

Chemical Engineering



DEPARTMENT OF CHEMICAL ENGINEERING

**B.TECH. PROGRAMME IN CHEMICAL
ENGINEERING**

July, 2018

PART I: COURSE STRUCTURE

1st Year 1st Semester (Semester 1)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	PHYS 1001	Physics I	3	1	0	4	4
02	MATH 1101	Mathematics - I	3	1	0	4	4
03	CSEN 1001	Programming for Problem Solving	3	0	0	3	3
Total Theory							11
LABORATORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	PHYS 1051	Physics I lab	0	0	3	3	1.5
02	MECH 1051	Workshop/Manufacturing Practises	1	0	4	5	3
03	CSEN 1051	Programming for Problem Solving Lab	0	0	4	4	2
Total Practical							6.5
Semester Total							17.5

1st Year 2nd Semester (Semester 2)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	MATH 1201	Mathematics-II	3	1	0	4	4
02	CHEM 1001	Chemistry - I	3	1	0	4	4
03	ELEC 1001	Basic Electrical Engineering	3	1	0	4	4
04	HMTS 1201	Business English	2	0	0	2	2
Total Theory							14
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEM 1051	Chemistry lab	0	0	3	3	1.5
02	HMTS-1251	Language Lab	0	0	2	2	1
03	MECH 1052	Engineering Drawing & Design	1	0	4	5	3
04	ELEC 1051	Basic Electrical Engineering Lab	0	0	2	2	1
Total Practical							6.5
Semester Total							20.5

2nd Year 1st Semester (Semester 3)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 2101	Particle & Fluid Particle Processing	3	0	0	3	3
02	CHEN 2102	Fluid Mechanics	3	1	0	4	4
03	CHEN 2103	Material & Energy Balance Computation	3	1	0	4	4
04	MECH 2101	Engineering & Solid Mechanics	3	1	0	4	4
05	MECH 2102	Thermodynamics - I	3	1	0	4	4
Total Theory							19
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 2151	Fluid Mechanics Lab	0	0	4	4	2
Total Practical							2
Semester Total							21

2nd Year 2nd Semester (Semester 4)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 2201	Heat Transfer	3	0	0	3	3
02	CHEN 2202	Mass Transfer I	3	0	0	3	3
03	CHEN 2203	Thermodynamics II	3	1	0	4	4
04	CHEM 2201	Chemistry II	3	0	0	3	3
05	MECH 2201	Material Science	3	0	0	3	3
06	HMTS- 2001	Human Values And Professional Ethics	3	0	0	3	3
07	EVSC 2216	Environmental Science					0
Total Theory							19
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 2251	Heat Transfer lab	0	0	4	4	2
02	CHEN 2252	Particle and Fluid Particle Processing lab	0	0	4	4	2
Total Practical							4
Semester Total							23

3rd Year 1st Semester (Semester 5)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 3101	Chemical Process Technology	3	0	0	3	3
02	CHEN 3102	Chemical Reaction Engineering - I	3	0	0	3	3
03	CHEN 3103	Mass Transfer II	3	0	0	3	3
04	CHEN 3104	Numerical Methods in Chemical Engineering	3	0	0	3	3
05	CHEN 3141- 3143	Professional Elective-I	3	0	0	3	3
06	CHEN 3144- 3146	Professional Elective-II	3	0	0	3	3
Total Theory							18
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 3151	Mass Transfer laboratory	0	0	4	4	2
02	CHEN 3152	Chemical Reaction Engineering Laboratory	0	0	4	4	2
Total Practical							4
Semester Total							22

Professional Elective- I	CHEN 3141	CHEN 3142	CHEN 3143
Subject name	Reactor Design	Polymer Science	<u>Energy Engineering</u>
Professional Elective – II	CHEN 3144	CHEN 3145	CHEN 3146
Subject name	Bioprocess Engineering	<u>Industrial Safety and Hazards Analysis</u>	Advanced Numerical Methods

