

**BIRLA INSTITUTE OF TECHNOLOGY- MESRA, RANCHI**  
**NEW COURSE STRUCTURE - To be effective from B.Tech 2021-22**  
*Based on CBCS system & OBE model*

***(BTech- Chemical Engineering)***

S.No	Semester of Study (Recommended)	Category of course	Course Code (TBD) XX100x	Subjects	Mode of delivery & credits <i>L-Lecture; T-Tutorial; P-Practicals</i>			Total Credits <i>C- Credits</i>	
					L <i>(Periods/week)</i>	T <i>(Periods/week)</i>	P <i>(Periods/week)</i>	C	
<b>THEORY</b>									
I.1	<b>FIRST</b>	<b>FS</b> <i>Foundation Sciences</i>	MA103	Mathematics - I	3	1	0	4	
I.2			PH113	Physics	3	1	0	4	
I.3			BE101	Biological Sciences	2	0	0	2	
I.4		<b>GE</b> <i>General Engineering</i>	EE101	Basic of Electrical Engineering	3	1	0	4	
I.5			CS101	Programming for Problem Solving	3	1	0	4	
<b>LABORATORIES</b>									
I.6		<b>FS &amp; GE</b>	PH114	Physics Lab	0	0	3	1.5	
I.7			CS102	Programming for Problem Solving Lab	0	0	3	1.5	
I.8			PE101	Workshop Practice	0	0	3	1.5	
I.9		<b>MC</b> <b>Mandatory Course</b>	MC101/102/103/104	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1	
<b>TOTAL (Theory + Labs)</b>								<b>23.5</b>	

<b>THEORY</b>								
II.1	<b>SECOND</b>	<b>FS</b>	MA107	Mathematics - II	3	1	0	4
			CH101	Chemistry	3	1	0	4
II.2		<b>MC</b>	CE101	Environmental Sciences	2	0	0	2
II.3		<b>GE</b>	ME101	Basics of Mechanical Engineering	3	1	0	4
II.4			EC101	Basics of Electronics and Communication Engineering	3	1	0	4
		<b>LABORATORIES</b>						
II.6		<b>FS</b>	CH102	Chemistry Lab	0	0	3	1.5
II.7		<b>GE</b>	EC102	Electronics and Communication Lab	0	0	3	1.5
II.8			ME102	Engineering Graphics	0	0	4	2
II.9		<b>MC</b>	MC105/106/107/108	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
<b>TOTAL (Theory + Labs)</b>							<b>24</b>	
<b>GRAND TOTAL FOR FIRST YEAR</b>							<b>47.5</b>	

FIRST SEMESTER

## COURSE INFORMATION SHEET

Course code: MA 103  
 Course title: Mathematics - I  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 1  
 Branch: Chemical Engineering

### Syllabus

Module	Hours
Module –I Sequences and Series: Sequences, Convergence of Sequence. Series, Convergence of Series, Tests for Convergence: Comparison tests, Ratio test, Cauchy's root test, Raabe's test, Gauss test, Cauchy's Integral test, Alternating series, Leibnitz test, Absolute and Conditional Convergence.	9
Module –II Rank of a Matrix, elementary transformations, Row - reduced Echelon form. Vectors, Linear Independence and Dependence of Vectors. Consistency of system of linear equations. Eigenvalues, Eigenvectors, Cayley - Hamilton theorem.	9
Module –III Function of several variables, Limit, Continuity, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Chain rules, Jacobians and its properties, Taylor series for function of two variables, Maxima – Minima, Lagrange's method of multipliers.	9
Module –IV Beta and Gamma functions: definition and properties. Double integrals, double integrals in polar coordinates, Change of order of integration, Triple Integrals, cylindrical and spherical coordinate systems, transformation of coordinates, Applications of double and triple integrals in areas and volumes.	9
Module –V Scalar and vector point functions, gradient, directional derivative, divergence, curl, vector equations and identities. Line Integral, Work done, Conservative field, Green's theorem in a plane, Surface and volume integrals, Gauss – divergence theorem, Stoke's theorem.	9

### Text Books:

1. M. D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 11th Edition, Pearson Educations, 2008E.
2. H. Anton, I. Brivens and S. Davis, Calculus, 10th Edition, John Wiley and sons, Singapore Pte. Ltd., 2013.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

### Reference Books:

1. M. J. Strauss, G. L. Bradley And K. J. Smith, Calculus, 3rd Ed, Dorling Kindersley (India) Pvt. Ltd. (P Ed), Delhi, 2007.
2. David C. Lay, Linear Algebra and its Applications, 3rd Edition, Pearson Ed. Asia, Indian Reprint, 2007.
3. D. G. Zill and W.S. Wright, Advanced Engineering Mathematics, 4th Edition, 2011.

