volume-1, S. Chand Publication
5. Debashisha Jena, "Basic Electrical Engineering", 1st edition, Wiley India Publication, 2012.
6. B.L. Theraja, R.S. Sedha, " Principles of Electric Devices and Circuits", S. Chand Publication, 1st edition, 2006

-

Course Title: Electrical and Electronics Technology Laboratory
Course Code: ELE-102

L	T	P	Credits	Marks
0	0	2	2	50

List of Experiments

1. To verify Ohm's Law, Kirchhoff's Current Law and Kirchhoff's Voltage Law.
2. To verify Thevenin's and Norton's theorems.
3. To verify Superposition theorem.
4. To verify Maximum Power Transfer theorem.
5. To study frequency response of a series R-L-C circuit and determine resonant frequency and Q-factor for various values of R, L and C
6. To study frequency response of a parallel R-L-C circuit and determine resonant frequency and Q-factor for various values of R, L and C.
7. To perform direct load test of a transformer and plot efficiency versus load characteristics.
8. To perform open circuit and short circuit test on transformer.
9. To perform speed control of DC motor.
10. Measurement of power in a three phase system by two wattmeter method.
11. To plot the V-I characterics of PN-junction diode.
12. To verify the truth table of logic gates.

Course Title: **Fundamentals of Mechanical Engineering**

Course Code: MEC-102

L	T	P	CREDITS	Marks
4	0	0	4	100

Course Objectives: To impart the basic knowledge of thermodynamic principles, various power producing and power absorbs devices. To impart the knowledge of mechanical devices and manufacturing processes.

.

Part - A

Fundamental Concepts of Thermodynamics (6)

Introduction, Thermodynamic System and its types, Boundary and its types, Surroundings, Thermodynamic properties, processes and cycles, Working Substance, Units and Dimensions, Mechanical and Thermodynamic work, Equations for work done in various processes, Heat, Pressure, Pressure measurement, Pressure exerted due to a column of fluid, Barometer, Mechanical gauges for pressure measurement: Bourdon tube pressure gauge, Diaphragm pressure gauge, Dead weight pressure gauge, Manometer: Piezometer, Single tube manometer(Numerical), Double tube manometer, Differential manometers

Laws of Thermodynamics (6)

Zero law of Thermodynamics, Thermodynamic property and Thermometers, Principle of temperature measurement, Scale of temperature, Microscopic and Macroscopic point of view, Quasi Static Process, Reversible and Irreversible processes, Energy and Forms of Energy i.e. store and transient, Law of conservation of energy, Joule's Experiment, First law of thermodynamics, Work is a path function and properties are point function, Internal energy, Enthalpy, Specific heat at constant volume, Specific heat at constant pressure, Adiabatic Index, Limitations of first law of thermodynamics

Part - B

Heat Transfer **(5)**

Introduction, Modes of heat transfer, Thermal Conductivity, Thermal Resistance, Fourier law, Newton's law of cooling, Stefan Boltsmann's Law, Heat Exchangers, Insulation, Properties of insulation, Types of Insulations

Power Producing Devices **(6)**

Forms of matter, Steam boiler, Classification of boilers, Types of boilers, Advantages of superheating the steam, Essentials of a good boiler, Comparison between Water tube and Fire tube boilers, Steam Turbines, Classification, Advantage, Working of common type of turbines, Hydraulic Turbines, Internal combustion engines, Two and Four stroke SI engines

Part - C

Power Absorbing Devices **(5)**

Power Absorbing Devices, Difference between Hydraulic pump, Air compressor, Fan, Blower, Classification, Positive displacement and Dynamic, Reciprocating, Rotary, Centrifugal, Axial along with their types, Uses of compressed air.

Principles of Design **(5)**

Need of design, Stress and Strain and its types, Hooke's law, Poisson's ratio, Stress- Strain Curve, Factor of Safety, Material properties and selection, Factors affecting material selection, Aesthetics.

Part - D

Mechanical Devices **(5)**

Individual and group drive system, Belt drive, Ropes, Chain drive, Gear drive, Clutches, Brakes

Machine Elements **(5)**

Power transmission shafts, Types of shafts, Shaft material, Application of shafts, Axle, Keys, Coupling and their types, Flanged coupling, Oldham's coupling, Universal coupling, Bearings and their types, Flywheel construction and types, Governor

Reference:

1. Rajan T.S. **"Basic Mechanical Engineering",** New Age Publishers.
2. Dr. Singh Sadhu **"Principles of Mechanical Engineering"**, S Chand Publishers.
3. Shankar V.P., **"Basic Mechanical Engineering"**, Laxmi Publishers.
4. Phthak G. K., **"Basic Mechanical Engineering"**, Rajsons Publications.
5. Kumar Parveen, **"Basic Mechanical Engineering"**, Pearson Education

Course Title: Basic Communication Skills
Course Code: ENG151

L	T	P	Credits	Marks
3	1	0	3	70

No. Of Lectures: 45

Course Objective:

- To enhance students' vocabulary and comprehensive skills through prescribed texts.
- To hone students' writing skills.

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced tests will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. Students are expected to provide reasoning/solution/working for the answer. They will attempt all questions. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise tests will be taken. Two best out of four objective/MCQ type surprise tests will be considered towards final, each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

Learning Outcomes:

Unit – A Applied Grammar (Socio-Cultural Context)	
• Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection	4 hours
• Tenses (Rules and Usages in Socio-cultural contexts)	5 hour
• Modals: Can, Could, May, Might, Will, Would, Shall, Should, Must, Ought to	4 hours
• Passives	3 hours

• Reported/Reporting Speech	3 hour
Unit – B Reading (Communicative Approach to be Followed)	
• J M Synge: Riders to the Sea (One Act Play)	5 hours
• Anton Chekhov : Joy (Short Story)	s
• Swami Vivekanand : The Secret of Work (Prose)	5 hours
Unit – C Writing	
• Paragraph and Essay Writing	4 Hours
• Letter Writing: Formal and Informal	4 hours
• Notice and Email	4 hours

References:

a. Books

1. Kumar, Sanjay and Pushp Lata. *Communication Skills*. India: OUP, 2012.
2. Vandana, R. Singh. *The Written Word* by. New Delhi: Oxford University Press, 2008.

b. Websites

1. www.youtube.com (to download videos for panel discussions)
2. www.letterwritingguide.com
3. www.teach-nology.com
4. www.englishforeveryone.org
5. www.dailywritingtips.com
6. www.englishwsheets.com
7. www.mindtools.com

Course Title : General Knowledge and Current Affairs
Course Code : SGS-102

L	T	P	Credits	Marks
2	0	0	2	50

COURSE OBJECTIVES

The study of General Knowledge and Current Affairs has become even more important today. It is not only a major constituent of most competitive examinations but also aids in acquiring general awareness.

The objectives of this course are :

- To introduce students with the course and contents of various competitive examinations
- To prepare a foundation for appearing in various competitive examinations
- To sensitize the students about the current issues and events of national and international importance
- To provide opportunity to the students to study inter disciplinary subjects like Geography, Science, Economy, Polity, History, International Relations etc.

Learning Outcomes:

- Students would get an opportunity to aspire, plan and prepare for various competitive examinations in advance.
- It would polish their personalities and sharpen the skills of debates, group discussions, communication, interview etc.
- Students would acquire general awareness of National and International Events.

Unit — A

General Geography

World Geography :

The Universe, The Solar System, The Earth, Atmosphere, The World we live in, Countries rich in Minerals, Wonders of the World, Biggest and Smallest. **3 hours**

Indian Geography :

Location, Area and Dimensions, Physical Presence, Indian States and Union Territories, Important sites and Monuments, Largest-Longest and Highest in India. **3 hours**

General History

Glimpses of India History, Ancient Indian, Medieval India, Modern India, Various Phases of Indian National Movement, Prominent Personalities. Glimpses of Punjab history with special reference to period of Sikh Gurus. **3 hours**

Glimpses of World History

Important Events of World History, Revolutions and Wars of Independence, Political Philosophies like Nazism, Fascism, Communism, Capitalism, Liberalism etc. 3**hours**

Unit — B

General Polity

World Politics – Major Actors and their political relations, UNO and other organizations viz: WTO, EU, SAARC, ASEAN, BRICS, WTO, OIC, OAU, OPEC, GCC etc. **3 hours**

Indian Polity : Constitution of India :

Important Provisions, Basic Structure, Union Government, Union Legislature and Executive, State Government: State Legislature and Executive, Indian Judiciary, The Election Commission, Panachayati Raj System, RTI etc. **3 hours**

General Economy :

The process of liberalization, privatization, globalization and **3 hours**

Major

World Issues. Indian Economy, Indian Financial System, Major Economic Issues, Economic Terminology.

Unit — C

General Science :

General appreciation and understandings of science including the matters of everyday observation and experience. Inventions and Discoveries. **3 hours**

Sports and Recreation : **3 hours**

The World of Sports and recreation. Who's Who is sports, Major Events, Awards and Honours. Famous personalities, Festivals. Arts and Artists.

Current Affairs :

National and International Issues and Events in News. Governments Schemes and Policy Decisions. **3 hours**

India and Neighbours:

Current phase relations with China, Pakistan, Bangladesh, Nepal, Sri Lanka and Afghanistan **3 hours**

Unit — D

Miscellaneous Information

Who is who

Books and Authors, Persons in News, Awards and Honours, Abbreviations and Sports **2 hours**

Total : 35 Hours

SUGGESTED READINGS :

Books

- Advance Objective General Knowledge, R. S. Aggarwal, S. Chand Publisher (2013)
- Concise General Knowledge Manual 2013, S. Sen, Unique Publishers,2013
- Encyclopedia of General Knowledge and General Awareness by R P Verma, Penguin Books Ltd (2010)
- General Knowledge Manual 2013-14, Edgar Thorpe and Showick Thorpe, The Pearson, Delhi.
- General Knowledge Manual 2013-14, Muktikanta Mohanty, Macmillan Publishers India Ltd., Delhi.
- India 2013, Government of India (Ministry of Information Broadcasting), Publication Division, 2013.
- Manorama Year Book 2013-14, Mammen Methew, Malayalam Manorama Publishers, Kottayam, 2013.
- Spectrum's Handbook of General Studies – 2013-14, Spectrum Books (P) Ltd., New Delhi
- Unique Quintessence of General Studies – 2013-14, Unique Publishers, New Delhi.

- **DAV UNIVERSITY, JALANDHAR**

CURRENT AFFAIRS

Magazines

Economic and Political Weekly, Yojna, the Week, India Today, Frontline, Spectrum.

Competition Success Review, Competition Master, Civil Services Chronicle, Current Affairs, World Atlas Book

Newspapers

The Hindu, Times of India, The Hindustan Times, The Tribune

Course Title: MANUFACTURING PRACTICE

Course Code: MEC-104

L	T	P	CREDITS	Marks
0	0	4	2	50

COURSE OBJECTIVES:

1. Know basic workshop processes, Read and interpret job drawing.
2. Identify, select and use various marking, measuring, holding, striking and cutting tools & equipment's.
3. Operate and control different machines and equipment's.

CARPENTRY SHOP

a) Preparation of half lap joint
b) Preparation of Mortise and Tenon Joint
c) Preparation of a Dove & Tail joint
d) To prepare a White board duster

Welding Shop:

a) Preparation of Joint by Arc Welding
b) Preparation of Joint by using Gas Welding
c) Preparation of Joint by MIG/ TIG Welding
d) Preparation of Joint by Spot/ Seam Welding

Smithy Shop

a) To Forge the L – Hook
b) To Forge a Chisel
c) To Forge a Cube from a M.S Round
d) To forge a screw driver

Fitting Shop

a) Filing a dimensioned rectangular or square piece and prepare a sq. fitting
b) Preparation of T fitting male part
c) Preparation of U fitting Female part
d) Internal thread Cutting in Square piece and external thread cutting on a rod and assembling as a paper weight

Foundry Shop:

a) To make a Mould of solid pattern
b) To prepare a mould of sleeve fitting using gating system
c) To make a Mould of Split Pattern using Cope & Drag
d) To check the Hardness of the Mould
To check the Moisture Content in the Molding Sand
To check the Compressive Strength of Molding Sand

Sheet-Metal Shop

a) Preparation of a funnel from G.I. sheet
b) Preparation of a book rack stand from G.I. Sheet
c) Preparation of a leak proof tray with inclined edges from G.I. Sheet
d) Preparation of a square pen stand from G.I. Sheet with riveting at corners

Course Title: Engineering Mathematics III

Course Code: MTH252

L	T	P	Credits	Marks
4	1	0	4	100

Objective: The objective of the course is to enable the students to understand the basic concepts related to Laplace transforms, Fourier series, ordinary differential and partial differential equations and their applications.

UNIT-A **14 HOURS**

Fourier series: Periodic functions, Euler's formula. Dirichlet's conditions.Fourier series of discontinuous functions. Fourier series of Even and Odd functions, half range expansions, Fourier series of different wave forms, Complex form of Fourier series. Fourier Transformation.

