

BETBSC102 Engineering Chemistry

UNIT-I Atomic and molecular structure

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 multicentre 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.

UNIT-II Spectroscopic techniques and applications

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.

UNIT-III Intermolecular forces and potential energy surfaces

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3 , H_2F and HCN and trajectories on these surfaces.

UNIT-IV Use of free energy in chemical equilibria

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. Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT-V Periodic properties

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

Suggested Text Books

- (i) University chemistry, by B. H. Mahan
- (ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
- (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- (iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- (v) Physical Chemistry, by P. W. Atkins
- (vi) Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

(ii) Chemistry Laboratory

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction

7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
- 9.** Synthesis of a polymer/drug

BETBSC104 Engineering Mathematics-II

UNIT-I: Multivariable Calculus (Integration)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

UNIT-II 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.

UNIT-III: Ordinary differential equations of higher orders

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT-IV Module 4: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm)

UNIT-V Module 5: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text/Reference Books

- (i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- (ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- (iii) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
- (iv) S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
- (v) E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
- (vi) E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
- (vii) J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
- (viii) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
- (ix) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

BETESC205 Engineering Mechanics

UNIT –I Types of Infrastructures, Effect of infrastructure facilities on economy and environment, Role of Civil Engineers in the infrastructural Development Introduction to sub-domains of Civil Engineering, Size of Infrastructure Industry, emerging trends in infra spending through public and public-private partnership (PPP), talent shortage, and global trends in workforce mobility and skill-demands.

UNIT-II Stages in the life of construction : Design, Construction, Maintenance, Repair, Demolition/Recycling; an overview of Indian Standards, units and conversion factors for Lengths, Areas, Volumes and Weights; Opportunities and challenge of India's Infrastructure, Interdisciplinary nature of Civil Engineering Projects

UNIT-III Basics of Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy

UNIT -IV Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Module 3: Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

UNIT-V Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

BETESC104 Workshop Manufacturing process

UNIT-I: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods

UNIT-II: CNC machining, Additive manufacturing

UNIT-III: Fitting operations & power tools Carpentry

UNIT-IV: Plastic moulding, glass cutting Metal casting

UNIT-V: Welding (arc welding & gas welding), brazing

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 Mc Graw Hill House, 2017.

Laboratory Outcomes

1. Upon completion of this laboratory course, students will be able to fabricate
2. components with their own hands.
3. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
4. By assembling different components, they will be able to produce small devices of their interest.

BETESC103 Programming for solving problem

UNIT 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.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of

Algorithm: Flowchart/Pseudocode 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

UNIT II: Arithmetic expressions and precedence Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching Iteration and loops

UNIT III: Arrays (1-D, 2-D), Character arrays and Strings Basic Algorithms 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 IV Function Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference Recursion 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 V Structures, Defining structures and Array of Structures Pointers Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation) 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

LAB MANUALS

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self referential structures.
8. To be able to create, read and write to and from simple text files.

BEPMC Environmental Science

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY: Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment, concept of an ecosystem, structure and function of an ecosystem. Energy flow in the ecosystem. Ecological succession processes. Introduction to biodiversity, value of biodiversity. Biodiversity at global, national and local levels. In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION: Definition – causes, effects and control measures of: (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Role of an individual in prevention of pollution. Pollution case studies. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES : Forest resources: Use and over-exploitation, deforestation, Water resources: Use and overutilization of surface and ground water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT : From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics, Enforcement machinery involved in environmental legislation- central and state pollution control boards disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations – population explosion – family welfare programme – environment and human health, Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health, Public participation is an important aspect which serves the environmental Protection.