COURSE INFORMATION SHEET

Course code: PH 113  
 Course title: Physics  
 Credits: 4  
 Class schedule per week: (L: 0, T: 1, P: 0)  
 Class: 4  
 Semester / Level: B. Tech  
 Branch: 1  
 Chemical Engineering

Syllabus

Module	Hours
Module-I Physical Optics: Polarization, Malus' Law, Brewster's Law, Double Refraction, Interference in thin films (Parallel films), Interference in wedge-shaped layers, Newton's rings, Fraunhofer diffraction by single slit, Double slit.	9
Module-II Electromagnetic Theory: Curl, Gradient, Divergence, Gauss theorem, Stokes theorem, Gauss's law, Applications, Concept of electric potential, Relationship between E and V, Polarization of dielectrics, dielectric constant, Boundary conditions for E & D, GAUSS'S law in magnetostatics, Ampere'S circuital law, Boundary conditions for B & H, Equation of continuity of charge, Displacement current, Maxwell's equations.	9
Module-III Special Theory of Relativity: Introduction, Inertial frame of reference, Galilean transformations, Postulates, Lorentz transformations and its conclusions, Length contraction, time dilation, velocity addition, Mass change, Einstein's mass energy relation.	9
Module-IV Quantum Mechanics: Planck's theory of black-body radiation, Compton effect, Wave particle duality, De Broglie waves, Davisson and Germer's experiment, Uncertainty principle, physical interpretation of wave function, Schrodinger equation in one dimension, free particle, particle in an infinite square well.	9
Module-V Lasers: Spontaneous and stimulated emission, Einstein's A and B coefficients, Population-inversion, Light amplification, Basic laser action, Ruby and He-Ne lasers, Properties and applications of laser radiation, Elementary ideas of fiber optics and application of fiber optic cables.	9

Textbooks:

1. A. Ghatak, Optics, 4th Edition, Tata Mcgraw Hill, 2009
2. Mathew N.O. Sadiku, Elements of Electromagnetics, Oxford University Press, 2001
3. Arthur Beiser, Concept of Modern Physics, 6th edition, Tata McGraw- Hill, 2009

Reference book:

1. Fundamentals of Physics, Halliday, Walker and Resnick.

## COURSE INFORMATION SHEET

Course code: BE 101  
 Course title: Biological Sciences  
 Credits: 2 (L:2, T:0, P:0)  
 Class schedule per week: 2  
 Class: B. Tech  
 Semester / Level: 4  
 Branch: Chemical Engineering

### Syllabus

Module	Hours
Module -I Basic Cell Biology: Origin of life, Cell theory, Cell Structure and function, Biomolecules, Cell cycle and cell division, Biological Organization.	5
Module -II Bioenergetics and Metabolism: Gibbs free energy and thermodynamics, aerobic and anaerobic respiration, Glycolysis, Krebs cycle and electron transport chain, Beta oxidation, Photosynthesis.	5
Module - III Enzymes and its Application: Classification of enzymes, Structure and mechanism of enzyme action and uses of enzymes, factors affecting enzyme activity, Immobilization of enzymes and their application.	5
Module - IV Biological Signal Generation and Propagation: Nerve cell structure and signal propagation. Mechanism of vision and hearing, cell signaling, Circadian rhythm.	5
Module -V Engineering Biological Systems and its Applications: Central dogma of molecular biology, Methods in genetic engineering and application, PCR, ELISA and its application, stem cell and tissue engineering. Artificial Intelligence in Biology, Plant factory.	5

### Textbooks:

1. Purves et al, (1998) Life: The Science of Biology, 4th Ed.
2. R. Dulbecco, The Design of Life.
3. Lehninger A, Principals of Biochemistry, 5th Ed.

### Reference books:

1. Stryer, L. (2002). Biochemistry. New York: W.H. Freeman.
2. K. Wilson & K.H. Goulding, (2006) A biologist's guide to Principles and Techniques of Practical Biochemistry.

## COURSE INFORMATION SHEET

Course code: EE 101  
 Course title: Basics of Electrical Engineering  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 1  
 Branch: Chemical Engineering

### Syllabus

Module	Hours
Module -I Introduction: Importance of Electrical Engineering in day-to-day life, Electrical elements, properties and their classification, Ideal and Real Sources, Source Conversion. D.C. Circuits: KCL and KVL, Loop current and Nodal voltage method Steady state analysis with independent and dependent sources, Star-Delta conversion. Magnetic Circuits: Introduction, Series-parallel magnetic circuits, Analysis of Linear and Nonlinear magnetic circuits, Energy storage, A.C. excitation, Eddy currents and Hysteresis losses.	9
Module -II Single-phase AC Circuits: Series Circuits: Common signals and their waveforms, RMS and Average value, Form factor & Peak factor of sinusoidal waveform, Impedance of Series circuits. Phasor diagram, Active Power, Power factor. Power triangle. Parallel Circuits: Admittance method, Phasor diagram. Power, Power factor. Power triangle, Series-parallel Circuit, Power factor improvement, Series and Parallel Resonance: Resonance curve, Q-factor, Dynamic Impedance and Bandwidth.	9
Module -III Three-Phase Circuits: Line and Phase relation for Star and Delta connection, Power relations, Analysis of balanced and unbalanced 3 phase circuits, Measurement of Power.	9
Module -IV Circuit Theorems: Superposition theorem, Thevenin's & Norton's Theorem, Maximum Power Transfer theorem for Independent and Dependent Sources for DC and AC circuits. Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling.	9
Module -V Working principles of AC Generators, motors and transformers, working principles of measuring equipments such as digital voltmeter, ammeter, power factor meter and wattmeter.	9

### Text books:

1. Hughes, Electrical Technology, Pearson, 10th Edition, 2011.
2. Fitzgerald and Higginbotham, Basic Electrical Engineering, McGraw Hill Inc, 1981.
3. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 3rd Edition, TMH, 2009.