UNIT-B **14 HOURS**

Laplace Transforms: Laplace transforms of various standard functions, Linear property of Laplace transforms, Shifting property and change of scale, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-C **14 HOURS**

Partial Differential Equations: Formulation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Wave equation and Heat conduction equation in one dimension.Two dimensional Laplace equation and their applications, solution by the method of separation of variables.

UNIT-D **15 HOURS**

Analytic Function: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions.

Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Reference Books:

1. Grewal, B.S.,"**Higher Engineering Mathematics",** New Delhi: Khanna Publication., 2009
2. Kreyszig, Erwin. "**Advanced Engineering Mathematics",** New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. "**Advanced Engineering Mathematics",** New Delhi: Narosa Publishing House., 2003.
4. Thomas, George B. and Finney Ross L."**Calculus and Analytic Geometry**", New Delhi Addison Wesley., 1995.

Course Title: Object Oriented Programming
Course Code: CSE201

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To understand the basic concepts of object oriented programming language.

UNIT-A **14 Hours**

Object-Oriented Programming Concepts
Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, Basic concepts of object-oriented programming - concepts of an object and a class, interface and implementation of a class, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, Declaring and initializing pointers, accessing data through pointers.
Standard Input /Output
Concept of streams, hierarchy of console stream classes, Input/output using overloaded operators >> and << of I/O stream classes, formatting output, Manipulators.

UNIT –B

14 Hours

Functions and Arrays
Defining a function, Actual and Formal Arguments, Local and global variables, Nested functions, recursive functions, Array declaration, character array, multidimensional array, arrays and pointers
Classes and Objects
Specifying a class, creating class objects, accessing class members, Access specifiers, static members, nested classes, local classes, abstract classes, Constructors and Destructors, copy constructor, dynamic constructors, explicit constructors, advantages and disadvantages of constructor and destructor.

UNIT -C

14 Hours

Operator Overloading and Type Conversion
Overloading operators, rules for overloading operators, Overloading of various operators, Type conversion.
Inheritance Introduction, defining derived classes, Types of inheritance, virtual base class, Pure virtual functions, overriding member functions.
Polymorphism
Concept of binding - early binding and late binding, Virtual functions, abstract classes, Virtual destructors.

UNIT -D **14 Hours**
Exception Handling

Review of traditional error handling, basics of exception handling, Exception handling mechanism, Throwing mechanism, catching mechanism.

Files

File streams, hierarchy of file stream classes, Error handling during file operations, Reading/writing of files, updating files.

Reference Books:

1. E. Balagurusamy, "**Object Oriented Programming with C++**", Tata McGraw Hill.
2. D. Ravichandran, "**Programming in C++"**
3. Lafore R., "**Object Oriented Programming in C++",** Waite Group.
4. Herbert Schildt, "**The Complete Reference to C++ Language",** McGraw Hill-Osborne.
5. BjarneStroustrup, "**The C++ Programming Language", Addison Wesley.**
6. Lippman F. B, "**C++ Primer**", Addison Wesley.

Course Title: Mechanical Operations
Course Code: CHL201

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic concepts of properties of particulate solids and mechanical separation aspect such as screening, filtration, sedimentation, transportation of solids etc.

UNIT-A **14 HOURS**

Size Reduction

Particle size and shape, particle mass, size and shape distributions, measurement and analysis, concept of average diameter, size reduction, crushing, grinding and law of grinding.

Screening

Screening equipment, capacity and effectiveness of screen, effect of mesh size on capacity of screen.

UNIT -B **14 HOURS**

Settling

Motion of particle through a fluid: Stoke's and Newton's law, drag force and drag coefficient, settling velocity of particles in a fluid, hindered and free settling of particles, thickening gravity separation.

Filtration

Classification of filters, various types of cake filters, principle of cake filtration, clarification filters, liquid clarification, centrifugal settling process.

UNIT -C **14 HOURS**

Agitation & Mixing

Agitation and mixing of liquids, mixer for cohesive and non-cohesive solids, power consumption of agitated vessels.

Solid Handling

Flow of solid by gravity, transport of solids by screw/ belt conveyers, particulate collection system- cyclones, bag filters, electrostatic precipitators.

UNIT-D **14HOURS**

Fluidization

Packed beds, bed porosity, flow though a bed of particles, fluidization & fluidized bed, conditions for fluidization minimum velocity, types of fluidization. Ergun's equation.

Reference Books:

1. McCabe,W.L, Smith J .C. and Harriott P , "**Unit operations of chemical Engineering",** McGraw-HILL, 7th edition,2005.
2. Richardson, J.F., Harker, J.H. and Backhurst, J.R., Coulson and Richardsons "**Chemical Engineering**", Vol. 2, Butterworth-Heinemann., 2007.
3. Foust, A.S, Wenzel, L.A, Clump, C.W., Maus, L. and Anderson, L.B., "**Principles of Unit Operations",** John Wiley.,2008.
4. Perry, R.H, and Green, D.W., **Perry's** "**Chemical Engineers",** Handbook, McGraw Hill .2007.
5. Narayanan, C.M. and Bhattacharya, B.C., "**Mechanical Operations for Chemical Engineers Incorporating Computer Aided Analysis",** Khanna Publishers.,2005.

.

Course Title: Chemical Process Calculations
Course Code: CHL202

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic concepts of gases, liquids and solids and some basic mathematical tools. Learn what material balances energy balances are, and how to apply them and finally, to learn how to deal with the complexity of big problems.

UNIT-A **14 HOURS**

Introduction to Chemical Engineering Calculations

Units and dimensions, mole concept, conventions in methods of analysis and measurement, basis, temperature, pressure, the chemical equations and stoichiometry, limiting and excess reactant, conversion and yield.

UNIT -B **16 HOURS**

Material Balance

Material balance, program of analysis of material balance problems, solving material balance problems that do not involve chemical reactions, solving material balances problems involving chemical reactions, multiple subsystems, recycle, bypass, and purge calculations. Gases Vapors, Liquids and Solids: Ideal gas law calculations, real gas relationships, vapor pressure and liquids, saturation, partial saturation and humidity.

UNIT-C **14 HOURS**

Energy Balance

Concepts and units, calculation of enthalpy changes, application of the general energy balance without reactions occurring energy balances that account for chemical reaction, reversible processes and the mechanical energy balances, heats of solution and mixing.

UNIT -D **12HOURS**

Application of material and energy balance to the evaporators, reactors and other industrial processes (steady state operations), Basic calculations using chemical flow sheet simulator

Reference Books:

1. Himmelblau, D.M. and Riggs, J.M.,"**Basic Principles and Calculations in Chemical Engineering**", Prentice Hall of India .,2003.
2. Bhatt, B.I. and Vora, S.M., "**Stoichiometry**", Tata McGraw Hill .,2004.
3. Hougen, O.A., Watson, K.M. and Ragatz, R.S., "**Chemical Process Principles**", Volume I, C.B.S. Publications .,2004.

Course Title: Fluid Flow
Course Code: CHL203

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic concept of nature of fluids, pressure concepts and measurement of pressure by various experimental methods , work complex flow systems using Bernoulli's equation with application to industrial problems.

UNIT-A

12HOURS

Introduction
Introduction, Ideal and real fluids, Extensive and Intensive Properties, Specific Weight, Mass density and Specific gravity, Viscosity, Surface Tension and Capillarity, Evaporability and Vapour pressure, Newtonian & Non Newtonian fluids. Newtonian and non-Newtonian Fluids, Nature of Turbulence, Eddy Viscosity, Flow in Boundary Layers.

UNIT-B **16 HOURS**

Fluids Static
Pressure, Hydrostatics law, Pascal's Law, Different types of manometer, Continuous gravity Decanter, Centrifugal decanter and other pre- measuring equipment, Determination of meta centric height.

Fluids Kinematics and Dynamics
Classification of fluid flows, streamline, streak line, and Path lines, Basic Equation of Fluid Flow. Bernoulli's Equation. Flow rate & continuity equation, Bernoulli's Theorem, Kinetic energy correction factor in Bernoulli's equation. Pump work in Bernoulli's equations. Nature of Turbulence, Eddy Viscosity,Flow in Boundary Layers,. Dimensional Analysis of fluid flow problem

UNIT -C **14 HOURS**

Laminar Viscous Flow and Flow measurement devices
Laminar and Turbulent flow in pipes, Velocity Distribution in Pipes, Frictional Losses in Pipes and Fittings, Fanning equation, friction factor chart. Estimation of economic pipe diameter. Derivation of HAGEN-POISEULLI equation.

Flow Measurement
Venturimeter, Orifice Meter, Pitot Tube, Rotameter and Notches

UNIT -D **12 HOURS**

Fluid Machinery

Pump Classification & Applications, Centrifugal pumps verses reciprocating pumps, pump losses and Efficiencies, Multistage pumps, Work and power Input, Cavitation and maximum Suction lift, specific and minimum speed.

References Books:

1. Smith J. C., McCabe W. L., Harriot P. H., "**Unit Operations of Chemical Engineering"**, 7th Edition, Singapore, McGraw Hill., 2005.
2. Kumar D. S., "**Fluid Mechanics & Fluid power engineering"**, S. K. Kataria& Sons.,2003
3. Bansal, R.K., "**Fluid Mechanics and Hydraulic Machines"**, 7th Edition, Laxmi Publications., 2007.
4. Perry's, "**Handbook of Chemical Engineering",** 7th Edition, New York, McGraw Hill., 1997.
5. Sekhar G. C., **Unit Operations in Chemical Engineering**, 7th Edition, Pearson Practice Series., 2005.

Course Title: Object Oriented Programming Lab
Course Code: CSE205

L	T	P	Credits	Marks
0	0	4	2	50

Instruction for Students: The candidate will be attending a laboratory session of 4 hours weekly and students have to perform the practical related to the following list.

15. Introduction to basic structure of C++ program, utility of header and library files.
16. Implementation of program related to the basic constructs in C++
17. Programs using different data types in C++
18. Programs using Loops and Conditional Statements in C++
19. Programs using arrays single dimension in C++.
20. Programs using functions by passing values using call by value method and call by reference method.
21. Programs related to string handling in C++
22. Program to demonstrate the objects of the class and their working
23. Programs to implement the working of constructor & destructor
24. Programs to implement the concept of operator overloading
25. Programs to implement Inheritance and its types
26. Programs using early and late binding
27. Programs to show the working of abstract classes
28. Programs to show the working of Exception Handling
29. Program to illustrate the concept of file handling

Course Title: Mechanical Operations Lab
Course Code: CHL221

L	T	P	Credits	Marks
0	0	2	1	25

List of Experiments

1. Analysis of various sizes of given material by sieve analysis and determination of cumulative and differential analysis.
2. Determination of specific cake resistance and medium resistance of a leaf filter.
3. Determination of the specific cake resistance and medium resistance in a vacuum filter.
4. To study the working of continuous type thickener.
5. Determination of screening efficiency in a vibrating screen.
6. Plate and frame filter press: determination of cake resistance and filter medium resistance.
7. Determination of power consumption and study of agitation and mixing characteristic of a fluid.
8. To plot Power number Vs Reynolds number for the given set of impeller with baffled/ unbaffled mixing.
9. To study effect of RPM on the power consumption of a Ball Mill.
10. To determine the efficiency of a Ball Mill

Course Title: Fluid Flow Lab
Course Code: CHL223

L	T	P	Credits	Marks
0	0	4	2	50

List of Experiments

1. To find coefficient of friction in pipes of different materials.

2. To verify Bernoulli's equation using hydraulic bench.

3. To find losses due to sudden expansion and sudden contraction in pipes.

4. To calculate Reynold's number for laminar and turbulent flow.

5. To calculate metacentric height.

6. To determine volumetric and mass flow rates through the Venturi meter.

7. To determine volumetric and mass flow rates using Orifice meter.

8. To determine the efficiency of a pump.

9. To calibrate and to find mass flow rate through Rotameter.

10.To measure the velocity of flow at different points along the cross section in a pipe

Course Title: Material Science and Engineering
Paper Code: PHY257

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic concepts Of Microstructure and information on selection of materials for design and manufacturing.

UNIT-A **14 Hours**

Introduction: Introduction to Materials Science, Classification of Engineering Materials, Levels of Structure, Structure-Property relationship in materials, Primary and secondary bonds.

Crystal Geometry and Structure Determination: Geometry of crystals- the Bravais lattices, Crystal directions and Planes-Miller indices, Structure determination-X -ray diffraction- Bragg's Law, the power method.

UNIT-B **14 Hours**

Crystal Imperfections: Point Imperfections, Line imperfections- edge and screw dislocations, Surface imperfections.

Phase Diagram And Phase Transformations: Phase rule, Single component systems, Binary Phase Diagrams, Lever rule, Typical Phase diagrams for Magnesia-Alumina, Copper-Zinc, Iron-carbon system, TTT-curves, Heat treatment :Annealing, normalizing, hardening, tempering and age hardening, critical cooling rate, flame hardening, lnduction hardening

UNIT-C **12 Hours**

Material of construction : Ferrous Metals, Grey and white castiron, Plain Carbon steels : Classification, properties and applications, Alloy steels : Stainless steels, applications of stainless steels in chemical industries,
Ceramics- Various types, Speciality glasses and refractories, properties and applications.
Polymers : Classifications, comparison and properties, of various polymers and their relationship with chain structure.