3rd Year 2nd Semester (Semester 6)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 3201	Process Control and Instrumentation	3	0	0	3	3
02	CHEN 3202	Transport Phenomena	3	0	0	3	3
03	CHEN 3241- 3243	Professional Elective-III	3	0	0	3	3
04		Open Elective I	3	0	0	3	3
05	HMTS 3201	Economics for Engineers	3	0	0	3	3
06	INCO 3016	Indian Constitution					0
Total Theory							15
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 3251	Process Control Lab	0	0	4	4	2
02	CHEN 3252	Numerical Computations Laboratory	0	0	4	4	2
03	CHEN 3293	Term Paper & Technical Seminar	0	0	4	4	2
Total Practical							6
Semester Total							21

Professional Elective – III	CHEN 3241	CHEN 3242	CHEN 3243
Subject name	Computational Fluid Dynamics	Advanced Separation Process	Nanotechnology

4th Year 1st Semester (Semester 7)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 4131- 4133	Professional Elective IV	3	0	0	3	3
02	HMTS 4101	Principles of Management	3	0	0	3	3
03		Open Elective-II	3	0	0	3	3
04		Open Elective-III	3	0	0	3	3
Total Theory							12
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 4195	Project –I	0	0	0	8	4
02	CHEN 4191	Industrial Training					2
Total Practical							6
Semester Total							18

Professional Elective – IV	CHEN 4131	CHEN 4132	CHEN 4133
Subject name	Project Engineering	Petrochemicals Technology	Waste Management and Pollution Control

4th Year 2nd Semester (Semester 8)

THEORY							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 4231-4233	Professional Elective V	3	0	0	3	3
02		Open Elective-IV	3	0	0	3	3
Total Theory							6
LABORATORY/SESSIONAL							
S.No	Code	Course Title	L	T	P	H	Credit
01	CHEN 4295	Project –II	0	0	0	12	8
02	CHEN 4251	Design & Simulation Lab	0	0	4	4	2
03	CHEN 4297	Grand Viva					1
Total Practical							11
Semester Total							17

Professional Elective – V	CHEN 4231	CHEN 4232	CHEN 4233
Subject name	<u>Process Simulation</u>	Statistical Design of Experiments	Optimization in Chemical Engineering

Open Electives to be offered by Chemical Engineering Department for Non-departmental Students		
Semester VI Open Elective I	Materials for Engineering Applications (CHEN 3221)	Industrial Safety and Hazards (CHEN 3222)
Semester VII Open Elective II	Industrial Total Quality Management (CHEN 4121)	Industrial Pollution Control (CHEN 4122)
Semester VII Open Elective III	Statistical Methods in Design of Experiments (CHEN 4123)	Reactor Design (CHEN 4124)
Semester VIII Open Elective IV	Nanotechnology(CHEN 4221)	Introduction to Solar and Wind Technology(CHEN 4222)

Honours Courses for B.Tech Chemical Engineering Students			Contact Hours / Week			Credit
Sem. No.	Code	Course Title	L	T	P	
1 st	HMTS1011	Communication For Professionals	3	0	0	3
	HMTS1061	Professional Communication Lab	0	0	2	1
2 nd	ECEN1011	Basic Electronics	3	0	0	3
	ECEN1061	Basic Electronics Engineering Lab	0	0	2	1
3 rd	PHYS 2111	Physics II	3	0	0	4
5 th	CHEN111	Chemical Reaction Engineering II	3	0	0	4
7 th	CHEN4111	Industrial Process Control & Instrumentation	3	0	0	4

Division of Credits according to Categories	AICTE Recommended	HIT CHE Credit
Basic Sciences	27	22
Engineering Sciences	27	27
Humanities	12	12
Professional Core	55	55
Professional Elective	12	15
Open Elective	12	12
Seminar, Project, Internship etc.	12	17
Total	157	160

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

- ü A total of 160 credits will be necessary for a student to be eligible to get B Tech degree.
- ü A student will be eligible to get B Tech degree with Honours if he/she completes an additional 20 credits. These could be acquired through various Honours Courses offered by the respective departments.
- ü A part or all of the above additional credits may also be acquired through MOOCs. Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.
- ü For any additional information, the student may contact the concerned HODs.