### Reference books:

1. W. H. Hayt, Jr J. E. Kemmerly and S. M. Durbin, Engineering Circuit Analysis, 7th Edn TMH, 2010.
2. Electrical Engineering Fundamental, Vincent Del Toro, Prentice Hall, New Delhi.

## COURSE INFORMATION SHEET

Course code: CS 101  
 Course title: Programming for Problem Solving  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 1  
 Branch: Chemical Engineering  
 Syllabus

Module	Hours
Module -I Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Problem Solving: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.	9
Module -II Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals, Iterations, Loops.	9
Module -III Array, Character array, strings. Case studies to discuss the various Problems related to Basic science (Matrix addition, Matrix-matrix multiplication, Roots of an equation etc.), Sorting,	9
Module -IV Functions (including using built in libraries), Parameter passing in functions, call by value, call by reference. Passing arrays to functions, Recursion (Finding Factorial, Fibonacci series, Ackerman function etc.).	9
Module -V Structures, Defining structures and Array of Structures Pointers: Defining pointers, Use of Pointers in self-referential structures, File Handling.	9

### Text Books:

1. Jery R Hanly, Problem solving and Program design in C, 7th Edition, Pearson Education.
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
3. Reema Thareja, Introduction to C Programming, 2nd Edition, Oxford University Press, 2015.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice.
5. Byron Gottfried, Schaum's Outline of Programming with C, Tata McGraw-Hill.



## COURSE INFORMATION SHEET

Course code:	PH 114
Course title:	Physics Lab
Credits: 1.5	(L: 0, T: 0, P: 3)
Class schedule per week:	3
Class:	B. Tech
Semester / Level:	1
Branch:	Chemical Engineering

### List of Experiments

1. Error analysis in Physics Laboratory
2. To determine the frequency of AC mains with the help of sonometer.
3. To determine the wavelength of sodium light by Newton's rings Method
4. To determine the resistance per unit length of a Carey Foster's bridge wire and then to find the resistivity of the material of a given wire.
5. Measurement of mechanical equivalent of heat by electrical method
6. Determination of refractive index of the material of a prism using spectrometer and sodium light
7. To determine the frequency of electrically maintained tuning fork by Melde's experiment
8. Measurement of voltage and frequency of a given signal using cathode ray oscilloscope
9. To determine the wavelength of prominent spectral lines of mercury light by a plane transmission grating using normal incidence
10. To determine the electromotive force (emf) of an unknown cell using a stretched wire potentiometer
11. To study the frequency response and quality factor of series LCR circuit.
12. To find the specific rotation of sugar solution by using a polarimeter.
13. To determine the Hall voltage and calculate the Hall coefficient and carrier concentration of a semiconductor sample

## COURSE INFORMATION SHEET

Course code:	CS 102
Course title:	Programming for Problem Solving Lab
Credits: 1.5	(L: 0, T: 0, P: 3)
Class schedule per week:	3
Class:	B. Tech
Semester / Level:	1
Branch:	Chemical Engineering

### Sample Program List

#### Module 1 & Module 2: Introduction and Control Flow

- Write an interactive program that will read in a +ve integer value and determine the following
  - If the integer is a prime number
  - If the integer is a Fibonacci number
- WAP in C to compute  $\sin x = x - x^3/3! + x^5/5! - x^7/7! \dots$  to five place of accuracy. Test the program for  $x = 1, x = 2,$  and  $x = 3$ . In each case display the number of terms used to obtain the final answer.
- WAP to generate every 3rd integer beginning with  $I = 2$  and continue for all integers that are less than 150. Calculate the sum of those integers that are evenly divisible by 5.
- WAP to find whether a given year is a leap year or not. Modify it to generate a list of leap years between two year limits given by user.
- WAP to display the following pattern:

```
11
11 10 11
11 10 9 10 11
11 10 9 8 9 10 11
```

- Using Ternary / Conditional operator find the greatest among 3 numbers.
- WAP to convert a decimal number into an equivalent number of the input base. Test your program for base 2, 8 & 16.
- WAP to read a number n, and print it out digit-by-digit, as a series of words. For e.g. 123 would be printed as "one two three".
- WAP to check whether any input +ve integer is palindrome or not.
- WAP to simulate a simple calculator (+ -/ \*%) that takes two operands and an operator as input and displays the result.
- WAP to find the GCD of two input +ve integer numbers. Using this find GCD of 9 numbers.
- WAP to swap the values of two variables without using a third variable.