UNIT-D **14 Hours**

NANO-MATERIALS:Fundamentals of nonmaterial's and nanotechnology, nano particles, properties of nonmaterial's, synthesis and characterisation, applications of nonmaterials

Corrosion And its Prevention: Electro-chemical corrosion, Galvanic cells,Passivity, Corrosion rate and its prediction, Prevention of corrosion.

Reference Books:

1. Khanna, O. P. "**Material Science**", Dhanpat Rai Publications, New Delhi.
2. VanVlack, H.L., "**Elements of Materials Science"**, 2nd Edition, Addision-Wesly Publishing Company, NY, 1964.
3. Raghavan V., "**Material Science and Engineering",** A First Course, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1996.
4. William D. Callister, "**Materials Science and Engineering: An Introduction",**6th Edition, Wiley, 2006.
5. Hajra Choudhary S. K**., "Material Science and Processes"**, Indian Book Distributing Co., 1982.

Course Title: Chemical Technology –I (Inorganic)
Paper Code: CHL204

L	T	P	Credits	Marks
4	0	0	4	100

Course objective: The objective of the course is to enable the students to understand the basic flow chart symbols and flow charts for typical chemical processes.

UNIT-A **12 HOURS**

Sulphur and Chlor-alkali industry: Sulphur dioxide, sulphuric acid, oleum, Brine ,Electrolysis manufacture of caustic soda and chlorine ,Solvey and modified solvey process, diaphragm cells, membrane cells, hydrochloric acid.

UNIT -B **14 HOURS**

Cement & Glass: Cement- types and manufacture of Portland cement. Glass- manufacture of glass, application of special glasses.

Ceramics- Refractories: Introduction, properties of ceramics, classification of refractories, important steps involved in the manufacture of refractories.

UNIT -C **14 HOURS**

Industrial gases: Manufacture and uses of carbondioxide, oxygen, nitrogen and acetylene.

Paints: Introduction, classification of paints, manufacture of paints.

Dyes: Classification of dyes, manufacture of dyes, various physical and chemical properties of dyes and their industrial uses.

UNIT -D **12 HOURS**

Fertilizers: Nitrogeneous fertilizers- Manufacture of Ammonia, Nitric acid, Urea, CAN, Ammonium Sulphate. Phosphatic fertilizers- superphosphate and tripl superphosphate. Potassic fertilizers- Potassium Chloride and Potassium Sulphate.

Refrences Books:

1. 1.Dryden C. E., "**Outlines of Chemical Technology**", 2nd Edition, East–West Press Pvt. Ltd., New Delhi, 1999.
2. Austin G. T., "**Shreve's Chemical Process Industries**", 5th Edition, McGraw Hill Book Company, New Delhi, 2012.
3. 3.Bose, P.K., "**Chemical Engineering Technology"**, Vol. 1,2, Books and Allied (Pvt) Ltd, 2011
4. Shukla S. D., Pandey G. N., "**A text book of Chemical Technology, Vol. I, II**", Vikas Publishing House Pvt. Ltd., New Delhi, 2000

Course Title: Chemical Engineering Thermodynamics
Paper Code: CHL205

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic concepts related to laws of thermodynamics and its application.

Unit-A **12 HOURS**

Basic Concepts and First Law: System, surrounding, processes, state and properties intensive and extensive properties, State and path functions, Reversible & irreversible processes, Zeroth law of thermodynamics. General statement of first law of thermodynamics, First law for cyclic process and non flow processes, Heat capacity. Derivation for closed system and steady state flow process- flow calorimeter and heat capacity.

Unit-B **14 HOURS**

P-V-T Behaviour: P-V-T behaviour of pure fluids, Equations of state and ideal gas law, Processes involving ideal gas law: Constant volume, constant pressure, Constant temperature, adiabatic and polytropic processes, Equations of state for real gases: Van der Waals equation, Redlich – Kwong equation, Virial equation,Principles of corresponding states.

Second Law of Thermodynamics: General statements of the Second law, concept of Entropy, Carnot's principle, Calculations of entropy change, Clausius Inequality, Entropy and Irreversibility, Third law of thermodynamics.

Unit-C **14 HOURS**

Thermodynamic Properties of Pure Fluids: Work function, Gibbs free energy, Fundamental property relations, Maxwells equations, Residual properties, two phase system, Thermodynamic diagram Equations for U and H, Effect of temperature on U, G, H and S, Entropy heat capacity relations, Relationship between Cp, Cv, Clapeyron equation, Gibbs-Helmholtz equation, Fugacity and fugacity coefficient, determination of fugacity of pure fluids.

Properties of Solutions: Partial molar properties, estimation, Gibbs-Duhem equation, Chemical potential, Fugacity in solutions, Henry's law and dilute solutions, Activity in

solutions, Activity coefficients, Property changes of mixing, excess properties (Qualitative treatment) Activity & Activity coefficients. Ideal and non-ideal solutions.

Unit -D **14 HOURS**

Phase Equilibria: Chemical potential, criterion for VLE for ideal solutions, Raoult's law, P-x,y and T-x,y diagrams, Non ideal solutions- Azeotropes types, VLE at low pressures, VLE correlations- van laar, Margules and Wilson equation. Co-existence equation, G-D equation for VLE,VLE at high pressures, Liquid-liquid equilibrium.

Chemical Reaction Equilibrium: Reaction stoichiometry, Criteria of chemical reaction equilibrium, Equilibrium constant and standard free energy change, Effect of temperature, pressure on equilibrium constants and other factors affecting equilibrium conversion, Liquid phase reactions, Heterogeneous reaction equilibria, Phase rule for reacting system

Recommended Books

1. Smith J. M., Van Ness H. C., Abbott M. M., "**Introduction to Chemical Engineering Thermodynamics**", 7th Edition, Tata McGraw Hill, 2005.
2. Rao Y. V. C., "**Chemical Engineering Thermodynamics**", 7th Edition, Universities Press (India) Ltd., Hyderabad, 2005.
3. Kyle B. G., "**Chemical and Process Thermodynamic**s", Third Edition, Prentice Hall Inc., 1999.
4. Denbigh K. G., "**Principles of Chemical Equilibrium**", 4th Edition, Cambridge University Press, 1981.
5. Halder G., "**Introduction to Chemical Engineering Thermodynamics**", Prentice Hall Inc., 2009.

Course Title: Heat Transfer

Paper Code: CHL206

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic Heat transfer and their fundamental relations.

UNIT -A **14 HOURS**

Introduction to modes of heat transfer.

Conduction: Review of Fourier's Law, one-dimensional heat conduction through composites having plane wall, spherical & cylindrical geometry. Steady state heat flow with heat source through plane wall and cylindrical surface. Thermal conductivity of materials. Optimal thickness of insulation, Fins and their applications. Unsteady-state conduction; Lumped heat capacity system, semi-infinite solid.

UNIT-B **12 HOURS**

Convection: Free and forced convection, concept of heat transfer co-efficient, dimensionless numbers in free and forced convection, Dimensional analysis, Determination of Heat transfer coefficient using heat and momentum transfer analogies, experimental determination of heat transfer coefficient and common working correlations.

UNIT-C **12 HOURS**

Radiation Heat Transfer: Radiation: Distribution of radiant energy, Definition of emissivity, absorpitivity, Reflectivity and Transmissivity, concept of Black and Grey bodies, Planck's Law of monochromatic radiation, Kirchhoff's Law, Wein's displacement law, Stefan-Boltzmann law, definition of intensity of radiation. Radiation formula for radiation exchange between simple bodies, two parallel surfaces and between any source and receiver.

UNIT -D **14 HOURS**

Condensation and Boiling: Condensation heat transfer phenomenon, film condensation on vertical plates and cylinders as well as on horizontal cylinders. Effects

of non-condensable gases and vapor velocity on condensation, pool boiling, forced convection boiling, working correlations for pool boiling.

Evaporation: Types of Evaporators, single and multiple effects, single and multiple effects calculations, evaporator capacity, economy, effect of liquid head and boiling point elevation, methods of feeding.

Heat Exchangers: Various types of heat exchangers, overall heat transfer coefficients, and heat exchanger mean temperature differences, heat exchanger effectiveness and the number of transfer units.

Reference Books:

1. McCabe,W.L, Smith J .C. and Harriott P , "**Unit Operations of Chemical Engineering",** McGraw-HILL, 7th edition,2005.
2. Holman, J.P., "**Heat Transfer**", McGraw Hill, 9th edition, 2004.
3. Rao, Y.V.C., "**Heat Transfer,"** University Press (India) Ltd, New Delhi, Ist edition ,2000.
4. Kern, D. Q., **"Process Heat Transfer**", McGraw Hill, Tata McGraw Hill ,2004.
5. Foust, A.S., Wenzel, L.A, Clump, C.W., Maus, L. and Anderson, L.B., "**Principles of Unit Operations"**, John Wiley, 2th edition 2008.

Course Title: Chemical Process Instrumentation
Course Code: CHL207

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The objective of the course is to enable the students to understand the basic concepts related to instruments used in chemical process industry.

UNIT -A

INTRODUCTION **12 HOURS**

Process instrumentation diagrams for some typical units like reactors and evaporators. Importance of instruments in chemical process industries General principles of measurement, static and dynamic characteristics of instruments, sensors and transducers.

PROCESS INSTRUMENTS

Recording instruments, indicator and signaling instruments, transmission of instrument reading control centre, instrumentation diagram, on line instrumentation in modern plants.

UNIT-B **12 HOURS**

TEMPERATURE MEASUREMENT

Thermocouple resistance thermometers, bimetallic thermistors, optical and radiation pyrometer.

LIQUID LEVEL MEASUREMENT

Direct and differential method for the measurement in open pressure vessels.

UNIT-C **14 HOURS**

FLOW MEASUREMENTS

Use of obstruction type meters, variable area pressure probe, positive displacement type meters, electromagnetic flowmeters and mass flow meters.

PRESSURE MEASUREMENT

Use of manometer, bourdon and bellow, type gauge, measurement of vacuum, pressure transducers.

UNIT-D **12 HOURS**

MISCELLANEOUS MEASUREMENTS

lnstruments for gas analysis. Gas chromatography, mass spectroscopy. Measurement of nuclear radiation, instruments of gas analysis, viscosity, conductivity, humidity and pH value, industrial weighing and feeding systems, amplification, automatic gain amplifiers

BOOKS RECOMMENDED:

1. Eckman, D.P. "**lndustrial lnstrumentation"**, Wiley Eastern Ltd, 2004
2. Krishnaswamy, K. **"Industrial Instrumentation",**Volume1, New Age International P Limited, 2003.
3. Singh, S.K, **" Industrial Instrumentation and Control** ," 3rd Edition, McGraw Hill Education (India) Pvt Ltd ,2008.
4. Coughanour, D.R., **"Process Systems analysis and Control,"** McGraw Hill .1991.

Course Title: Material Science Lab
Course Code: PHY258

L	T	P	Credits	Marks
0	0	2	1	25

List Of Experiments:

1. To find Dielectric Constant of Insulating Material.
2. To find capacitance of capacitor
3. To study Hysteresis Curve of Ferroelectric material.
4. To find resistivity of semi-conductor by using Four prove method
5. To study characteristic of Lead-Tin alloy

Course Title: Chemical Engineering Thermodynamics Lab

Course Code: CHL225

L	T	P	Credits	Marks
0	0	3	2	50

List of Experiments:

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Study of locomotive boiler (Model).
4. To study the Red wood viscometer and measure the viscosity of fluid.
5. To measure the flash point of the given fuel.
6. To study various parts of the vertical steam engine.
7. To Study the Vapour liquid Equilibria
8. To Study the Heat of solution mixing
9. To Study the Elevation in boiling point
10. To Study the Depression in freezing point
11. To Study the Determination of specific heat.
12. To determine the heat of reaction between acid & base.

Course Title: Heat Transfer Lab
Course Code: CHL226

L	T	P	Credits	Marks
0	0	3	2	50

List of Experiments

1. Determination of emmissivity of the given test plate.
2. Determination of thermal conductivity of the given liquid..
3. Determination of thermal conductivity of insulating powder.
4. Determination of heat transfer coefficient by forced convection.
5. Determination of heat transfer coefficient for pin fin by natural convection.
6. Determination of heat transfer coefficient for pin fin by forced convection.
7. Determination of overall heat transfer for parallel flow in double pipe heat exchange.
8. Determination of overall heat transfer coefficient for counter flow in double pipe heat exchanger
9. To conduct test on heat pipe and comparison of the temperature distribution.
10. Determination of heat transfer coefficient in shell & tube heat exchanger.
11. Determination of overall heat transfer coefficient in an open pan evaporator.
12. Determination of heat transfer coefficient by dropwise and filmwise condensation.

Course Title: Numerical Methods
Course Code: MTH256

L	T	P	Credits	Marks
4	1	0	3	75

Course Objectives

The course is an introductory course on Wavelets so as to enable the students to understand further topics related to solution of differential equations. Wavelets are a helpful tool to solve a variety of problems of science and engineering such as image processing, cloud computing etc.

UNIT-A **15 HOURS**

Approximate numbers, Significant figures, rounding off numbers. Error Absolute, Relative and percentage.