PART II: DETAILED SYLLABUS

1st Year 1st Semester(Semester1)

THEORY

Subject Name: Physics I					
Paper Code: PHYS1001					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. To develop basic understanding of the modern science to the technology related domain.
2. Analytical & logical skill development through solving problems.
3. To impart idea of concise notation for presenting equations arising from mathematical formulation of physical as well as geometrical problems percolating ability of forming mental pictures of them.
4. Imparting the essence and developing the knowledge of controlling distant object like satellite, data transfer through optical fiber, implication of laser technology, handling materials in terms of their electrical and magnetic properties etc.

Module 1 [12L]**Mechanics:**

Elementary concepts of grad, divergence and curl. Potential energy function; $F = -\text{grad } V$, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, Curl of a force field; Central forces ; conservation of angular momentum; Energy equation and energy diagrams; elliptical, parabolic and hyperbolic orbit; Kepler Problem; Application : Satellite manoeuvres .

Non-inertial frames of reference; rotating coordinate system; five term acceleration formula- centripetal and coriolis accelerations; applications: Weather system, Foucault pendulum.

Module II [12 L]**Optics:****Oscillatory Motion:**

Damped harmonic motion – Over damped, critically damped and lightly damped oscillators; Forced oscillation and resonance. Electrical equivalent of mechanical oscillator, Wave equation, plane wave solution.

Optics:

Elementary features of polarization of light waves. Double refraction, Production and analysis of linearly, elliptic and Circularly polarized light, Polaroid and application of polarizations.: Polarimeter.

Laser & Fiber Optics:

Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Fiber optics - principle of operation, numerical aperture, acceptance angle, Single mode , graded indexed fiber.

Module III [12 L]

Electrostatics:

Electrostatics in free space

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplace's and Poisson's equation for electrostatic potential. Boundary conditions of electric field and electrostatic potential. Method of images, energy of a charge distribution and its expression in terms of electric field.

Electrostatics in a linear dielectric medium

Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, Boundary conditions on displacement, Solving simple electrostatic problem in presence of dielectric – point charge at the centre of a dielectric sphere, charge in front of dielectric slab, Dielectric slab and dielectric sphere in uniform electric field.

Module IV [12L]

Magnetostatics :

Biot-Savart law, divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; equation for vector potential and its solutions for given current densities.

Magnetostatics in a linear magnetic medium:

Magnetization and associated bound currents; Auxiliary magnetic field \vec{H} ; boundary conditions on \vec{B} and \vec{H} . Solving for magnetic field due to simple magnet like a bar magnet; Magnetic susceptibility; ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Faraday's Law:

Differential form of Faraday's law expressing curl of electric field in terms of time derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi static approximation. Energy stored in a magnetic field.

Books of reference :

1. Optics – Eugene Hecht Pearson Education India Private Limited.
2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited.
3. Waves and Oscillations by N.K. Bajaj.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley.
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press.
6. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education.
7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education.
8. Optics, Ghatak, McGraw Hill Education India Private Limited.
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora.

Subject Name: Mathematics I					
Paper Code: MATH 1101					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply the notion of matrices for solving a system of linear simultaneous equations and some basic concepts of linear algebra in a comprehensive manner.
2. To test the convergence of an infinite series
3. Some analytical techniques to solve ordinary differential equations that model physical processes.
4. The concept of differentiation and integration for functions of several variables and some of their applications in Vector Calculus.

Module I [10L]**Matrix:**

Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II [10 L]**Vector Calculus:**

Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics.

Infinite Series:

Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test (statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III [10 L]**First order ordinary differential equations:**

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders:

General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV [10L]

Calculus of functions of several variables:

Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables.