#### Module 3: Array

- Read a line of mixed text, and then write it out with all lower case and uppercase letters reversed, all digits replaced by 0s and all other characters (non-letters and nondigits) replaced by '\*'.  
14. WAP to find the product of two matrices A and B. Display the source matrices and product matrix C in matrix format.
- WAP to find whether a given matrix is a triangular matrix or not.
- WAP to find the transpose of a matrix. Display the source and the transposed matrix in matrix format.

17. Implement Prob. No. – 14 to 16 using functions for reading, manipulating and displaying the corresponding matrices in matrix form.
18. WAP to sort a list of strings alphabetically using a 2-dim. Character array.
19. WAP to display the row sum and the column – sum of an input 2- dim. Matrix. Display the source matrix with row and column sum.

#### Module 4: Functions, Pointer & String

20. Write a recursive function to calculate  $S = 2 + 4 + 6 + 8 + \dots + 2N$ . Implement the function in a complete C program.
21. Write a function that accepts two arguments an array and its size n. It performs Bubbleup sort on the array elements. Using indirection operator '\*' implement this in a complete C program. Display the source and the sorted array.
22. Using pointer, write a function that receives a character string and a character as argument. Delete all occurrences of this character in the string. The function should return corrected string with no holes.
23. Write a function for reading character string using pointer. Calculate the length of the string (without using strlen()). Finally print the string in reverse order, using pointer.
24. Implement prob. No. 14 using pointers representation of 2 – dim. array.
25. Implement prob. No. 15 using pointer representation of 2 dim. array.
26. Implement prob. No. 16 using pointer representation of 2 dim. array.
27. WAP to sort a list of strings into alphabetical order using array of pointers.

#### Module 5: Structure and File

28. Create records of 60 students, where each record has fields-name, roll, GPA and fees. Write a function update () to reduce the fees of those students who have obtained GPA greater than 8.5 by 25% of the original fees. Write a complete program to exercise this function in the main program and display all the records before and after updation.
29. Define a structure that describes a hotel. It should have members that include the name, address, grade, average room charge and number of rooms. Write a function to perform the following operations:
  - a) To print out hotels of a given grade in order of charges.
  - b) To print out hotels with room charges less than a given value.
30. WAP to concatenate the contents of two files into a third file.
31. WAP to copy the content of one file into another file. Names of both the files are to be input as command line arguments.

## COURSE INFORMATION SHEET

Course code: PE 101  
Course title: Workshop Practice  
Credits: 1.5 (L: 0, T: 0, P: 3)  
Class schedule per week: 3  
Class: B. Tech  
Semester / Level: 1  
Branch: Chemical Engineering

### LIST OF EXPERIMENT:

1. MACHINE SHOP  
EXPERIMENT – I:Center Lathe  
Objective: To study lathe machine and to machine a given job on center lathe as per drawing.
2. MACHINE SHOP  
EXPERIMENT-II:Shaper Machine  
Objective: To study Shaper machine and to machine a given job on shaper as per drawing.
3. CARPENTRY SHOP  
EXPERIMENT-I: Carpentry Tools and Instruments  
Objective: To study the various tools, instruments and equipment used in carpentry practice.
4. CARPENTRY SHOP  
EXPERIMENT-II: Carpentry Practice  
Objective: To perform the carpentry work by making a wooden job using different tools.
5. FITTING SHOP  
EXPERIMENT-I:Fitting Tools and Measuring Instruments  
Objective: To study the various tools used in fitting shop and perform fitting operations (like marking, chipping, hack-sawing, filing, drilling etc.)
6. FITTING SHOP  
EXPERIMENT-II:Fitting Assembly Practice  
Objective: To make a job clamping plate as per given drawing by fitting operations and to check for its assembly with a given component.
7. FORGINGSHOP  
EXPERIMENT-I:Forging Tools  
Objective: To study different tools and equipment used in hand forging practice.
8. FORGINGSHOP  
EXPERIMENT-II: Forging Practice  
Objective: To learn about hand forging practice by making a job (make a square bar from round blank and bend it at a sharp corner of 90 degree as per drawing).

9. FOUNDRY SHOP

EXPERIMENT-I:Green Sand Moulding

Objective: To get acquainted with various tools and equipment used in making green sand mould (to practice green sand mould making with single piece pattern).

10. FOUNDRY SHOP

EXPERIMENT-II:Aluminium Casting

Objective: To get acquainted with melting and pouring of metal in a mould (given two-piece patterns of handle) and to make aluminium casting.

11. WELDING SHOP

EXPERIMENT-I:Manual Metal Arc Welding

Objective: To study arc welding processes including arc welding machines (AC & DC), electrodes and equipment. To joint two pieces of given metal by arc welding process.

12. WELDING SHOP

EXPERIMENT-II: Gas Welding

Objective: To study gas welding processes including types of flames produced, filler metals and fluxes etc. To joint two pieces of given metal by gas welding process.

Books recommended:

TEXT BOOKS:

1. S K HajraChoudhury, A K. Hajra, "Elements of Workshop Technology:Vol- I and Vol -II", Media PromotersPvt Ltd.
2. B S Raghuwanshi, "A course in Workshop Technology", DhanpatRai Publications.