Operators: Forward, Backward and Shift (Definitions and some relations among them).

Non-Linear Equations: Bisection, Regula-Falsi, Secant, Newton-Raphson, Muller, Chebshev and General Iteration Methods and their convergence, Aitken Method for acceleration of the Convergence, Methods for multiple roots, Newton-Raphson and General iteration Methods for System of Non-Linear Equations, Methods for Complex roots and Methods for finding roots of Polynomial Equations

UNIT-B **14 HOURS**

Systems of Simultaneous Linear Equations: Direct methods: Gauss elimination method, Gauss Jordon method, Matrix inversion method; Iterative methods: Jacobi method and Gauss-Seidel method, Successive over relaxation iterative method, iterative method to determine A^{-1}, Eigen values problem: Power method for finding largest/smallest Eigen value.

UNIT-C **13 HOURS**

Lagrange's interpolation, Newton Interpolation, Finite Difference Operators, Piecewise and Spline Interpolation, Interpolating Polynomials using Finite Differences and Hermite Interpolation. Least square approximation, Uniform approximation, Rational approximation Numerical Differentiation, Error in Numerical Differentiation, Cubic Spline method, Maximum and Minimum values of a tabulated function.

UNIT-D **14 HOURS**

Numerical Integration:, Numerical Integration: Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Boole's and Weddle's Rule, Integration using Cubic Splines, Romberg Integration, Newton Cotes formulae, Adaptive Quadrature, Gaussian Integration, Euler-Maclaurin Sum Formula, Numerical Integration of Singular and Fourier Integrals, Numerical Double Integration.

Numerical solutions to first order ordinary differential equations: Taylor's Series method, Picard's Method, Euler's and modified Euler's methods, Runge Kutta methods

Reference Books:

1. K.E. Atkinson, "**An Introduction to Numerical Analysis"**, Wiley, 1989.
2. K. Eriksson, D. Estep, P. Hansbo and C. Johnson, "**Computational Differential Equations"**, Cambridge Univ. Press, Cambridge, 1996.
3. S.D. Conte and Carl De Boor, "**Elementary Numerical Analysis, An Algorithmic Approach",** Tata McGraw Hill, New Delhi, 1981.
4. M.K. Jain, "**Numerical Analysis for Scientists and Engineers"**, S.B.W. Publishers, Delhi, 1971.

Course Title: Mass Transfer-I
Course Code: CHL301

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The course enable the students to understand the concepts of transfer of mass in chemical systems and equilibrium. Study and analyze the diffusion of fluids and theories of interface mass transfer.

.

UNIT-A **12 HOURS**

Introduction: Types of diffusion in fluids. Types of diffusion in solid. Measurement and calculations of diffusivities.

Eddy diffusion: Mass transfer coefficients and their correlations. Theories of mass transfer. Interphase mass transfer , problems on mass transfer resistance. J_d factor, Analogies in mass, heat and momentum transfer processes.

UNIT-B **14 HOURS**

Equilibrium diffusion between phases: Material balance for co-current, cross-current and counter-current operations. Concept of stages, efficiencies, cascades operation, continuous contacting equipment, NTU and HTU concepts.

Humidification: General theory. Psychrometric chart. Concepts in humidification, dehumidification. Cooling towers, Design of cooling towers and related equipments.

UNIT-C **12HOURS**

Drying: Drying Equilibria. Drying rate curves. Mechanism of drying. Calculation of batch and continuous drying. Equipments for drying. Design of continuous rotary dryer.

Crystallization: Factors governing nucleation and crystal growth rates. Controlled growth of crystals. Yield calculations and energy balance. Different types of crystallizer equipments. Fractional crystallization.

UNIT-D **12 HOURS**

Adsorption: Theories of adsorption. Isotherms, Industrial adsorbents. Stagewise operations, Adsorptions calculations and equipments.

Ion exchange: Process & equipment.

Reference Books:

1. Treybal, R.E., "**Mass Transfer Operations"**, 3rd Edition, McGraw Hill, 2001.
2. Dutta, B.K, "**Principles of Mass Transfer and Seperation Processes,"** PHI Learning Pvt. Ltd,2007.
3. Coulson JM, Richardson JF and Sinnott RK, **" Chemical Engineering"** ,Vol I, II, IV and V, 4th Edition, Pergmen Press, 1998.
4. Badger & Banchero, "**Introduction to Chemical Engineering"**, TMH, 6th Reprint, 1998.
5. Geankoplis, C. J., "**Transport Processes and Unit Operation"**, Prentice Hall(I), 2000.

Course Title: Chemical Reaction Engineering I
Course Code: CHL302

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The students will study design of various types of reactors for the application to chemical industry and learn the fundamentals related to homogeneous chemical reactions and their kinetics

UNIT-A

Introduction **12 HOURS**

Kinetics of homogeneous chemical and biochemical reactions, single and multiple reactions, order & molecularity, rate constant, elementary and non elementary reactions, temperature dependent term of rate equation.

Interpretation of Batch Reactor

Constant volume batch reactor, integral method of analysis of data, series and parallel reactions, reversible reactions, Variable volume batch reactor, Differential methods of analysis, Temperature and reactions rate.

UNIT-B **12 HOURS**

Introduction to Reactor Design

Ideal batch reactor, mixed flow reactor, plug flow reactor, holding and space time, design for single reactions, size comparison analytical and graphical method, plug flow reactors in series & parallel, mixed reactor in series, recycle reactors.

UNIT –C **14 HOURS**

Design for Multiple Reactions

Reactions in parallel and series in CSTR, reactions in parallel and series in Plug flow reactor, autocatalytic reactions, choice of reactors for simple and complex reactions ,yield & selectivity.

UNIT-D **14 HOURS**

Temperature and Pressure Effects

General design procedure, optimum temperature progression, adiabatic operation, non adiabatic operation, semi batch reactors.

Basics of Non Ideal flow: Importance & interpretation of RTD, C, E & F curves & Statistical interpretation. Dispersion model. Tanks in series model. Conversion in non-ideal flow reactors for simple systems.

Recommended Books:

1. Levenspiel O., "**Chemical Reaction Engineering**", 3rd Edition, John Wiley & Sons, Singapore, 2010
2. Fogler H. S., "**Elements of Chemical Reaction Engineering**", 4th Edition, Prentice Hall Inc.,2009
3. Smith J. M., "**Chemical Engineering Kinetics**", 3rd Edition, McGraw Hill, 1981.
4. Hill C. G., "**Chemical Engineering Kinetics and Reactor Design**", John Wiley, 1977.
5. Coulson J. M., Richardson J. F., "**Chemical Engineering Volume 3",** Pergamon Press, 1999.

Course Title: Chemical Technology-II (Organic)
Course Code: CHL303

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The students will
1. Study the Organic ,Petroleum Process industries.
2. Learn to write flow chart symbols and flow charts for typical chemical processes

UNIT-A **12HOURS**

Oils and fats: Major oil seeds, solvent process, hydrogenation of oils. Soaps and Detergents: Raw material, manufacturing of detergents, biodegradability, and glycerin manufacture, fat splitting, purification of fatty acids,

UNIT-B **12HOURS**

Sugar Industry: Cane production and varieties, manufacturing equipment and technology, cane sugar refining, Bagasse utilization,
Fermentation: Production of ethyl alcohol from molasses, citric acid and antibiotics like pencillin.

UNIT-C **14HOURS**

Petroleum refining: General composition of crude oil, typical refinery operations for obtaining useful products, their utilization for manufacture of ethylene glycol, acrylonitile, styrene, andbutadiene. Polymer: classification of polymers, degree of polymerization, modes of polymerization synthetic fibers (Nylon, terylene) synthetic & natural rubbers.

UNIT –D **12HOURS**
Pulp and paper: pulping processes, recovery of chemicals, stock preparation and paper making, recovery, of chemicals, viscose rayon. Surface-coating Industries: paints, pigments, varnishes, Lacquers.

Reference Books:

1. Dryden C. E., "**Outlines of Chemical Technology**", 2nd Edition, East–West Press Pvt. Ltd., New Delhi, 1999.
2. Austin G. T., "**Shreve's Chemical Process Industries**", 5th Edition, McGraw Hill Book Company, New Delhi, 2012.
3. Groggins, P.H., "**Unit Processes in Organic Synthesis**", 5th Edition Tata McGraw Hill ,2003
4. Garry, James H., Handwerk, G. E. and Kaiser, M.J., "**Petroleum Refining Technology and Economics"**, Taylor & Francis ,2007

Course Title: Process Dynamics and Controls
Paper Code: CHL304

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The student will
1. Understand a control system with various input functions, characteristics and transfer functions
2. Know the behaviour of a control system for I and II order type
3. Understand different closed loop systems and Controllers (P, I, D and On – Off modes)

UNIT-A **12HOURS**

Laplace Transformation. Inversion by partial fractions. Properties of transform. Linear Open-loop System. Response of first-order systems, physical examples of first order system, response of higher order systems and Transportation Lag.

UNIT-B **12 HOURS**

Linear closed-loop systems, control systems, Controllers and Final control elements, closed-loop Transfer functions. Transient response of Simple control Systems Control valve, Construction, valve sizing and characteristics.

UNIT-C **14 HOURS**

Stability, Routh Test of stability, Root Lacus. Introduction to Frequency Response, Bode diagram, Gain Margins and Phase Margins.

UNIT-D **14 HOURS**

Controller tuning (Ziegler- Nichols Controller settings), Process identification, Identification methods: Step test data, Sine Wave testing, Pulse testing, Introduction to advanced control technique, cascade control, ratio control, overwrite control, feed forward control.

Reference Books:

1. Coughanour, D.R., **"Process Systems Analysis and Control"**, 2nd edition, McGraw Hill 2001.
2. Stephanopoulous, G.,"**Chemical Process Control: An introduction to Theory and Practice**", Prentice Hall of India, 1984.
3. Harriott, P., "**Process Control",** Tata McGraw Hill,2001
4. Eckman, D.P., "**Industrial instrumentation",** John Wiley & Sons ,2004

Course Title: Numerical Methods with C/C++
Paper Code: MTH 257

L	T	P	Credits	Marks
0	0	2	1	25

List of Programs:

1. Write a program to solve a polynomial equation.
2. Write a program to find C (n, r).
3. Write a program to write a tridiagonal matrix.
4. Write a program to solve the system of linear equations
   a) Using Gauss Elimination b) using LU Decomposition.
5. Write a program in Matlab to find the characteristic roots and the characteristic functions
6. WAP on Bisection and False Position Method.
7. WAP on polynomial interpolation.
8. WAP on Taylor Series method.
9. WAP on Runge-Kutta Methods
10. WAP on Finite Difference Methods
11. WAP on Numerical Integration.
12. WAP on Trapezoidal and Simpson's rule.
13. WAP on Gaussian Quadrature.
14. WAP on Spline Interpolation.
15. WAP on Hermite Interpolation.

Reference Books:

1. Atkinson, K.E., "**An Introduction to Numerical Analysis"**. New Delhi: Wiley, 1989.
2. Eriksson, K., Estep, D., Hansbo, P. and Johnson, C., "**Computational Differential Equations"**. Cambridge: Cambridge Univ. Press, 1996.
3. Golub, G.H. and Ortega, J.M. ,"***Scientific Computing and Differential Equations: An Introduction to Numerical Method"*** ,London: Academic Press, 1992.
4. Conte, S.D. and Boor, C.D.., "**Elementary Numerical Analysis, An Algorithmic Approac",** New Delhi : Tata McGraw Hill, 1981.

DAV UNIVERSITY, JALANDHAR

Course Title: Process Dynamic and control lab
Paper Code: CHL324

L	T	P	Credits	Marks
0	0	3	2	50

List of Experiments

1. Determination the time constant of a given Mercury Thermometer.
2. Determination of time constant in a liquid level tank
3. Determination of time constant in interacting and non-interacting tank
4. Determination of time constant in a heated tank
5. To study the effect of proportional controller in a liquid level tank
6. To study the effect of proportional Integral controller in a liquid level tank

Course Title: Chemical Technology Lab
Course Code: CHL323

L	T	P	Credits	Marks
0	0	3	2	50

1. To find Acid value of vegetable oil
2. To find Iodine value of vegetable oil
3. To Saponification of polymer
4. Determination of NPK value
5. Preparation of soap
6. Preparation of polymer(Preparation of Urea Formaldehyde)
7. To determine the Moisture, Volatile and Ash content in a given coal sample by Proximate Analysis
8. Determination of viscosity of Ostwald Viscometer

Course Title: **MASS TRANSFER-II**

Course Code: CHL305

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The students will
1. Study of the stage wise mass transfer operations.
2. Study principles of various stage wise contact processes like absorption, distillation, extraction and leaching.
3. Study Design aspects of the equipments utilized for above mentioned operations

UNIT-A **12HOURS**

Absorption: Equilibria for absorption systems – use of Raoult's law, Henry's law for solubility predictions, Selection of absorbent, limiting liquid gas ratios, absorption factor use in design of plate absorbers. Kremser equation for ideal plates and translation of ideal plates to real plates using various efficiencies. Concept of transfer units for the design of packed absorbers.