Multiple Integration:

Concept of line integrals, Double and triple integrals. Green's Theorem, Stokes Theorem and Gauss Divergence Theorem.

Books of reference :

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
8. Vector Analysis(Schaum's outline series): M.R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education).
9. Engineering Mathematics: S. S. Sastry (PHI).
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education).

Subject Name: Programming for Problem Solving					
Paper Code: CSEN 1001					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

On completion of this course, students are expected to be capable of solving problems using mathematics and generalize those solutions into flowcharts to form programs. This course is directed towards teaching the students, how to automate those solutions by implementing them in C programming language. It is expected that due to the use of C programming language, the students will learn the basics of how a high-level language works in tandem with memory. The students should be able to identify coding inefficiencies and errors in C code and turn those programs into efficient ones and remove programming bugs, primarily with manual inspection and later with the use of debuggers.

Learning Objectives:

Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Module I [10L]**Fundamentals of Computer:**

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX

How to write algorithms & draw flow charts.

Module II [10L]**Basic Concepts of C:****C Fundamentals:**

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of

evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III [10L]

Program Structures in C:

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables.

C preprocessor (macro, header files), command line arguments.

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality. String and character arrays; C library string functions and their use.

Module IV [9L]

Data Handling in C:

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell().

Text Books:

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Books of reference:

1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

Subject Name: Communication for Professionals					
Paper Code: HMTS 1011					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

Students will be able to

1. Write business letters and reports
2. Communicate in an official and formal environment.
3. Effectively use the various channels of communication at work place.
4. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.

Module I**Introduction to Linguistics:**

- Introduction to Linguistics.
- Phonetics- Vowel and Consonant Sounds (Identification & Articulation).
- Word- stress, stress in connected speech.
- Intonation (Falling and Rising Tone).
- Voice Modulation.
- Accent Training.
- Vocabulary Building.
- The concept of Word Formation.
- Root words from foreign languages and their use in English.
- Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- Synonyms, Antonyms and standard abbreviations.

Module II**Communication Skills:**

- Definition, nature & attributes of Communication.
- Process of Communication.
- Models or Theories of Communication.
- Types of Communication.
- Levels or Channels of Communication.
- Barriers to Communication.

Module III

Professional Writing Skills:

- Letter Writing : Importance, Types , Process, Form and Structure, Style and Tone.
- Proposal Writing: Purpose,Types of Proposals, Structure of Formal Proposals.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies.

Module IV

Communication skills at Workplace:

- Communication and its role in the workplace.
- Benefits of effective communication in the workplace.
- Common obstacles to effective communication.
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections.
- Identify common audiences and design techniques for communicating with each audience.

Books of reference :

- 1 Kumar,S. &Lata, P. Communication Skills, OUP, New Delhi2011.
- 2 Rizvi,Ashraf,M. Effective Technical Communication, Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018.
- 3 Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

LABORATORY

Subject Name: Physics-I lab					
Paper Code: PHYS 1051					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcomes:

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
5. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Minimum of six experiments taking at least one from each of the following four groups :

Group 1 : Experiments in General Properties of matter

1. Determination of Young's modulus by Flexure Method.
2. Determination of bending moment and shear force of a rectangular beam of uniform cross- section.
3. Determination of modulus of rigidity of the material of a rod by static method.
4. Determination of rigidity modulus of the material of a wire by dynamic method.
5. Determination of coefficient of viscosity by Poiseulle's capillary flow method.

Group 2: Experiments in Optics

1. Determination of dispersive power of the material of a prism.
2. Determination of wavelength of light by Newton's ring method.
3. Determination of wavelength of light by Fresnel's biprism method.
4. Determination of the wavelength of a given laser source by diffraction method.

Group 3: Electricity & Magnetism experiments

1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
3. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
4. Determination of specific charge (e/m) of electron.