REFERENCE BOOKS;

1. P.N. Rao, "Manufacturing Technology Vol-Iand Vol-II", Tata McGraw Hill.
2. Kalpakjian, "Manufacturing Engineering and Technology", Pearson.

SECOND SEMESTER

## COURSE INFORMATION SHEET

Course code: MA 107  
 Course title: Mathematics-II  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 2  
 Branch: Chemical Engineering  
 Syllabus

Module	Hours
Module -I Ordinary Differential Equations – I Linear differential equations, Wronskian, Linear independence and dependence of solutions, Linear differential equations of second and higher order, Operator method, Legendre's and Euler – Cauchy's form of linear differential equation, Method of variation of parameters.	9
Module -II Ordinary Differential Equations – II Ordinary and singular points of differential equation, Power and Frobenius series solutions, Bessel's differential equation, Bessel function of first kind and its properties. Legendre's differential equation, Legendre's polynomial and its properties.	9
Module -III Fourier series and Partial Differential Equations Fourier series: Euler formulae for Fourier series, Dirichlet conditions, Half range Fourier series. Partial Differential Equations: Linear partial differential equations, Lagrange's method. Method of separation of variables and its application in solving one dimensional wave and heat equations.	9
Module -IV Function of a complex variable, Limit, Continuity, Differentiability, Analyticity, Analytic functions, Cauchy– Riemann equations. Harmonic functions, Harmonic Conjugate. Cauchy's theorem, Cauchy's Integral formula, Taylor and Laurent series expansions. Singularities and its types, Residues, Residue theorem.	9
Module -V Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, variance, moment generating function. Introduction to Binomial, Poisson and Normal Distribution.	9

### Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. D. G. Zill and W.S. Wright, Advanced Engineering Mathematics, 4th Edition, 2011.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edition, McGraw Hill, 2004.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing, 2009.
5. R. A . Johnson, I. Miller and J. Freund: Probability and Statistics for Engineers, PHI.
6. S. C. Gupta and V.K .Kapoor.: Fundamental of Mathematical Statistics, Sultan Chand and Sons.

### Reference Books:

1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition ., Wiley India, 2009.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
4. G. F. Simmons, Differential Equations with Applications and Historical Notes, TMH, 2nd Edition, 2003.
5. P. L. Meyer: Introductory Probability and Statistical Applications, Oxford & IBH.



COURSE INFORMATION SHEET

Course code: CH 101  
 Course title: Chemistry  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 2  
 Branch: Chemical Engineering

Syllabus

Module	Hours
Module -I Chemical Bonding: Ionic bond: Radius ratio rule, Born-Landé equation, Born-Haber cycle. Metallic Bond: valence bond and band theories, defects in solids, Werner's Theory, Bonding in Transition metal complexes, Ligands, coordination complexes, Ligand Field, Crystal Field Theory, Octahedral, Tetrahedral and square planar complexes, CFSE, Jahn Teller theorem, electronic spectra, magnetism, and isomerization in coordination compounds.	9
Module -II Organic Structure and Stereochemistry: Covalent bond: Lewis structure, Valence Bond theory, Molecular orbital theory, Molecular orbital of diatomic and polyatomic system, hybridization, conjugated molecules, Huckel molecular orbital theory of conjugated systems. Isomerism, Geometrical isomerism: cis-trans and syn-anti isomerism; Optical isomerism & Chirality; Wedge, Fischer, Newmann and Sawhorse Projection formulae and interconversions; E/Z, D/L, R/S nomenclature system; Conformational studies of ethane, n-butane, Cyclohexane.	9
Module -III Kinetics and Catalysis: Order & molecularity of reactions: chain, parallel, Competing, Side, Consecutive reactions; Kinetics of Fast reactions, Characteristics of catalyst, types of catalysis, catalytic poison; Theories of catalysis; Acid base catalysis: including kinetics, Enzyme catalysis, Mechanism and kinetics of enzyme catalyzed reaction, Michaelis-Menten equation, Important catalysts in industrial processes; Hydrogenation using Wilkinsons catalyst, Hydroformylation by using Cobalt-catalyst, Phase transfer catalyst.	9
Module -IV Spectroscopic Techniques: Absorption and emission Spectroscopy, Lambert-Beers Law, Principles and applications of UVA Visible, Factors influencing for UV-VIS spectrum; Rotational and Vibrational spectroscopy, Principle of FT-IR, and NMR spectroscopy; Modern techniques in structural elucidation of compounds by UVo VIS, IR, & NMR Spectroscopy.	9
Module -V Phase and Chemical equilibrium: Phase Rule: Terms Involved, Phase diagram of one component (Water) & two component (Pb/Ag) system & their applications. Law of chemical equilibrium, equilibrium constants and their significance, Weak and strong electrolytes, Standard electrode potential and its application to different kinds of half cells, EMF and its measurement and application, Batteries and Fuel Cells, Chemical and Electrochemical corrosion, Factors affecting the rate of corrosion.	9

Text books:

1. Huheey, J. E., Inorganic Chemistry: Principles of Structure and Reactivity, 4th edition, Pearson.
2. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Seventh Edition, Pearson
3. Atkins, P. W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.