UNIT-B **14HOURS**

Distillation: Limitations and applications, prediction of VLE using thermodynamic & experimental techniques. Dew point & bubble point estimations for binary & multicomponent mixtures. Distillation methods – flash distillation, differential distillation for binary systems, steam distillation, optimum reflux ratio. Fractionation of binary mixtures using McCabe – Thiele method and enthalpy concentration method (Ponchon and Savarit method). Packed distillation columns. Azeotropic & extractive distillation preliminaries and molecular distillation.

UNIT-C **14HOURS**

Liquid-Liquid Extraction: Ternary Equilibria and its representation on various plots. Selection criteria for solvent, Multistage extraction using partially miscible & immiscible solvents.Stagewise contact for countercurrent and crosscurrent extraction. Constructional details of equipment like mixer-settler, packed columns, pulsed extractor, sieve-tray extractor and centrifugal extractor.

UNIT-D **12HOURS**

Leaching: Preparation of solid, countercurrent and crosscurrent multistage contact Shank's system. Constructional details of equipment like Rotocel extractor, Hildebrandt extractor, Bollman extractor, Kennedy Extractor & Beet-Sugar Diffusion battery extractor.

Reference Books:

1. Treybal, R.E., "**Mass Transfer Operations**", McGraw Hill, 3rd Edition,2001.
2. Dutta, B.K, "**Principles of Mass Transfer and Seperation Processes,"** PHI Learning Pvt. Ltd, 2007.
3. Coulson JM, Richardson JF and Sinnott RK, **" Chemical Engineering"** ,Vol I, II, IV and V, 4th Edition, Pergmen Press, 1998.
4. Geankoplis, "**Transport Processes and Unit Operations**", Prentice-Hall of India ,1993.
5. McCabe, W.L.,and Smith, J.C., **"Unit Operations of Chemical Engineering**", McGraw Hill, 7th Edition, 2005.

Course Title: Chemical Reaction Engineering II
Course Code: CHL306

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The students will
1. Learn heterogeneous reaction systems.
2. Study the design and analyze performance of non-ideal reactors.
3. Study catalytic systems and its deactivation studies for students to handle such process systems.

UNIT-A **12HOURS**

Design equations for semi-batch reactor, concepts of non-ideality. Age Distribution function and interrelationship, Models for non-ideal flow patterns, estimation of parameters.

UNIT-B **12HOURS**

Introduction to catalysis. Classification of catalysts. Preparation and physical characteristics of solid catalyst, concept of physical adsorption and chemisorptions.

UNIT-C **14HOURS**

Diffusion of mass and heat in porous solids with and without external diffusion resistance, effectiveness factor Fluid- fluid reaction modelling based on film and penetration theory. Enhancement factor. Reactor system and design for gas-liquid and gas-solid non-catalytic systems.

UNIT-D **12HOURS**

Fixed bed catalytic reactors, single and multibed adiabatic reactors, multibular fixed bed reactors. Design equations for fixed bed reactors using pseudo homogeneous.

Reference Books:

1. Levenspiel O., "**Chemical Reaction Engineering**", 3rd Edition, John Wiley & Sons Singapore, 2010.
2. Fogler H. S., "**Elements of Chemical Reaction Engineering"**, 4th Edition, Prentice Hall Inc., 2009.
3. Smith J. M., "**Chemical Engineering Kinetics",** 3rd Edition, McGraw Hill, 1981.
4. Hill C. G., "**Chemical Engineering Kinetics and Reactor Design**", John Wiley, 1977.
5. Coulson J. M., Richardson J. F., "**Chemical Engineering,Volume** 6", 3rd Edition Pergamon Press,

Course Title: PROCESS PLANT UTILITIES
Course Code: CHL307

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The students will
1. Learn about the various utilities used in the process industries.
2. Learn to evaluate the utility requirements in process industries

UNIT-A **12HOURS**

Introduction

Different utilities.Role of utilities in process plant operations and criteria for selection and estimation of suitable utilities.

Water: Water resources. Process water, Cooling water, drinking water and boiler feed water Quality Standards. Water treatment processes for drinking, process and boiler feed. Storage and handling of water. Types and selection of pumps, piping and accessories. Water pre treatment , reuse and recycling.

UNIT-B **14 HOURS**

Steam and Power

Steam generation in chemical plants. Types of boilers and waste heat boilers. Fuels-types, emissions and global warming, green fuels. Calorific value. Proximate and ultimate analysis. HHV, LHV and related calculations. Cogeneration power plants. CHPs and Boiler performance. Related Calculations. Economy of steam generation with different fuels, related calculation. Steam storage and handling-piping and accessories.

Unit -C **12 HOURS**

Air

Compressed air, blower air, fan air. Types of compressor and vacuum pumps and selection. Power requirements, performance and related calculations. Booster and receivers. Quality of compressed air for instruments and processes. Compressed air distribution system- piping and accessories. Air-water vapour system: humidification/ dehumidification and evaporative cooling-related calculations.

Unit –D

Refrigeration **14 HOURS**

Different refrigeration systems and their characteristics. Air-conditioning systems. Coefficient of performance. Power requirements and refrigeration effect- related calculations for each type of refrigeration system. Refrigerant properties and selection. Some commonly used refrigerants and secondary refrigerants. Air-conditioning.

Insulation: Insulation Materials and Selection- Economics of insulation. Insulating factors. Properties & Classification. Cold insulation and cryogenic insulation

Reference Books:

1. Fair, G.M., Geyer, J.C. and Okun, D. A., "**Water and Waste Water Engineering**", Vol 2, Wiley, 1969.
2. Narayan and Viswanathan, "**Chemical and Electrochemical Energy Systems**", University Press, 1998.
3. Perry, Chemical Engineers Handbook, 8th Edition, McGraw Hill.
4. Sinnot, R.K., Coulson and Richardson's , "**Chemical Engineering- Vol 6"**, Pergamon, 1996.
5. Stoccker, W.F. , "**Refrigeration and Air Conditioning**", Mc-Graw Hill, 1963.

Course Title: Environmental Engineering
Course Code: CHL308

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The main objective of this course is to understand the various types of industrial pollution and their control methods

UNIT-A **12HOURS**

Air Pollution Control Engineering

Introduction, Definition, Sources, Characteristics and Perspective of Air Pollutants, Effects of Air Pollution on Biodiversity, Economic Effects of Air Pollution, Air Quality and Emission Standards, Engineering Systems of Control of Air Pollution by Equipment and by Process Changes.

UNIT-B **14HOURS**

Water Pollution Control Engineering

Introduction, Definition, Sources, Characteristics and Perspective of Water and Wastewater Pollutants, Effects of Water Pollution on Biodiversity, Economic Effects of Water Pollution, Water Quality and Emission Standards, Physical, Chemical and Biological Parameters(BOD and COD). Waste water treatment techniques, primary treatment involving removal of suspended particles through flocculation, settling, skimming and friction. Secondary treatment: biological treatment, aerobic and anaerobic digestion, activated sludge processes, trickling filters and oxidation periods and Advance Treatment.

UNIT-C **12HOURS**

Solid Waste Management

Introduction, Definition, Sources, Characteristics and Perspective of Solid Waste, Generation, Separation, Handling, Storage and Transportation of Solid Waste, Chemical and Biological Treatment of Solid Waste.

UNIT-D **12HOURS**

Biomedical and Hazardous Waste Management

Introduction, Definition, Sources, Characteristics and Perspective of Biomedical and Hazardous Waste, Handling, Storage, Transportation of Biomedical and Hazardous Waste, Physical, Chemical and Biological Treatment of Biomedical and Hazardous Wastes.

Recommended Books:

1. Rao ,C.S, **"Environmental Pollution Control Engineering"**, New Age Publication,3rd Edition ,2013.
2. Rao M. N., Rao H. V. N., "**Air Pollution**",Tata McGraw Hill Publishing Company Ltd.,2005.
3. Dhameja,S. K . **"Environmental Science"**, S. K. Kataria & Sons, 2010.
4. Metcalf and Eddy, Inc., "**Wastewater Engineering-Treatment and Reuse**", Tata McGraw Hill Publishing Company Ltd., Fourth Edition, 2004.
5. Rittmann BE.,McCarty P. L.,"**Environmental Biotechnology: Principles and Application**", McGraw Hill International Editions, First Edition, 2001.
6. Kiely G.,**"Environmental Engineering",** Tata McGraw Hill, Special Indian Edition, 2007.

Course Title: Optimization Techniques
Course Code: CHL309

L	T	P	Credits	Marks
4	0	0	4	25

Course Objectives: Students will learn about the basic concepts of optimization techniques and to use them for optimum utilization of resources.

Part – A

Introduction: **(4)**
Origin of OR and its role in solving industrial problems. General approach for solving OR problems. Classification of mathematical models, various decision making environments.

Linear Programming: **(5)**
Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis.

Part – B

Transportation and Assignment Models: **(5)**
Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function.

Dynamic Programming: **(3)**
Introduction to deterministic and probabilistic dynamic programming.

Part – C

Network models: **(6)**
Shortest route and traveling sales - man problems, PERT &CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction.

Queuing Theory: **(3)**
Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

Part – D

Replacement Models: **(4)**
Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy.

Optimization Techniques: **(7)**
Introduction, Theory and algorithms, classical method, non-linear optimization-Unconstrained optimization, constrained optimization: Langrangian multiplier method.

References:

1. Wagner H.M, "**Principles of Operations Research**", Prentice Hall.
2. Gupta P.K. and Hira D.S., "**Operations Research**", S. Chand & Co.
3. Hiller F.S. and Libermann G.I., "**Introduction to Operation Research**", Holden Ray.
4. Wiest& Levy, "**A Management Guide to PERT/CPM**", Prentice Hall
5. Ackoff and Saseini, "**Fundamental of Operations Research**", Wiley Eastern

Course Title: Mass Transfer Lab
Course Code: CHL325

L	T	P	Credits	Marks
0	0	3	2	50

List of Experiments

1. To plot the ternary phase diagram for acetic-acid–water Toluene.
2. To draw the tie line and to determine plait point for ternary system.
3. To determine the diffusivity of acetone in air.
4. To study the drying characteristics of the given wet material (Natural Convection).
5. To determine the Mass Transfer Coefficient for vaporization of naphthalene in air.
6. To verify Rayleigh's Equation for Batch distillation.
7. To find HETP and HTU for packed distillation column.
8. To purify turpentine oil having high boiling point using steam distillation.
9. To determine VLE data for methanol–water and to compare it with literature data.
10. To determine the mass transfer coefficient by carrying out liquid-liquid extraction in a packed column using acetic acid- toluene-water system.
11. To study the drying characteristics of the given wet material (forced convection).
12. To study the process of crystallization in an agitated batch crystallizer and to plot a graph between weight of crystals vs. temp.
13. To find out mass transfer coefficient in a drop wise liquid–liquid extraction. To Study the Heat and Mass Balance in Cooling Tower.

Course Title: Chemical Reaction Engineering Lab
Course Code: CHL326

L	T	P	Credits	Marks
0	0	3	2	50

1. Determination of rate constant for saponification reaction in a batch reactor
2. Determination of porosity and sphericity of the given catalyst.
3. RTD study in a Packed bed reactor
4. To study the adsorption of acetic acid on charcoal and prove the validity of Freundlich and Langmuir adsorption isotherm
5. To study the adsorption of oxalic acid on charcoal and prove the validity of Freundlich and Langmuir adsorption isotherm

Course Title: Environmental Engineering Lab
Course Code: CHL328

L	T	P	Credits	Marks
0	0	3	2	50

1. To determine the Total Solids of a given sample.
2. To find out Total Dissolved Solids of a given sample.
3. To find out Fixed and Volatile solids of the given sample.
4. To determine Acidity of the given sample.
5. To determine the Alkalinity of the given sample.
6. To determine the Total Hardness of the given sample.
7. To find out amount of Sulphates in a given sample.
8. To estimate the content of Chlorides in the given water sample
9. To find the quantity of the Dissolved Oxygen present in the given sample.
10. To determine the BOD of a given wastewater sample.
11. To determine the COD of a given wastewater sample.

Course Title: Energy Technology
Course Code: CHL401

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The student will study different types of fuels and their combustion.

UNIT-A **12 HOURS**

Introduction: Classification of energy source and resources, present and future energy demands.
Solid Fuels: Principal solid fuels, Classification of Indian coals, coal preparation, storage of coal, low and high temperature carbonization, briquetting

UNIT –B **12 HOURS**

Liquid fuels: crude petroleum, Physical processing of crude petroleum- distillation, purification of petroleum products, properties of petroleum products , liquid fuels from coal by hydrogenation or liquification, storage and handling of liquid fuels

UNIT-C **12 HOURS**
Gaseous Fuels: Natural gas, LPG, Producer gas Water gas and carburetted water gas, storage and distribution of gaseous fuels

UNIT –D **14 HOURS**

Principles of combustion: Combustion of fuels(solid,liquid and gaseous) , Combustion equipments, Incomplete combustion,effeiciency and heat recovery, calorific value, gas analysis, Fluidized bed combustion.

Furnaces: Classification of furnaces, draught, furnace atmosphere, Portland cement continuous rotary kiln, blast furnace, glass melting furnace.

