

Second Semester

I.K. Gujral Punjab Technical University, Kapurthala
Bachelor of Technology in Computer Science & Engineering

BTCH101-18	Chemistry-I (Theory)	L:3 T:1 P:0	Credits: 4
Pre-requisites (if any): Nil			
Detailed contents <p>1. Atomic and molecular structure (12 lectures)</p> <p>Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.</p> <p>2. Spectroscopic techniques and applications (8 lectures)</p> <p>Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.</p> <p>3. Intermolecular forces and potential energy surfaces (4 lectures)</p> <p>Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H₃, H₂F and HCN and trajectories on these surfaces.</p> <p>4. Use of free energy in chemical equilibria (6 lectures)</p> <p>Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.</p> <p>Use of free energy considerations in metallurgy through Ellingham diagrams.</p> <p>5. Periodic properties (4 Lectures)</p> <p>Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries</p> <p>6. Stereochemistry (4 lectures)</p> <p>Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds</p> <p>7. Organic reactions and synthesis of a drug molecule (4 lectures)</p> <p>Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.</p>			
Suggested Text Books <ol style="list-style-type: none"> University chemistry, by B. H. Mahan Chemistry: Principles and Applications, by M. J. Sienko and R.A. Plane Fundamentals of Molecular Spectroscopy, by C. N. Banwell Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan Physical Chemistry, by P. W. Atkins (Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition. http://bcs.whfreeman.com/vollhardtschore5e/default.asp 			
Course Outcomes <p>The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.</p>			

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Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules

BTCH102-18	Chemistry-I (Lab.)	L:0 T:0 P:3	Credits- 1.5
Choice of 10-12 experiments from the following			
<ul style="list-style-type: none"> • Determination of surface tension and viscosity • Thin Layer Chromatography • Ion exchange column for removal of hardness of water • Colligative properties using freezing point depression • Determination of the rate constant of a reaction • Determination of cell constant and conductance of solutions • Potentiometry-determination of redox potentials and emf • Synthesis of a polymer/drug • Saponification/acid value of an oil • Chemical analysis of a salt • Lattice structures and packing of spheres • Models of potential energy surfaces • Chemical oscillations- Iodine clock reaction • Determination of the partition coefficient of a substance between two immiscible liquids • Adsorption of acetic acid by charcoal • Use of the capillary viscometers to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg. 			
Laboratory Outcomes			
<p>The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:</p> <ul style="list-style-type: none"> • Estimate rate constants of reactions from concentration of reactants/products as a function of time • Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc • Synthesize a small drug molecule and analyse a salt sample 			

BTA204-18	Mathematics Paper-II (Probability & Statistics)	4L:1T:0P	credits - 4
Course Objective:			
<p>The objective of this course is to familiarize the students with statistical techniques. 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.</p>			
Detailed Content:			
Section-A			
Unit I: (10 hours)			

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Measures of Central tendency: Moments, skewness and kurtosis, Variance, Correlation coefficient, Probability, conditional probability, independence; Discrete random variables, Independent random variables, expectation of Discrete random variables.

Unit II: (15 hours)

Probability distributions: Binomial, Poisson and Normal, Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Section-B

Unit III: (10 hours)

Continuous random variables and their properties, distribution functions and densities, normal and exponential densities. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Unit IV; (15 hours)

Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
- S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
- W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
- N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- T. Veerarajan, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Course Outcomes:

The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties. The basic ideas of statistics including measures of central tendency, correlation and regression and the statistical methods of studying data samples.

BTPS101-18	Programming for Problem Solving (Theory)	L:3 T:0 P:0	Credits: 3
Pre-requisites (if any): Nil			
Detailed contents			
Unit 1			
Introduction to Programming (4 lectures)			
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) – (1 lecture) .			
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture)			
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures)			
Unit 2			
Arithmetic expressions and precedence (2 lectures)			

Conditional Branching and Loops (**6 lectures**)
Writing and evaluation of conditionals and consequent branching (**3 lectures**)
Iteration and loops (**3 lectures**)

Unit 3

Arrays (**6 lectures**)
Arrays (1-D, 2-D), Character arrays and Strings

Unit 4

Basic Algorithms (**6 lectures**)
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5

Function (**5 lectures**)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6

Recursion (**4 -5 lectures**)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7

Structure (**4 lectures**)
Structures, Defining structures and Array of Structures

Unit 8

Pointers (**2 lectures**)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9

File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books:

- (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

- (i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of

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function and simple integration.