Reference books:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier (2009).
3. William Kemp, Organic Spectroscopy, 3rd Ed., 2008 Macmillan

### COURSE INFORMATION SHEET

Course code: ME 101  
 Course title: Basics of Mechanical Engineering  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 2  
 Branch: Chemical Engineering  
 Syllabus

Module	Hours
Module -I System of Forces and Structure Mechanics : Addition of Forces, Moment of a Force, Couple, Varignon's theorem, Free Body Diagram, Equilibrium in Two and Three Dimensions, Equivalent Forces and Moment. Types of Trusses, Plane and Space Trusses. Analysis of Plane Trusses by: Method of Joints and Method of Sections, Analysis of Frames with Hinged Joints. Hooke's Law of elasticity, Stress and Strain, Relation between elastic constants, Thermal Stresses, Properties of surfaces such as centroid and area moment of inertia.	9
Module -II Kinematics & Kinetics of rigid bodies: Types of rigid body motion– translation, rotation about fixed axis, equations defining the rotation of a rigid body about a fixed axis, plane motion, absolute and relative velocity in plane motion, instantaneous center of rotation. Equation of translational and rotational motion, Newton's law and D'Alembert's principle –inertia force and inertia couple.	9
Module – III Friction and Vibration: Interfacial Friction (a) Laws of dry friction, static & kinetic co-efficient of friction, Analysis of static, kinetic and rolling friction.(b) Analysis of frictional forces in inclined planes, wedges, screw jacks and belt drives. Vibrations: Types of vibration, free undamped longitudinal vibrations, free damped longitudinal vibrations	9
Module - IV Boilers and Internal Combustion Engine: Boiler Mountings and Accessories, Fire Tube and Water Tube Boilers, Cochran Boiler, Babcock and Wilcox Boiler. Basic components and terminology of IC engines, working of four stroke/two stroke - petrol/diesel engine, classification and application of IC engines. Heat transfer: various modes of heat transfer, one dimensional steady state conduction, Application to composite walls and cylinder.	9
Module –V Non-Conventional Energy and their resources: Renewable and Non-renewable Energy Resources, Advantages and Disadvantages of Renewable Resources, Renewable Energy Forms and Conversion, Solar Energy, Wind Energy, Tidal Energy, Ocean Thermal Energy; Geothermal Energy, Nuclear Energy, Hydro Energy.	9

#### Text Books

1. Engineering Mechanics, Irving H. Shames, P H I. ltd, 2011.
2. Engineering Mechanics, S. Timoshenko, D. H. Young, J. V. Rao, SukumarPati, McGraw Hill education, 2017.
3. Theory of vibrations with applications, Thomson and Dahleh, Pearson Education, 5th Edition, 2008.
4. Boiler operator, Wayne Smith, LSA Publishers, 2013.
5. Internal Combustion Engines, M. L. Sharma and R. P. Mathur, DhanpatRai Publications, 2014.

6. Heat Transfer, J. P. Holman, Souvik Bhattacharya, Mcgraw Higher Ed Publishers, 2011.
7. Fundamentals of Renewable Energy Processes, Aldo Vieira Da Rosa, Elsevier publication, 2012.

Reference Books

1. Engineering Mechanics : statics, James L. Meriam, L. G. Kraige, Wiley, 7th Edition, 2011.
2. Engineering Mechanics, S. Rajasekaran & G. Sankarasubramaniam, Vikash publishing house, 2018.
3. Engineering Vibration, Daniel J. Inman, Pearson, 2013.
4. An Introduction to Steam Boilers, David Allan Low, Copper Press Publisher, 2012.
5. Internal Combustion Engines – V Ganesan, McGraw hill, 2017.
6. Heat and Mass Transfer: Fundamentals and Applications, Yunus A. Cengel, Afshin J. Ghajar, McGraw Hill Education Publisher, 2017.
7. Non Conventional Energy Resources, B. H. Khan, McGraw Hill Education Publisher, 2017.

### COURSE INFORMATION SHEET

Course code: EC 101  
 Course title: Basics of Electronics & Communication Engineering  
 Credits: 4 (L: 3, T: 1, P: 0)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 2  
 Branch: Chemical Engineering  
 Syllabus