Reference Books :

1. Rao, S. and Parulekar, B.B., "**Energy Technology-Non- conventional, Renewable and Conventional",** Khanna Publishers ,2000.
2. Gupta, O.P., "**Elements of Fuel, Furnaces and Refractories"**, Khanna Publishers ,2001.
3. Rai, G.D., "**Non-Conventional Energy Sources**," Khanna Publishers ,2001.
4. Brame J.S.S. and King J.G., Edward Arnold ,"**Fuel Solid, Liquid and Gases",** Edward Arnold ,1967.
5. Sukhatme S.P, "**Solar Energy - Principles of Thermal Collection and Storage",** 2nd Edition,Tata McGraw- Hill ,2003

Course Title: TRANSPORT PHENOMENA
Course Code: CHL402

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: The student will
1. Learn the mechanisms and Laws transport phenomena, Effect of temperature and pressure on transport properties
2. Study velocity distributions in laminar flow for simple fluid flow situations by shell balances

UNIT-A **12 HOURS**

Introduction: Basic concepts of transport phenomena, Newtonian and non-Newtonian fluids; Newton's law of viscosity, Fourier's law of heat conduction and Fick's law of diffusion.

UNIT-B **14 HOURS**

Momentum Transport: Velocity Distribution, Equation of continuity in Cartesian, polar and spherical coordinates, Laminar flow of Newtonian fluid over an inclined plate, through circular tube and through annulus, Bingham flow in a circular tube, Equation of Change: Partial, total and substantial times derivatives, Equation of motion and Navier's-Stokes equation and their applications to solve problems of different geometries.

Flow with More Than One Independent Variable: Unsteady-state Newtonian fluid flow, Stream function, Potential function and two-dimensional viscous flow, Boundary layer theory.

UNIT-C **12 HOURS**

Energy Transport: Temperature Distribution: Heat conduction with an electrical, viscous, chemical and nuclear heat source, Heat conduction in a cooling fin, Equation of Change, Equation of energy in rectangular, spherical and cylindrical geometries, Equations of energy for convection in non-isothermal flow, Forced convection, Free convection.

UNIT-D **14HOURS**

Mass Transfer: Concentration distribution with shell mass balances, Diffusion through stagnant gas film, Diffusion with moving interface, Diffusion through a non-isothermal spherical film, Gas absorption with chemical reaction in an agitated tank, Diffusion with heterogeneous and homogeneous chemical reaction, Diffusion and chemical reaction inside porous catalyst, Equation of Change, Equation of component continuity for binary and ternary mixtures and various simplifying assumptions.

Reference Books

1. Bird, R. B., Stewart, W. E., and Lightfoot, E. N., "**Transport Phenomena**", Wiley ,2002.
2. Raj, B., "**Introduction to Transport Phenomena**,"PHI Learning, 2012.
3. Geankoplis, C. J., " **Transport Processes and Unit Operations**", Prentice-Hall 1993.
4. Bennett, C.O., and Myers, J.E., "**Momentum, Heat, and Mass Transfer"**, 3rd Edition,McGraw-Hill,1983.
5. Welty, J. R., Wicks, C. E., and Wilson, R. E., "**Fundamentals of Momentum, Heat, and Mass Transfer",** John Wiley and Sons ,1984.
6. William J. T., "**Introduction to Transport Phenomena**", Prentice Hall 1999.

Course Title: Plant Design and Economics
Course Code: CHL403

L	T	P	Cr	Marks
4	0	0	4	100

Course Objectives: The student will
1. Learn basics of Cost estimation, Working Capital and Capital Investment and understand the time value of money
2. Study depreciation methods and learn tax calculation methods
3. Learn the methods of estimation of profitability of an industry

UNIT-A **12 HOURS**

Cost Estimation
Factors affecting investment and production costs, capital investment-fixed investments and working capital. Cost indices. Estimating equipment costs by scaling 6/10 factor rule. Methods for estimating capital investment. Estimations of total product cost. Different cost involved in the total product for a typical chemical process plant.

UNIT-B **12 HOURS**

lnterest and lnstrument costs
Simple and compound interest. Nominal and effective rates of interest. continuous interest. ordinary annuity. Perpetuities and capitalized costs.

UNIT-C **12 HOURS**

Taxes and lnsurance
Type of taxes and tax returns, type of insurance and returns, types of insurance of legal responsibility.
Depreciation :
Types of depreciation, service life, salvage value, present value and methods of determining depreciation single unit and group depreciation, single unit and group depreciation.

UNIT-D **12 HOURS**

Profitability Alternative lnvestment and Replacements :
Methods for profitability evaluation, cash flow diagram. Determination of acceptable investment. Alternatives when an investment must be made and analysis with a small increment investment, replacement, break even analysis.. Balance sheet and income statement.

Optimum design :
Procedure with one variable optimum reflex ratio in distillation and other examples.

BOOKS RECOMMENDED :

1. Peters, M.S. Timmerhaus, K.D, "**Plant Design and Economics of Chemical Engineers**", 5th Edition ,MC Graw Hill,New York, 2003 **.**
2. Desai, V., "**Dynamics of Entrepreneurial Development & Management**", Himalaya Publishing House.
3. Schweyer, H. E., **" Process Engineering Economics**", McGraw Hill, NY.
4. Gupta, C.B., Kanka, S.S., " **Entrepreneurship & Small Business Management**", S Chand & Sons, 2007.
5. Ulrich G.D. "**A Guide to chemical Engineering process Design and Economics**", John Wiley ,1984.

Course Title: Process Engineering Design-I
Course Code: CHL404

L	T	P	Cr	Marks
3	0	2	4	100

Course Objectives: The students will
1. Study design safe process and design appropriate equipment like reactors, mass transfer heat transfer equipment, pipelines storage tanks etc.
2. Study relevant codes for design of chemical plant equipment as per the standard procedures specified by design code books

UNIT-A **12 HOURS**

Introduction

Introduction to principles involved in the design and construction of plant.

Design preliminaries

Design codes, pressure, temperature, factor of safety, corrosion allowance, weld joint efficiency factor, design loadings, Poisson's ratio, dilation of pressure vessels, criteria of failure, material of construction.

UNIT-B **12 HOURS**

Storage tanks

Introduction to Indian standards for storage tanks and their use to design cylindrical and spherical vessels under internal pressure, fixed roof and open roof tanks.

UNIT-C **12 HOURS**

Mechanical design

Mechanical design of tall vessels for distillation and absorption columns.

UNIT-D **12 HOURS**

Design of supports

Design of supports for vertical and horizontal vessels, Flanges.

Recommended Books:

1. Bhattacharya B. C., "**Chemical Equipment Design**", CBS Publisher, 2011.
2. Coulson, Richardson &Sinnott, R.K., "**An Introduction to Chemical Engineering Design**", Chemical Engineering, Volume 6 , 4th Edition, Pergamon Press, 2007.
3. Joshi , M.V., "**Process Equipment Design**", 3rd Edition, Macmillan India,2007.
4. Perry's, "**Handbook of Chemical Engineering**", 7th Edition, McGraw Hill, 1997

Course Title: Energy Technology Lab
Course Code: CHL421

L	T	P	Cr	Marks
0	0	3	2	50

List of Experiments

1. To determine the flash point of a given sample
2. To determine the Smoke Point of a given sample
3. To study the Distillation of Petroleum Products
4. To determine the calorific value of a fuel using Peroxide Bomb Calorimeter
5. To estimate the moisture content in the given coal sample
6. To determine the Cloud Point and Pour Point of a given sample
7. To study the burning properties of the given sample
8. To determine the Melting Point of Petroleum wax

Course Title: Process Modeling and Simulation
Course Code: CHL405

L	T	P	Cr	Marks
4	0	0	4	100

Course Objective: The student will
1. Study the principles of model building and precautions
2. Learn the approach to solution by the method of shell balances and a review of continuity equation, energy equation, equation of motion, transport equation of state equilibrium and Kinetics.
3. Learn the classification of mathematical models

UNIT-A **12 HOURS**

Introduction: Uses of mathematical models. Scope of coverage. Principles of formulations Fundamental Laws: Continuity equations, energy equations, equations of motion, Transport equations, equation of state, equilibrium. Chemical kinetics.

UNIT-B **14 HOURS**

Mathematical Models: Series of isothermal CSTR & constant hold-up CSTR's, CSTR's With variable hold ups two heated tanks, gas phase pressurized CSTR' Non isothermal CSTR & single component vaporizer, multicomponent flash drum, batch, reactor with Mass transfer.

UNIT –C **12 HOURS**

Mathematical Modeling of Mass Transfer and Heat transfer Processes: Ideal binary distillation column multi component non ideal distillation column, batch distillation with hold up, liquid extraction, absorption, adsorption, heat exchanger.

UNIT-D **12 HOURS**

Interacting and Non-Interacting Systems: Real CSTR modeled with and exchange volume Real CSTR modeled using by passing and dead space. Two CSTR's with interchange.

Reference Books:

1. Luyben W.L., "**Process Modeling, Simulation and Control for Chemical Engineering",** McGraw-Hill ,1998.
2. Denn, M. M., "**Process Modeling, Longman Sc & Tech**", 1987.
3. Himmelblau, D.M and Bischoff, K.B., "**Process Analysis and Simulation: Deterministic System**s", John Wiley ,1968.
4. Holland, C. D., "**Fundamentals and Modeling of Separation Processes :Absorption, Distillation,Evaporation and Extraction",** Englewood Cliffs, Prentice-Hall ,1974.

Course Title: Industrial Safety and Hazardous Management
Course Code: CHL406

L	T	P	Cr	Marks
4	0	0	4	100

Course objectives: The student will
1. Have awareness of different hazards in process industries
2. Learn classification of hazards and their identifications
3. Learn precautions in chemical storage and handling
4. Learn risk analysis techniques and quantify them
5. Learn emergency management plans

UNIT-A **12 HOURS**

Definition, ldentification, classification and assessment of various types of industrial hazards. General principles of industrial safety, importance of safety in chemical industrial. Protective and preventive measures in hazard control.

UNIT-B **12HOURS**

Standard safety procedures for disaster control, lndian legislation on safety and prevention of hazards and safety code. Environmental Protection Act (1986).

UNIT-C **12HOURS**

Toxic chemicals, Maximum allowable concentration and other standards biological threshold limit values, toxicity and radioactivity. Regulations for storage and handling of hazardous substances and labelling

UNIT-D **12HOURS**

Hazards, hazards classification, hazard due to the explosion' Dow's fire and explosion index,HMOP, : Hazard & Operability (HAZOP) studies ,guide words and their meaning, application of guide words to hazardous operation deviation, possible causes, Consequences and actions required, event trees and fault trees.

Refrences Books :

1. Raghavan K. V. and Khan AA., " **Methodologies in Hazard Identification and Risk Assessment"**, Manual by CLRI, 1990.
2. Marshal V. C., "**Major Chemical Hazards**", Ellis Horwood Ltd., Chichester, 1987.
3. Sam Mannan, Lees, "**Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control**", 4th Edition, Butterworth Heineman, 2012.
4. Wells, G. L., "**Safety in process plant design**," New York ,J. Wiley, 1980.

Course Title: Process Engineering Design-II
Course Code: CHL407

L	T	P	Cr	Marks
3	0	2	4	100

Course Objectives: The students will study design safe process and design appropriate equipment like reactors, mass transfer heat transfer equipment, pipelines storage tanks etc.

UNIT-A **12HOURS**

Process Equipment Design: Introduction, General design procedure. Agitated vessels: Design of mixing vessels, impellers, propellers' anchors and helical ribbon type agitators.

UNIT-B **12HOURS**

Heat Transfer Equipment: Process design calculations for heat transfer equipment, Shell and Tube heatexchangers-general description, Estimation of heat transfer coefficients and pressure drop by Kerns' and Bell's methods, Condenser and re-boiler design, Plate type heat exchanger design, Heat Transfer in stirred vessels, Codes & standards and Heat-exchanger nomenclature, Mechanical turbulators.

UNIT-C **12HOURS**

Mass Transfer Equipment: Process design calculations for binary and multi-component distillation, Fenske- Underwood-Gilliland Method, Selection of two key components, Fenske equation for minimum equilibrium stage, Gilliland correlations for actual reflux ratio and theoretical stages, Minimum reflux ratio by Underwood method, Feed stage location, Type of towers, types of plate contractors, Sieve tray layout and hydraulic design, Packed towers – column internals, Types of packing, General pressure drop correlation, Column diameter and height.

UNIT-D **12HOURS**

Piping System Design: Piping classification. Important fittings and their use, Symbols, Layouts, and Color codes for pipe lines.

Reference Books

1. Sinnott Ray and Towler Gavin, Coulson and Richardson's, " **Chemical Engineering Design**", 2010.
2. Kern, D.Q., "**Process Heat Transfer**", International Student Edition, McGraw Hill ,2002.
3. Ludwig E.E., "**Applied Process Design in Chemical and Petrochemical Plants Vol I, II, III**," Gulf PublishingCo.,1995
4. Brownell, L.E. and Young, E.H., " **Process Equipment Design**", Wiley Eastern India Limited ,1991.
5. Perry, R.H. and Green, D, Chemical Engineer's Handbook, 8th Edition, McGraw Hill, New York. 2008.
6. Seader, J. D., Henley, E.t6 J., "**Separation Process Principles"**, Wiley 2001.
7. Bausbacher Ed. And Hunt Roger, **" Process Plant Layout and Piping Design"**, PTR Prentice Hall, 1993.