BTPS102-18	Programming for Problem Solving (Lab)	L:0 T:0 P:4	Credits: 2
Pre-requisites (if any): Nil			
<p>[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]</p> <p>Tutorial 1: Problem solving using computers: Lab1: Familiarization with programming environment</p> <p>Tutorial 2: Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions</p> <p>Tutorial 3: Branching and logical expressions: Lab 3: Problems involving if-then-else structures</p> <p>Tutorial 4: Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series</p> <p>Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation</p> <p>Tutorial 6: 2D arrays and Strings Lab 6: Matrix problems, String operations</p> <p>Tutorial 7: Functions, call by value: Lab 7: Simple functions</p> <p>Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Programming for solving Numerical methods problems</p> <p>Tutorial 10: Recursion, structure of recursive calls Lab 10: Recursive functions</p> <p>Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures</p> <p>Tutorial 12: File handling: Lab 12: File operations</p>			
<p>Laboratory Outcomes</p> <ul style="list-style-type: none"> • To formulate the algorithms for simple problems • To translate given algorithms to a working and correct program • To be able to correct syntax errors as reported by the compilers • To be able to identify and correct logical errors encountered at run time • To be able to write iterative as well as recursive programs • To be able to represent data in arrays, strings and structures and manipulate them through a program • To be able to declare pointers of different types and use them in defining self-referential structures. • To be able to create, read and write to and from simple text files. 			

BTMP101-18	Workshop/Manufacturing Practices (Theory)	L:1 T:0 P:0	Credits:3
Pre-requisites (if any): Nil			
<p>Detailed contents</p> <ol style="list-style-type: none"> 1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures) 2. CNC machining, Additive manufacturing (1 lecture) 3. Fitting operations & power tools (1 lecture) 			

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4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

- (i) 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.
- (ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
- (iii) Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.
- (iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
- (v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

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.

BTMP101-18	Workshop Practice	L : 0; T:0 ; P : 4	credits - 2
<ol style="list-style-type: none"> 1. Machine shop (10 hours) 2. Fitting shop (8 hours) 3. Carpentry (6 hours) 4. Electrical & Electronics (8 hours) 5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs) 6. Casting (8 hours) 7. Smithy (6 hours) 8. Plastic moulding & Glass Cutting (6 hours) <p>Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.</p>			
<p>Laboratory Outcomes</p> <p>Upon completion of this laboratory course, students will be able to fabricate components with their own hands. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. By assembling different components, they will be able to produce small devices of their interest.</p>			

BTHU-101-18	English	2L: 0T: 0P	credits - 2
<p>Course Outcomes:</p> <ul style="list-style-type: none"> • The objective of the course is to help the students become the independent users of English language. • Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills. • Students will be able to understand spoken and written English language, particularly the language of their chosen technical field. • They will be able to converse fluently. • They will be able to produce on their own clear and coherent texts. 			
<p>Detailed contents</p> <p>Unit-1 Vocabulary Building & Basic Writing Skills</p> <ul style="list-style-type: none"> • 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. • Sentence Structures 			

- Use of phrases and clauses in sentences
- Importance of proper punctuation
- Creating coherence
- Organizing principles of paragraphs in documents
- Techniques for writing precisely

Unit-2 Identifying Common Errors in Writing

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced modifiers
- Articles
- Prepositions
- Redundancies
- Clichés

Unit-3 Mechanics of Writing

- Writing introduction and conclusion
- Describing
- Defining
- Classifying
- Providing examples or evidence

Unit-4 Writing Practices

- Comprehension
- Précis Writing
- Essay Writing
- Business Writing-Business letters, Business Emails, Report Writing, Resume/CV

Suggested Readings:

- (i) Practical English Usage. Michael Swan. OUP. 1995.
- (ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
- (iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (iv) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (v) Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
- (vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

BTHU-102-18	English Laboratory	0L: 0T: 2P	1 credit
Course Outcomes: <ul style="list-style-type: none"> • The objective of the course is to help the students become the independent users of English language. • Students will acquire basic proficiency in listening and speaking skills. • Students will be able to understand spoken English language, particularly the language of their chosen technical field. • They will be able to converse fluently • They will be able to produce on their own clear and coherent texts. 			
Detailed contents Interactive practice sessions in Language Lab on Oral Communication <ul style="list-style-type: none"> • Listening Comprehension • Self-Introduction, Group Discussion and Role Play • Common Everyday Situations: Conversations and Dialogues • Communication at Workplace 			

- Interviews
- Formal Presentations

Suggested Readings:

- (i) Practical English Usage. Michael Swan. OUP. 1995.
- (ii) Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
- (iii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press