Module	Hours
Module –I Diodes and Applications: Introduction to PN junction diodes; Characteristics of semiconductor diodes: V-I characteristics, diode-resistance, temperature-dependence, diode-capacitance; DC & AC load lines; Breakdown Mechanisms; Zener Diode – Operation and Applications; Diode as a Rectifier: Half Wave and Full Wave Rectifiers with and without C-Filters.	9
Module –II Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Input and Output Characteristics of CB, CE and CC Configurations, dc and ac load line analysis, operating point, Transistor biasing: Fixed bias, emitter bias/self-bias, Low-frequency response of CE amplifier. Field Effect Transistors: JFET, Idea of Channel Formation, Pinch-Off and saturation Voltage, Current F Voltage Output Characteristics; MOSFET: Basic structure, operation and characteristics.	9
Module –III Sinusoidal Oscillators: Concept of positive and negative feedback, Barkhausen criterion for sustained oscillations, Determination of Frequency and Condition of oscillation, Hartley and Colpitt's oscillator. Operational Amplifiers: Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Inverting and non-inverting amplifiers, Offset error voltages and currents; Power supply rejection ratio, Slew Rate and concept of Virtual Ground, Summing and Difference Amplifiers, Differentiator and Integrator, RC phase shift oscillator.	9
Module –IV Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Symbolic representation, Boolean algebraic function and Truth table of different Digital logic Gates (AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR); Realization of Basic logic gates using universal gates, Adder, Subtractor, adder/subtractor.	9
Module –V Electronic communication: Introduction to electronic communication system, Electromagnetic Communication spectrum band and applications, Elements of Electronic Communication System; Merits and demerits of analog and digital communication, Modes of communication; Signal radiation and propagation; Need for modulation; Introduction to Amplitude modulation and Angle modulation.	9

**Text Books:**

1. Millman J., Halkias C.C., Parikh Chetan, Integrated Electronics: Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw-Hill.
2. Mano M.M., Digital Logic and Computer Design, Pearson Education, Inc, Thirteenth Impression, 2011.
3. Singal T. L., Analog and Digital Communications, 2nd Edition, Tata McGraw-Hill.
4. Haykin S., Moher M., Introduction to Analog & Digital Communications, 2nd Edition, Wiley India Pvt. Ltd.

Reference Book:

1. Boylestad R.L., Nashelsky L., Electronic Devices and Circuit Theory, 10th Edition Pearson Education, Inc.

## COURSE INFORMATION SHEET

Course code:	CH 102
Course title:	Chemistry Lab
Credits: 1.5	(L: 0, T: 0, P: 3)
Class schedule per week:	3
Class:	B. Tech
Semester / Level:	2
Branch:	Chemical Engineering

### List of Experiments

1. Gravimetric estimation of Nickel by Dimethylglyoxime.
2. Quantitative estimation of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions by complexometric titration using  $\text{Na}_2\text{-EDTA}$ .
3. To verify Beer's Law using  $\text{Fe}^{3+}$  solution by spectrophotometer/colorimeter and to determine the concentration of a given unknown  $\text{Fe}^{3+}$  solution.
4. Separation of binary organic mixture by acid-base extraction and analysis using given FTIR and NMR spectrum.
5. Preparation of Diazoamino Benzene and report the melting point and yield of product.
6. Draw melting point-mass percent composition diagram for two component mixture and determine the Eutectic Temperature.
7. To study the kinetics of acid-catalyzed hydrolysis of ethyl acetate and to evaluate the value of the rate constant.
8. To determine the rate law for the reaction between iodide and hydrogen peroxide in an acidic environment and to determine the effect of a catalyst on the rate of reaction.
9. To determine the strength of the given strong acid by strong base Potentiometrically.
10. To determine the transition temperature of the given salt hydrate.
11. Qualitative detection of special elements in organic compounds.
12. To draw the pH-titration curve of strong acid vs strong base.

### Reference book:

1. Experimental Physical Chemistry, By B. Viswanathan, P. S. Raghavan, Narosa Publishing House (1997).
2. Vogel's Textbook of Practical Organic Chemistry
3. Experiments in General chemistry, C. N. R. Rao and U. C. Agarwal
4. Experimental Organic Chemistry Vol 1 and 2, P R Singh, D S gupta, K S Bajpai, Tata McGraw Hill.

## COURSE INFORMATION SHEET

Course code: CE 101  
 Course title: Environmental Science  
 Credits: 2 (L: 2, T:, P: 0)  
 Class schedule per week: 2  
 Class: B. Tech  
 Semester / Level: 3  
 Branch: Chemical Engineering  
 Syllabus

Module	Hours
Module –I Ecosystem and Environment: Concepts of Ecology and Environmental science, ecosystem: structure, function and services, Biogeochemical cycles, energy and nutrient flow, ecosystem management, fate of environmental pollutants, environmental status and reports on climate change.	5
Module –II Air Pollution; Structure and composition of unpolluted atmosphere, classification of air pollution sources, types of air pollutants, effects of air pollution, monitoring of air pollution, control methods and equipment for air pollution control, vehicular emissions and control, indoor air pollution, air pollution episodes and case studies.	5
Module –III Water Pollution: Water Resource; Water Pollution: types and Sources of Pollutants; effects of water pollution; Water quality monitoring, various water quality indices, water and waste water treatment: primary, secondary and tertiary treatment, advanced treatments (nitrate and phosphate removal); Sludge treatment and disposal.	5
Module –IV Soil Pollution and Solid Waste Management: Lithosphere – composition, soil properties, soil pollution, ecological & health effects, Municipal solid waste management – classification of solid wastes, MSW characteristics, collection, storage, transport and disposal methods, sanitary landfills, technologies for processing of MSW: incineration, composting, pyrolysis.	5
Module –V Noise pollution & Radioactive pollution: Noise pollution: introduction, sources: Point, line and area sources; outdoor and indoor noise propagation, Effects of noise on health, criteria noise standards and limit values, Noise measurement techniques and analysis, prevention of noise pollution; Radioactive pollution: introduction, sources, classification, health and safety aspects, Hazards associated with nuclear reactors and disposal of spent fuel rods-safe guards from exposure to radiations, international regulation, Management of radioactive wastes.	5