Group 4: Quantum Physics Experiments

1. Determination of Planck's constant.
2. Determination of Stefan's radiation constant.

3. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
4. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum.
5. Determination of Hall co-efficient of semiconductors.
6. Determination of band gap of semiconductors.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Books of reference :

1. Optics – Eugene Hecht Pearson Education India Private Limited.
2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited.
3. Waves and Oscillations by N.K. Bajaj.
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley.
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press.
6. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education.
7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education.
8. Optics, Ghatak, McGraw Hill Education India Private Limited.
9. Refresher Course in B.Sc. Physics – Voll and Vol 2 – C.L.Arora.

Subject Name: Workshop/Manufacturing Practices					
Paper Code: MECH 1051					
Contact Hours Per Week	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcomes:

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Lectures & videos:**Detailed contents**

1. Introduction on Workshop and Safety Precautions.
2. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods.
3. CNC machining, Additive manufacturing.
4. Fitting operations & power tools.
5. Electrical & Electronics.
6. Carpentry.
7. Plastic molding, glass cutting.
8. Metal casting.
9. Welding (arc welding & gas welding), brazing.
10. Viva-voce.

Books of reference :

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Subject Name: Programming for Problem Solving Lab					
Paper Code: CSEN 1051					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course outcome:

After completion of this course the students should be able:

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX

NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors

Topic 2: Basic Problem Solving

Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)

Topic 4: Loops - Part I (for, while, do-while)

Topic 5: Loops - Part II

Topic 6: One Dimensional Array

Topic 7: Array of Arrays

Topic 8: Character Arrays/ Strings

Topic 9: Basics of C Functions

Topic 10: Recursive Functions

Topic 11: Pointers

Topic 12: Structures

Topic 13: File Handling

Text Books:

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Subject Name: Professional Communication Lab					
Paper Code: HMTS 1061					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

Students will be skilled in the following areas:

1. Using English to communicate.
2. Learn to articulate opinions and views in a comprehensive manner.
3. Gain knowledge of phonetics and learn correct pronunciation.
4. Prepare and present formal presentations.

Module I :

Techniques for Effective Speaking.

Voice Modulation: Developing correct tone.

Using correct stress patterns: word stress, primary stress, secondary stress

Rhythm in connected speech.

Module II :

Effective Speaking and Social awareness

The Art of Speaking

- Encoding Meaning Using Nonverbal Symbols.
- How to Improve Body Language.
- Eye Communication, Facial Expression, Dress and Appearance.
- Posture and Movement, Gesture, Paralanguage.
- Encoding meaning using Verbal symbols: How words work and how to use words.
- Volume, Pace, Pitch and Pause.
- Cross-Cultural Communication : Multiple aspects/dimensions of culture.
- Challenges of cross-cultural communication.
- Improving cross-cultural communication skills at workplace.

Module III :

Group Discussion: Nature and purpose

- Group Discussion:Nature and purpose.
- Characteristics of a successful Group Discussion.
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure.

Module IV :

Professional Presentation Skills

Nature and Importance of Presentation skills.

Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.

Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides.

Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, provide closure.

Improving Delivery: Choosing Delivery methods, handling stage fright

Post-Presentation discussion: Handling Questions-opportunities and challenges.

Books of reference :

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001.
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004.
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999.
4. R. Anand, Job Readiness For IT & ITES- A Placement and Career Companion, , McGraw Hill Education.2015.
5. Malhotra, A.,Campus Placements, McGraw Hill Education.2015.

1st Year 2nd Semester (Semester 2)

THEORY

Subject Name: Mathematics- II					
Paper Code: MATH 1201					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

The objective of this course is to familiarize the students with numerical techniques, integral transforms, graph theory and probability. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

The students will learn:

1. The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
2. Numerical techniques to solve problems which in general have no analytic solution.
3. To apply techniques of integral transforms for advanced engineering problems.
4. To represent certain physical problems as graphs and find out the shortest path between two vertices.