Course Title: Process Modeling and Simulation Lab
Course Code: CHL425

L	T	P	Cr	Marks
0	0	3	2	50

LIST OF EXPERIMENTS

1. Model and simulate a gravity flow tank.
2. Simulate the non-isothermal CSTR
3. Simulate three CSTR's arranged in series.
4. Simulate ideal binary distillation column.
5. Model and simulate a batch reactor.
6. Simulate two interacting tank system in series.
7. Simulate two non-interacting tank system in series.
8. Simulate a heat exchanger.
9. Simulate a real CSTR modeled using by passing and dead space.
10. Simulate an extrusion column.

Course Title: Biochemical Engineering
Course Code: CHL451

L	T	P	Cr	Marks
3	0	0	3	75

Course Objectives: The students will
1. Study introduction to the application of chemical engineering principles in biochemical systems.
2. Be enabled to understand the biological systems and kinetics of enzymatic reactions.
3. Learn the kinetics of growth of microorganisms, hence be able to control the process

UNIT-A **14 HOURS**

Introduction
Bioprocess engineering and technology. Role of a Chemical engineer in bioprocess industry. An introduction to basic biological sciences.Microbiology: Structure of cells: Prokaryotes and Eukaryotes. Classification of micro-organisms.Taxonomy, Whitaker's 5-kingdom concept. Characteristics and control of microorganisms. Environmental and Industrial microbiology.
Biochemistry: Chemicals of Life: Lipids, Sugars, Polysaccharides, Amino acids and proteins, Vitamins, Biopolymers, Nucleic Acids: RNA, DNA and their derivatives (Structure, Biological function and Importance for life only to be studied).

UNIT-B **14 HOURS**

Enzymes and Proteins: Detailed structure of proteins and enzymes: Primary, Secondary, Tertiary and quaternary. Functions. Production and purification of Enzymes (Methods only). Nomenclature and Classification of enzymes. Mechanism and Kinetics using various models. Kinetics of Enzyme action: Michaelis–Menten rate equation. Derivation with Equilibrium and Pseudo- (quasi-) steady state approximations. Experimental determination of rate parameters: Batch and continuous flow experiments.

UNIT-C **12 HOURS**

Enzyme Inhibition: Effect of Inhibitors (Competitive, noncompetitive, uncompetitive, substrate and product inhibitions), Temperature and pH on the rates enzyme catalyzed reactions.

Fermentation Technology: Ideal reactors: A review of Batch and Continuous flow reactors for bio kinetic measurements. Microbiological reactors: Operation and maintenance of typical aseptic aerobic fermentation processes. Formulation of medium: Sources of nutrients. Alternate bioreactor configurations. Introduction to sterilization of bioprocess equipment. Design of batch & continuous sterilization equipment

UNIT-D **12 HOURS**

Growth Kinetics of Microorganisms: Transient growth kinetics (Different phases of batch cultivation). Quantification of growth kinetics: Substrate limited growth, Models with growth inhibitors, Logistic equation, Filamentous cell growth model. Continuous culture: Optimum Dilution rate, Critical Dilution rate in Ideal Chemostat. Introduction to Fed-batch reactors. Strategies and Steps involved in product purification.

Reference Books:

1. Bailey and Ollis, "**Biochemical Engineering Fundamentals**", 2nd Edition, McGraw Hill, 1986.
2. Shuler, M. L. and Kargi, F.**, "Bioprocess Engineering**", 2nd Edition, Prentice Hall, 2002.
3. Pelczer, "**Microbiology Concept and Application**", 5th Edition, McGraw Hill, 2001 Reprint.
4. Stanbury and Whittaker, "**Principles of Fermentation Technology**", 2nd Edition.

Course Title: Membrane Separation
Course Code: CHL452

L	T	P	Cr	Marks
3	0	0	3	75

Course Objective: The student will learn different membrane separation technological processes and their design

UNIT-A **12HOURS**

Fundamental, mechanisms of membrane transport. Gaseous diffusion. Membrane, osmosis and reverse osmosis, porosity, permeability, salt rejection, different membrane processes.

UNIT-B **12HOURS**

Physical and chemical properties of membranes, cellulosic and non cellulosic membrane

UNIT-C **12HOURS**

Techniques of membrane formation, membrane characteristics, type of membrane modules, liquid membranes.

UNIT-D **12HOURS**

Separation processes : Design, operation, maintenance and industrial applications of different membrane separation processes such as Reverse Osmosis, Ultra filtration, Electro Dialysis, nanofiltration pervaporation dialysis.

Refrences BOOKS :

1. Wilson, Sirkar, "**Membrane Handbook**", McGraw Hill, London, 2001.
2. Nune, Peinemann, "**Membrane Technology in Chemical Industries",** Wiley, New York, 2000.
3. Cheryan M., "**Ultra filtration Handbook**", Technomic, New York, 1985.
4. Noble, Stern, "Membrane **Separation and Technology, Principles and Applications",** Elsevier, 1995.
5. Baker R. W., "**Membrane Technology and Applications**", Wiley, New York, 2000.

Course Title: Polymer Science
Course Code: CHL453

L	T	P	Cr	Marks
3	0	0	3	75

Course Objectives: The student will learn about the different classification of polymer and rubbers and their strength properties

UNIT-A **12 HOURS**

Definition, types of polymers, functionality, polymerization reactions, polycondensation. Addition-free radical and chain polymerization. Co-polymerization kinetics of radical chain and tonic polymerization. Gelation phenomena.

UNIT-B **12 HOURS**

Molecular weight estimation :Average molecular weight, number average and weight average molecular weight. polydispersity, degree of polymerization.Methods of determination of molecular weight.
Polymerization Processes : Bulk, solution, suspension and emulsion polymerization. Thermoplastic composites, fibre reinforcement fillers.

UNIT-C **12 HOURS**

Polymer Processing:Thermoforming, injection moulding, extrusion moulding, calendaring rotational casting, film casting, blow moulding, foaming' Fiber spinning wet dry and melt.

UNIT-D **12 HOURS**

Polymerization Kinetics
Chemistry of step reaction polymerization, Mechanism and kinetics of poly condensation reactions, Relationship between average functionality, extent of reaction and degree of polymerisation. Mechanism and kinetics of free- radical chain polymerization, kinetic chain length, chain transfer reactions, Inhibition and retardation

Refrences BOOKS :

1. Gowarikar, V.R., Viswanathan, Sreedhar ,J., " **Polymer science**", Wiley eastern Limited,1993.
2. Ghosh, P., "**Polymer Science and Technology: Plastics, Rubber, Blends and Composites**" McGrraw Hill , 2010 .
3. Billmeyer, F. W., "**Textbook of polymer science**", John Wiley,1984.

Course Title: Fertilizer Technology
Course Code: CHL454

L	T	P	Cr	Marks
3	0	0	3	75

Course Objective: The main objective of this courts is to study the various manufacturing processes , uses and application of different fertilizer

UNIT-A **12 HOURS**

Micro and macro nutrients fertilizer grades, different types of fertilizer, fertilizer storage and handling. Nitrogenous fertilizers
Synthesis gas: various feed stocks, merits/demerits. Synthesis gas production by stem reforming and partial oxidation, purification methods, shift convertors, carbon dioxide removal systems, final gas purification.

UNIT-B **12 HOURS**

Ammonia synthesis: Different types of reactors, their design considerations and operations. Urea: Physiochemical consideration. Various processes. Calcium ammonium nitrate sulphate, methods of production.

UNIT-C **12 HOURS**

Phosphatic fertilizer: Raw materials, triple super phosphate, phosphoric acid, processes of manufacture and their limitations.

UNIT-D **12 HOURS**

Potash fertilizer: Methods of production of potassium chloride and potassium sulphate. Complex NPK fertilizer: mono and di ammonium phosphates, urea ammonium phosphate, mixed fertilizer, granulation techniques.

Refrences BOOKS:

1. A.V. Slack, "**Chemistry and Technology of fertilizer**", Interscience Publishers ,1966.
2. Dryden C. E., "**Outlines of Chemical Technology**", 2nd Edition, East–West Press Pvt. Ltd., New Delhi, 1999.
3. Austin G. T., "**Shreve's Chemical Process Industries**", 5th Edition, McGraw Hill Book Company, New Delhi, 2012.

COURSE TITLE: **Petrochemical Technology**
COURSE CODE: 455

L	T	P	Cr	Marks
3	0	0	3	75

Course Objective: The students will study about the petroleum industries and the operations that is carried out in them.

UNIT –A **08 HOURS**

An overview

Introduction to petroleum industry, world petroleum resources, petroleum industry in India. Origin, exploration & drilling of petroleum crude. Transportation of crude and products. Sources of petrochemicals-Natural gas and petroleum , classification of petrochemicals.

UNIT –B **12 HOURS**

Crude pretreatment: Refining and distillation of petroleum crude, composition and classification of petroleum crude, methods of evaluation: ASTM, TBP and EFV distillation. Properties and specifications of petroleum products such as LPG, gasoline,naphtha, kerosene, diesel, lubricating oils and waxes.

UNIT –C **12HOURS**

Separation Processes: Design and operation of topping and vacuum distillation units and tube still furnaces. Solvent extraction processes for lube oil base stock and for aromatics from naphtha and kerosene steams, solvent dewaxing

UNIT –D **10 HOURS**

Conversion Processes: Thermal cracking: visbreaking and coking processes, catalytic cracking, thermal reforming and catalytic reforming, alkylation, polymerization, isomerisation and hydroprocessing. Safety and pollution considerations in refineries.

References Books:

1. Rao, B.K. , "**Modern Petroleum Refining Processes"**, 5th Edition, Oxford & IBH Publishing Co., 2009.
2. Nelson, "**Petroleum Refinery Engineering"**, 4th Edition, McGraw Hill, 1987.
3. Guthrie, V.B. ,"**Petroleum Products Handbook",** McGraw Hill, 1960.

Course Title: Corrosion Engineering

Course Code: 456

L	T	P	Cr	Marks
3	0	0	3	75

Course Objective: The main objective of this course is to study the different types of corrosion and their prevention methods.

UNIT –A **12HOURS**

Basic concepts: Definition and importance, Electrochemical nature and forms of corrosion, Corrosion rate and its determination.
Electrochemical thermodynamics and kinetics: Electrode potentials, Potential-pH (Pourbiax) diagrams, Reference electrodes and experimental measurements, Faraday's laws, Electrochemical polarization, Mixed potential theory, Experimental polarization curves, Instrumentation and experimental procedure.

UNIT –B **12HOURS**

Galvanic and concentration cell corrosion: Basic concepts, Experimental measurements, and determination of rates of galvanic corrosion, Concentration cells.
Corrosion measurement through polarization techniques: Tafel extrapolation plots, Polarization resistance method, Instrumental methods and Errors in measurement of polarization resistance, Commercial corrosion probes, Other methods of determining polarization curves.

UNIT –C **12HOURS**

Passivity: Basic concepts of passivity, Properties of passive films, Experimental measurement, Applications of Potentiostatic Anodic Polarization, Anodic protection.
Pitting and crevice corrosion: Basic concepts, Mechanisms of pitting and crevice corrosion, Secondary forms of crevice corrosion, Localized pitting, Metallurgical features and corrosion: Inter-granular corrosion, Weldment corrosion, De-alloying and dezincification.
Environmental induced cracking: Stress corrosion cracking, Corrosion fatigue cracking, Hydrogen induced cracking, Some case studies, Methods of prevention and testing, Erosion, Fretting and Wear.

UNIT–D **12HOURS**

Environmental factors and corrosion: Corrosion in water and Aaqueous Ssolutions, Corrosion in sulphur bearing solutions, Microbiologically induced corrosion, Corrosion in soil, Corrosion of concrete, Corrosion in acidic and alkaline process streams.
Atmospheric and elevated temperature corrosion: Atmospheric corrosion and its prevention, Oxidation at elevated temperatures, Alloying, Oxidising environments.

Prevention and control of corrosion: Cathodic protection, Coatings and inhibitors, Material selection and design.

References Books:

1. Fontana, M.G., "**Corrosion Engineering**, Tata McGraw-Hill , 2005.
2. Jones, D.A., "**Principal and Protection of Corrosion,** Prentice-Hall ,1995.
3. Pierre R. Roberge, "**Corrosion engineering: principles and practice**", McGraw-Hill , 2008.
4. Mantell, C.L., "**Electrochemical Engineering**", McGraw-Hill, New York, 1960.
5. Sastri, V.S., Ghali, E. and Elboujdaïni, M.,"**Corrosion prevention and protection: practical solutions"**, John Wiley and Sons, 2007.

Course Title: Alternate Energy Technology
Course Code: 457

L	T	P	Cr	Marks
3	0	0	3	75

Course Objective: The students will study the non-conventional sources of energy which has higher priority with reference to national needs. It deals with the different non-conventional energy systems such as solar energy, wind energy, energy from biomass and biogas, geothermal energy, energy from oceans, chemical energy sources.