### Textbooks:

1. A, K. De. (3rd Ed). 2008. Environmental Chemistry. New Age Publications India Ltd.
2. R. Rajagopalan. 2016. Environmental Studies: From Crisis to Future by, 3rd edition, Oxford University Press.
3. Eugene P. Odum. 1971. Fundamentals of Ecology (3rd ed.) -. WB Saunders Company, Philadelphia.
4. C. N. Sawyer, P. L. McCarty and G. F. Parkin. 2002. Chemistry for Environmental Engineering and Science. John Henry Press.
5. S.C. Santra. 2011. Environmental Science. New Central Book Agency.



Reference books:

1. D.W. Conell. Basic Concepts of Environmental Chemistry, CRC Press.
2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw -Hill International.
3. G.M. Masters & Wendell Ela. 1991. Introduction to Environmental Engineering and Science, PHI.

## COURSE INFORMATION SHEET

Course code:	EC 102
Course title:	Electronics & Communication Lab
Credits: 1.5	(L: 0, T: 0, P: 3)
Class schedule per week:	3
Class:	B. Tech
Semester / Level:	2
Branch:	Chemical Engineering

### List of Experiments

1. Measurement of voltage, time period and frequency of different signals on CRO.
2. Measurement of frequency and phase of two different signals using Lissajous pattern.
3. To determine the forward and reverse bias characteristics of PN junction diode.
4. To determine the reverse bias characteristics of Zener diode and application as a voltage regulator.
5. Measurement of rectification efficiency and ripple factor of Half-wave and Full-wave rectifier Circuits with and without C-Filter.
6. To determine the frequency response of CE transistor amplifier and finding its gain bandwidth product.
7. To determine the transfer characteristics of JFET and measurement of its voltage gain.
8. Design of RC phase shift oscillator using IC-741 Op-Amp and finding its frequency of oscillation.
9. Design of Inverting and Non-inverting amplifier using IC 741 OP-AMP and finding its frequency response.
10. Realization of Basic logic gates (AND, OR, NOT) using NAND Gate (IC-7400).
11. Implementation of Boolean expression  $F = (A.B.C + D.E)$  using AND Gate(IC 7408) and OR Gate (IC 7432).
12. Generation of Amplitude modulated wave and calculation of percentage of modulation using standard setup.
13. Generation of FM-wave and its detection using standard setup.

### Text Books:

1. Millman J., Halkias C.C., Parikh Chetan, Integrated Electronics: Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw-Hill.
2. Mano M.M., Digital Logic and Computer Design, Pearson Education, Inc, Thirteenth Impression, 2011.
3. Singal T. L., Analog and Digital Communications, 2nd Edition, Tata McGraw-Hill.
4. Haykin S., Moher M., Introduction to Analog & Digital Communications, 2nd Edition, Wiley India Pvt. Ltd.

### Reference Book:

1. Boylstead R.L., Nashelsky L., Electronic Devices and Circuit Theory, 10th Edition Pearson Education, Inc.

## COURSE INFORMATION SHEET

Course code: ME 102  
 Course title: Engineering Graphics  
 Credits: 2 (L:0, T:0, P:4)  
 Class schedule per week: 4  
 Class: B. Tech  
 Semester / Level: 2  
 Branch: Chemical Engineering

### Syllabus

Module	Hours
Module -I Introduction to orthographic projections, Conventions, Fundamentals of First and Third Angle projection, Orthographic projections of points, lines and planes.	8
Module -II Development of surfaces- Development of prisms, pyramids and cylindrical & conical surfaces, Isometric projection and isometric views of different planes and simple solids, introduction to perspective projection.	8
Module -III Projections of simple solids - axis perpendicular to HP, VP and inclined to one or both planes, Sectioning of solids, section plane perpendicular to one plane and parallel or inclined to other plane.	8
Module -IV Working with AutoCAD Commands, Cartesian Workspace, Basic Drawing & Editing Commands, Drawing: Lines, Rectangles, Circles, Arcs, Polylines, Polygons, Ellipses, Creating Fillets and Chamfers, Creating Arrays of Objects, Working with Annotations, Adding Text to a Drawing, Hatching, Adding Dimensions, Dimensioning Concepts, Adding Linear Dimensions, Adding Radial & Angular Dimensions, Editing Dimensions.	8
Module -V Create views of engineering parts in AutoCAD, case studies with examples of Mechanical/ Electrical/Civil engineering drawings.	8

### Text Books

1. Engineering Drawing by N. D. Bhatt, Charotar Publishing House Pvt.Ltd., 53rd Edition, 2014.
2. Engineering Drawing and Graphics + AutoCAD by K. Venugopal, New Age International (P) Limited 4th Reprint: June, 2008

### Reference Books

1. Engineering Graphics with Autocad by J. D. Bethune, Prentice Hall (2007).