Module I [10 L]**Fundamentals of Probability:**

- Random experiment, Sample space and events.
- Classical and Axiomatic definition of probability.
- Addition and Multiplication law of probability.
- Conditional probability.
- Bayes' Theorem.
- Random variables.
- General discussion on discrete and continuous distributions.
- Expectation and Variance.
- Examples of special distribution: Binomial and Normal Distribution.

Module II [10L]**Basic Numerical Methods:**

- Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method.
- Solution of linear system of equations: Gauss elimination method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method.
- Solution of Ordinary differential equations: Euler's and Modified Euler's Method , Runge-Kutta Method of 4th order.

Module III [10L]

Basic Graph Theory:

- Graphs: Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub graph.
- Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices.
- Matrix representation of a graph, Adjacency and incidence matrices of a graph.
- Graph isomorphism.
- Bipartite graph.
- Definition and properties of a tree.
- Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees.
- Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms.

Module IV [10L]

Laplace Transformation:

- Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations.
- Introduction to integral transformation.
- Functions of exponential order, Definition and existence of Laplace Transform(LT) (statement of initial and final value theorem only).
- LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT.
- LT of periodic and step functions.
- Definition and properties of inverse LT.
- Convolution Theorem (statement only) and its application to the evaluation of inverse LT.
- Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Books of reference :

1. Advanced Engineering Mathematics , E.Kreyszig, Wiley Publications.
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier.
3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning.
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India.
5. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

Subject Name: Chemistry 1					
Paper Code: CHEM 1001					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

The subject code CHEM1001 corresponds to chemistry theory classes for the first year B. Tech students, which is offered as Engineering Chemistry and is common for all branches of engineering subjects. The course provides basic knowledge of theory based subjects like quantum mechanics, thermodynamics, reaction dynamics, electrochemistry, structure and reactivity of molecules. The course outcomes of the subject are

1. Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.
2. An ability to design and conduct experiments, as well as to organize, analyzes, and interprets data.
3. An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.for engineering applications.
4. Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.
5. Understanding of bulk properties and processes using thermodynamic considerations.
6. Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.
7. Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

MODULE 1 [10L]**Atomic structure and Wave Mechanics:**

Brief outline of the atomic structure, Dual character of electron, De Broglies's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ , concept of atomic orbital.

Thermodynamics:

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, Clausius Clapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation.

Spectroscopic Techniques & Application:

Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation.

Principle and application of UV- visible and IR spectroscopy

Principles of NMR Spectroscopy and X-ray diffraction technique.

MODULE II [10L]

Chemical Bonding:

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. Theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi-molecular orbitals of ethylene and butadiene.

Periodicity:

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect.

Ionic Equilibria:

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation .

MODULE III [10L]

Conductance:

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Application of conductance Acid-base and precipitation titration.

Electrochemical Cell:

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion.

Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells.

Reaction dynamics:

Rate Laws, Order & Molecularity; zero, first and second order kinetics. Pseudo-unimolecular reaction, Arrhenius equation.

Mechanism and theories of reaction rates (Transition state theory, Collision theory).

Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).

MODULE IV [10L]

Stereochemistry:

Representations of 3- dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

Structure and reactivity of Organic molecule:

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity.

Organic reactions and synthesis of drug molecule:

Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation-reduction reactions. Synthesis of commonly used drug molecules.

Text Books:

1. Atkins' Physical Chemistry, P.W. Atkins (10th Edition).
2. Organic Chemistry, I. L. Finar, Vol-1 (6th Edition).
3. Engineering Chemistry, Jain & Jain, (16th Edition).
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2nd Edition).
5. Engineering Chemistry -I, Gourkrishna Dasmohapatra, (3rd Edition).

Books of reference:

1. General & Inorganic Chemistry, R. P. Sarkar.
2. Physical Chemistry, P. C. Rakshit, (7th Edition).
3. Organic Chemistry, Morrison & Boyd, (7th Edition).
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4th Edition).
5. Physical Chemistry, G. W. Castellan, (3rd Edition).
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1st Edition).