Unit-A **12 HOURS**

Introduction: Energy, Present and future trends of energy consumption, Resources in India and worldwide, Introduction to different non conventional energy sources, Detailed study of following sources with particular reference to India.

Solar energy: Solar radiation and its measurement, Limitation in application of solar energy, Solar collectorstypes and constructional details, Solar water heating, Application of solar energy for residential and industrial heating, Drying, Space cooling, Water desalination, Photovoltaic power generation using silicon cells.

UNIT-B **12 HOURS**

Bio-Fuels: Importance, Combustion, Pyrolysis and other thermo chemical processes for biomass utilizationperformance analysis, Alcoholic fermentation, Anaerobic digestion for biogas production

Wind Power: Principle of energy from wind, Windmill construction, Operational details, Electricity generation, Mechanical power production.

UNIT-C **12 HOURS**

Tidal Power: Introduction, Causes of tides and their energy potential, Enhancement of tides, Power generation from tides and problems, Principles of ocean thermal energy conversion (OTEC) analysis.

Geothermal Energy: Geo thermal wells and other resources dry rock and hot aquifer analysis, Harnessing geothermal energy resources.

UNIT-D **12 HOURS**

Energy Storage and Distribution: Importance, Biochemical, Chemical, Thermal, Electrical storage, Fuel cells, distribution of energy.

Scope and Economics: Calculation of energy cost from renewable, Comparison with conventional fuel driven systems, Calculation of CO reduction, Incremental costs for renewable options.

Reference Books:

1. Rai, G.D., " **Non-Conventional Energy Sources**", Khanna Publishers ,2001.
2. Twiddle, J. Weir, T., "**Renewable Energy Resources**", Cambridge University Press ,1986.
3. Duffie, J. A., Beckman, W. A., "**Solar Engineering of Thermal Processes**", John Wiley ,1980.
4. Sukhatme, S. P., "**Solar Energy: Principles of Thermal Collection and Storage**", Tata McGraw-Hill, 2001.
5. Garg, H.P. and Prakash, J., "**Solar Energy: Fundamentals and Applications**", Tata McGraw-Hill .2001.

Course Title: Nanotechnology
Course Code: 458

L	T	P	Cr	Marks
3	0	0	3	75

Course Objectives: The students will study

1. Applied thermodynamic principles
2. Various methods of producing nanomaterials
3. Methods of analysis
4. Nanolithography and nanomanipulation

Unit-A **12HOURS**

Overview to Thermodynamics: The first and second laws of thermodynamics. Thermodynamic functions, heat capacity, enthalpy, entropy. Phase equilibrium in one component system, real gases, the interactions between gases. Ehrenfest classification of phase transition, the physical liquid surface; surface tension, curved surfaces, capillary action. Theory of Solution and related topics: Liquid mixtures: free energy as a function of composition, ideal solutions and excess functions. Equilibrium Electrochemistry; electrochemical cells, Methods for calculation of thermodynamic equilibrium. Electrochemical processes.

Unit –B **12HOURS**

Fabrication of Nanomaterials by Physical Methods: -Inert gas condensation, Arc discharge, RFplasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition method and Electro deposition.

Unit-C **12HOURS**

Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, X-ray diffraction. Optical Microscope and their description, operational principle and application for analysis of nanomaterials, UV-VIS-IR Spectrophotometers, Principle of operation and application for band gap measurement.

Unit-D **12HOURS**

Nanolithography and nanomanipulation, Ebeam lithography and SEM based nanolithography and nanomanipulation, Ion beam lithography, oxidation and metallization. Mask and its application. Deep UV lithography, X-ray based lithography.

Reference Books:

1. Mark James Jackson, " **Microfabrication and Nanomanufacturing**", CRC Press, 2005
2. Principe, E. L., Gnauck, P. and Hoffrogge, P., "**A Three Beam Approach to TEM Preparation Using In-situ Low Voltage Argon Ion Final Milling in a FIB-SEM Instrument Microscopy and Microanalysis,**" Cambridge University Press, 2005.
3. Shaw, L.L., "**Processing & properties of structural nano materials**", John Wiley and Sons, 2010.
4. Narayanan, K.V., "**Textbook of Chemical Engineering Thermodynamics**"**,** Prentice Hall of India Private Limited, New Delhi, 2001.

Course Title: Business Strategy
Paper Code: MGT451

L	T	P	Cr	Marks
4	0	0	4	100

Course Objective: To develop an understanding of fundamental concepts in strategic management: the role of the general manager, the levels and components of strategy, competitive analysis, and organizational evolution.

Learning Outcomes: The participants will develop essential skills and knowledge peculiar to general management. They will appreciate the inter functional issues in organisation better after undergoing this course.

UNIT-A **11 hours**

Nature of Strategic Management. Dimensions, benefits and risks. The strategic management process, Strategy formulation. Business Vision and Mission, Importance, Characteristics, and Components. Evaluating Mission statements.

UNIT-B **11 hours**

The External Assessment, Porters five Force Analysis. Industry and competitive analysis The Global Environment: Development of a Global Corporation. Complexity of Global Environment , Competitive Strategies for Firms in Global Markets. The Internal Assessment: SWOT Analysis, Strategy and Culture. Value Chain Analysis. Resource Based view of the Firm. Benchmarking. Strategies in Action: The Balanced scorecard, Types of strategies, Integrative, Intensive, Diversification strategies, Defensive Strategies, Porters Generic Strategies.

UNIT-C **11 hours**

Strategy Analysis and Choice: Business level strategies. Cost leadership, Differentiation, Speed and Market Focus. Multi business Strategy: BCG Matrix, GE Nine Cell matrix. Limitations of Portfolio Approaches. The Parenting Framework. Strategy Implementation: Short Term Objectives, Functional Tactics. Empowering Operating personnel. Allocation of Resources, Managing Resource Conflict.

UNIT-D **12 hours**

Structure and Strategy: Improving effectiveness of Traditional Organisational Structures. Creating Agile Virtual Organisations, Modular Organisation. Towards Boundary less Structures. Leadership and Culture: Strategic Intent. Shaping Organisational Culture. Role of Leader in Organisational Culture. Strategy Evaluation :Strategic Evaluation Process

Text Book:

1. Strategic Management: Formulation, Implementation and Control. Pearce, Robinson & Mittal , TATA Mc Graw Hill Special Indian Edition

Reference Books:

1. Strategic Management: Concepts and Cases. Fred David. Prentice Hall India
2. Strategic Management: an Integrated Approach, Hill & Jones. Cengage

Course Title: Principles of Marketing
Paper Code: MGT453

L	T	P	Cr	Marks
4	0	0	4	100

Course Objective: This course will enable the students to understand the theories and practices behind the marketing mix variables, to appreciate the holistic role of marketing in a firm, and develop knowledge of and skill in the operating techniques of the marketing management

Learning Outcomes: Students will be able to design the marketing mix for the customers as per their needs and will learn to create product package which sells itself.

UNIT-A

Understanding Marketing Management: Defining Marketing for the 21st Century, Developing Marketing Strategies and Plans, Assessing Market Opportunities and Customer Value: Scanning the Marketing Environment, Forecasting Demand, and Conducting Marketing Research, Creating Customer Value and Customer Relationships, Analyzing Consumer Markets, Analyzing Business Markets **12 hours**

UNIT-B

Choosing Value: Identifying Market Segments and Targets, Competitive Dynamics, Crafting the Brand Positioning, Creating Brand Equity **10 hours**

UNIT-C

Designing and Delivering Value: Setting Product Strategy, Designing and Managing Services, Developing Pricing Strategies and Programs, Designing and Managing Integrated Marketing Channels, Managing Retailing, Wholesaling, and Logistics **12 hours**

UNIT-D

Communicating Value and Sustaining Growth: Designing and Managing Integrated Marketing Communications, Managing Mass Communications, Managing Personal Communications, Introducing New Market Offerings, Tapping into Global Markets, Managing a Holistic Marketing Organization for the Long Run **11 hours**

Reference Books:

1. Kotler, Keller, Koshy & Jha. Marketing Management: A South Asian Perspective,14th Edition, Pearson Education
2. Saxena, R. Marketing Management, Tata McGraw-Hill Education, 4th Edition
3. Baines, P. Marketing: Asian Edition, Oxford University Press, 1st Edition
4. Czinkota Michael R, Marketing Management, Cengage Learning, 2nd Edition
5. Chopra, P.K. and Mehra, B. Marketing Management, Wiley

Course: MATLAB Programming
Course Code: ELE455

L	T	P	Credits	Marks
4	0	0	4	100

Unit-A

Introduction to MATLAB
Program ming and
Environment

MATLAB Windows, Expressions, Constants, Variables and assignment statement, Arrays

Basic plotting, Built in functions, Generating waveforms, Sound replay, load and save etc.

Unit-B

Procedures and Functions and Control Statements

Arguments and return values, M-files, Functions, Formatted console input-output, String handling, ,Manipulating Text, Writing to a text file, Reading from a text file, Randomising and sorting a list, Searching a list, Attaching buttons to actions, Getting Input, Setting Output, Variables, Data Types, Control Statements: Conditional program flow, Iteration/ Looping, Conditional statements.

Unit-C

Spectral Analysis and Speech Signal Analysis

Filterbank analysis, Fourier analysis, Spectrograms, Filterbank synthesis, Fundamental of Speech Signal, frequency estimation – frequency domain, Fundamental frequency estimation, time domain, Formant frequency estimation

Unit-D

MATLAB Applications

Math and computation – Algorithm development – Modeling, simulation, and prototyping – Data analysis, exploration, and visualization – Scientific and Engineering graphics – Application development, including graphical user interface building, Working with Sound and Images, Reading and Writing files, Recursion, Compression.

Suggested Books:

1. Agam Kumar Tyagi, MATLAB and Simulink for Engineers, Oxford University Press, USA (2012)
2. Stephen J. Chapman, MATLAB Programming for Engineers, Cengage Learning, 2008

Course Title: Robotics and Automation
Course Code: MEC401

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: Students will learn about the basic concepts of automation, about the fluid power, about the robotic, about the robotic sensors, end effectors and its programming.

Part – A

Introduction to Robotic **(4)**

Introduction, terminology, laws of robotics, classification based on geometry, machine vision, robot components, degree of freedom, coordinators, reference frames,

Robot Sensors and End Effectors **(5)**

Types of Sensors in robots, exteroceptors, proprioceptors, tactile, proximity, range, velocity and machine vision sensors, robot end-effectors, classification, gripper, gripper mechanism, type of gripper.

Part – B

Robot Programming **(5)**

Robot programming, techniques of programming, robot languages, requirement for a standard robot language, types of languages.

Industrial applications **(4)**

Applications of robots in welding, machine loading, fabrication, spray painting, assembly and unusual applications.

Part – C

Industrial Automation **(3)**

Basic principles of automation; Hard Automation, Flexible Automation, Low Cost Automation Elements of Automation

Fluid Power Learning Outcomes:

Fluid power control elements, Construction and performance of fluid power generators; Hydraulic and pneumatic cylinders - construction, design and mounting; Hydraulic and pneumatic valves for pressure, flow and direction control.

Part – D **(5)**

Logic Circuits

Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations

Fluidics **(4)**

Boolean algebra; Truth tables; Conda effect; Fluidic elements – their construction working and performance characteristics

Reference Books:

1. SR, Deb. *Robotics and Flexible Automation.* Tata McGraw-Hill Publishing Company Ltd., New Delhi.

2. SR, Majumdar. *Pneumatic Control.* Tata McGraw-Hill Publishing Company Ltd., New Delhi.

3. CR, Asfahl. *Robotics and Manufacturing Automation.* Wiley India.

Course Title: Software Engineering
Course Code: CSE352

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To understand the basic concepts of software engineering and software development life cycle.

Learning Outcomes: Students will learn about the different activities of software development and about the risk management. They will get aware about the different case tools.

PART – A

Introduction to Software Engineering:
Software Problem, Software Engineering, Approach, Software process, Characteristics of Software Engineering Process.

Process models:
The waterfall model, Incremental process models, Evolutionary process models, The Unified process.

Software Requirements:
Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

(12Hours)

PART – B

Planning:
Cost estimation, cost estimation models, Project scheduling, Software Configuration management, Team Structure, Risk Management.

Requirements engineering process:
Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models:
Context Models, Behavioural models, Data models, Object models, structured methods.

Software Design:
Design process and Design quality, Design concepts, the design model.

(12Hours)

PART – C

Creating an architectural design:
Software architecture, Data design, Architectural styles and patterns, Architectural Design.

Object-Oriented Design:
Objects and object classes, An Object-Oriented design process, Design evolution.

Performing User interface design:
Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

Testing Strategies:
A strategic approach to software testing, teststrategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.

Product metrics:
Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

(12Hours)

PART – D

Risk management:

Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management:

Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

(12Hours)

REFERENCES:-

1. Software Engineering- K.K. Agarwal &Yogesh Singh, New Age International Publishers
2. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, John Wiely.
3. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.
4. Software Engineering Approach, By R. S Pressman
5. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGrawHill International Edition.
6. Software Engineering- Sommerville, 7th edition, Pearson education.
7. An Integrated Approach to software Engineering. Pankaj Jalote