Subject Name: Basic Electrical Engineering					
Paper Code: ELEC 1001					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

After attending the course, the students will be able to

1. Study and analyze the basic concept of DC and AC electric circuits.
2. Understand and analyze the concept of basic magnetic circuits.
3. Study the working principles of different electrical machines.

Module-I [11L]**DC Network Theorem:**

Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star-Delta conversion.

Electromagnetism:

Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet.

Module II [10L]**AC single phase system:**

Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit.

Module-III [11L]**Three phase system:**

Generation of three-phase AC power, Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method.

DC Machines:

Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor.

Module-IV [10L]**Transformer:**

Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency, Introduction to three phase transformer.

Three-phase induction motor:

Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics.

Text Books :

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition.
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition.
3. Basic Electrical Engineering, Hughes.
4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication.
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company.

Books of reference :

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall.
2. Advance Electrical Technology, H.Cotton, Reem Publication.
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers.
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai.
5. Basic Electrical Engineering, Nath & Chakraborti.
6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Subject Name: Business English					
Paper Code: HMTS 1201					
Contact Hours Per Week	L	T	P	Total	Credit Points
	2	0	0	2	2

Course Outcomes:

The learner will

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.

Module I

Grammar (Identifying Common Errors in Writing)

- Subject-verb agreement.
- Noun-pronoun agreement.
- Misplaced Modifiers.
- Articles.
- Prepositions.
- Redundancies.

Module- II

Basic Writing Strategies

Sentence Structures

- Use of phrases and clauses in sentences.
- Creating coherence.
- Organizing principles –accuracy, clarity, brevity.
- Techniques for writing precisely.
- Different styles of writing: descriptive,narrative, expository.
- Importance of proper punctuation.

Module III

Business Communication- Scope & Importance

Writing Formal Business Letters:Form and Structure-Parts of a Business letter, Business Letter Formats, Style and Tone, Writing strategies.

Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular

Organizing e-mail messages, E-mail etiquette.

Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of well-written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section,

Middle Section, Closing Section.

Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination of Chronological and Functional Resume, Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References.

Module IV

Writing skills

- Comprehension: Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage – practice.
- Paragraph Writing: Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/developing a paragraph.
- Précis: The Art of Condensation-some working principles and strategies. Practice sessions of writing précis of given passages.
- Essay Writing: Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays.

Books of reference :

1. Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.
4. Kalia, S. & Agarwal, S. Business Communication, Wiley India Pvt. Ltd., New Delhi, 2015
5. Mukherjee, H.S., Business Communication- Connecting at work., , Oxford University Press. 2nd Edition. 2015.
6. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

Subject Name: Basic Electronics					
Paper Code: ECEN 1011					
Contact Hours Per Week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

1. The students will learn the conduction phenomenon in materials and importance of p-and n-type conductors, AC to Dc conversion.
2. They will have knowledge of BJT and its use.
3. Students will be able to explain FET, MOS operation, IC fabrication basics.
4. They will learn about the Op-AMP, feedback and some special devices.

Module I [10 L]**Basic Semiconductor Physics:**

Crystalline materials, Energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi Energy level, intrinsic and extrinsic semiconductors, drift and diffusion currents in semiconductor.

Diodes and Diode Circuits:

Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application.

Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

Module II [8 L]**Bipolar Junction Transistors (BJT):**

PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB & CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation, current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

Module III [9 L]**Field Effect Transistors (FET):**

n-channel Junction Field Effect Transistor (JFET) structure & V-I characteristics.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.

MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.

Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI),

Classification of Integrated circuits (IC) and their applications.

Module IV [9 L]

Feedback in amplifiers :

Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier:

Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices:

Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

Books of reference :

1. Boylestad & Nashelsky: Electronic Devices & Circuit Theory.
2. R.A Gayakwad: Op Amps and Linear IC's, PHI.
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications.
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering.
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

LABORATORY

Subject Name: Chemistry I Lab					
Paper Code: CHEM 1051					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcomes:

The subject code CHEM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratory equipments. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field. The course outcomes of the subject are

1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.
2. Estimation of ions like Fe^{2+} , Cu^{2+} and Cl^- present in water sample to know the composition of industrial water.
3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.
4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.
5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.
6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

List of Experiments:

1. Estimation of iron using KMnO_4 : self indicator.
2. Iodometric estimation of Cu^{2+} .
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
12. Determination of chloride ion in a given water sample by Argentometric method (using

chromate indicator solution).

Books of reference :

1. Vogel's Textbook of Quantitative Chemical Analysis-G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney.
2. Advanced Practical Chemistry- S. C. Das
3. Practicals in Physical Chemistry- P. S. Sindhu

Subject Name: Language lab					
Paper Code: HMTS 1251					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

The learner will

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.

Module I

Listening Skills

- Principles of Listening: Characteristics, Stages.
- Types of Listening: Passive listening, Marginal or superficial listening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.
- Guidelines for Effective Listening.
- Barriers to Effective Listening.
- Listening Comprehension.

Module II

- Interviewing
Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module III

- Public Speaking: The Speech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.
- Characteristics of a good speech : content and delivery, structure of a speech
- Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.
- Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
- Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation.

Module IV

Presentation Skills

- Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation.
- Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
- Project Team/Group Presentations.

Books of reference :

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001.
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004.
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999.
4. Sen, S.,Mahendra,A. &Patnaik,P.,Communication and Language Skills, Cambridge University Press, 2015.
5. Locker,Kitty O. Business and Administrative Communication McGraw-Hill/ Irwin.
6. Chaney,L.andMartin,J., Intercultural Business Communication. Prentice Hall.

Subject Name: Engineering Drawing & Design					
Paper Code: MECH 1052					
Contact Hours Per Week	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcomes:

After going through the course, the students will be able

1. To understand the meaning of engineering drawing.
2. To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
3. To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
4. To read and understand projection drawings.
5. To use engineering drawing software (CAD).

Lecture Plan [13 L]

1. Importance and principles of engineering drawing .
2. Concepts of lettering, dimensioning and Scale .
3. Conic sections .
4. Orthographic projection .
5. Definitions of different solids and their projections .
6. Section of solids and sectional view .
7. Isometric projection .
8. Introduction to CAD .
9. Viva Voci .

Module 1**Introduction to Engineering Drawing covering:**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

Module II**Orthographic Projections covering:**

Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina.

Module III**Projections of Regular Solids covering:**

Those inclined to both the Planes- Auxiliary Views.

Module IV

Sections and Sectional Views of Right Angular Solids covering:

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

Module V

Isometric Projections covering:

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Module VI

Overview of Computer Graphics covering:

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

Module VII

Customisation & CAD Drawing:

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Module VIII

Annotations, layering & other functions covering:

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

Module IX

Demonstration of a simple team design project that illustrates:

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

Books of reference:

1. Bhatt, N.D., Panchal V.M. & Ingle P.R., (2014) “Elementary Engineering Drawing”; Charotan Publishing House.
2. Narayana, k.L. and Kannaaiah P “Engineering Graphics”; TMH.
3. Lakshminarayanan, V. and Vaish Wanar, R.s “Engineering Graphics” Jain Brothers.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
5. Agarwal B. & Agarwal C. M. (2012), Engineering graphics, TMH Publications.

Subject Name: Basic Electrical Engineering Lab					
Paper Code: ELEC 1051					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

The students are expected to

1. Get an exposure to common electrical apparatus and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the application of common electrical measuring instruments.
4. Understand the basic characteristics of different electrical machines.

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

Subject Name: Basic Electronics Engineering Lab					
Paper Code: ECEN 1061					
Contact Hours Per Week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

1. The students will correlate theory with diode behavior.
2. They will design and check rectifier operation with regulation etc.
3. Students will design different modes with BJT and FET and check the operations.
4. They will design and study adder, integrator etc. with OP-AMPS.

List of Experiments (from)

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.