SEMESTER II

Second Semester		
Course Number	**Course Title**	**Lecture – Tutorial – Practical - Credits**
CH102	Chemistry-II	3-0-0-6
CS101	Introduction to Computing	3-0-0-6
CS110	Computing Laboratory	0-0-3-3
EE102	Basic Electronics Laboratory	0-0-4-4
MA102	Mathematics-II	3-1-0-8
ME101	Engineering Mechanics	3-1-0-8
PH110	Physics Laboratory	0-0-3-3
PH102	Physics – II	2-1-0-6
	Total L-T-P-C	**14-3-10-44**

MA 102 Mathematics II (3 1 0 8)

Pre-requisites: Nil

Linear Algebra: Vector spaces (over the field of real and complex numbers). Systems of linear equations and their solutions. Matrices, determinants, rank and inverse. Linear transformations. Range space and rank, null space and nullity. Eigenvalues and eigenvectors. Similarity transformations. Diagonalization of Hermitian matrices. Bilinear and quadratic forms.

Ordinary Differential Equations: First order ordinary differential equations, exactness and integrating factors. Variation of parameters. Picard's iteration. Ordinary linear differential equations of n-th order, solutions of homogeneous and non-homogeneous equations. Operator method. Method of undetermined coefficients and variation of parameters.

Power series methods for solutions of ordinary differential equations. Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kind.

Systems of ordinary differential equations, phase plane, critical point, stability.

Texts:

1. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall, 1996.
2. T. M. Apostol, Calculus, Volume II, 2nd Edition, Wiley, 1969.
3. S. L. Ross, Differential Equations, 3rd Edition, Wiley, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall, 1995.
5. W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 7th Edition, Wiley, 2001.

References:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley, 2005.

ME 101 Engineering Mechanics (3 1 0 8)

Pre-requisites: Nil

Rigid body static: Equivalent force system. Equations of equilibrium, Free body diagram, Reaction, Static indeterminacy and partial constraints, Two and three force systems.
Structures: 2D truss, Method of joints, Method of section. Frame, Beam, types of loading and supports, Shear Force and Bending Moment diagram, relation among load-shear force-bending moment.

Friction: Dry friction (static and kinematics), wedge friction, disk friction (thrust bearing), belt friction, square threaded screw, journal bearings (Axle friction), Wheel friction, Rolling resistance.
Center of Gravity and Moment of Inertia: First and second moment of area and mass, radius of gyration, parallel axis theorem, product of inertia, rotation of axes and principal M. I., Thin plates, M.I. by direct method (integration), composite bodies.
Virtual work and Energy method: Virtual Displacement, principle of virtual work, mechanical efficiency, work of a force/couple (springs etc.), Potential Energy and equilibrium, stability.
Kinematics of Particles: Rectilinear motion, curvilinear motion rectangular, normal tangential, polar, cylindrical, spherical (coordinates), relative and constrained motion, space curvilinear motion.
Kinetics of Particles: Force, mass and acceleration, work and energy, impulse and momentum, impact.
Kinetics of Rigid Bodies: Translation, fixed axis rotation, general planner motion, work-energy, power, potential energy, impulse-momentum and associated conservation principles, euler equations of motion and its application.

Texts/References:

1. I. H. Shames, *Engineering Mechanics: Statics and dynamics*, 4th Ed, PHI, 2002.
2. F. P. Beer and E. R. Johnston, *Vector Mechanics for Engineers*, Vol I - Statics, Vol II – Dynamics, 3rd Ed, Tata McGraw Hill, 2000.
3. J. L. Meriam and L. G. Kraige, *Engineering Mechanics*, Vol I – Statics, Vol II – Dynamics, 5th Ed, John Wiley, 2002.
4. R. C. Hibbler, *Engineering Mechanic*s, Vol I and II, Pearson Press, 2002.
5. Andy ruina and Rudra Pratap, *Introduction to Statics and Dynamics*

EC 102 Basic Electronics laboratory (0 0 4 4)

Experiments using diodes and bipolar junction transistor (BJT): design and analysis of half -wave and full-wave rectifiers, clipping circuits and Zener regulators, BJT characteristics and BJT amplifiers; experiments using operational amplifiers (op-amps): summing amplifier, comparator, precision rectifier, astable and monostable multivibrators and oscillators; experiments using logic gates: combinational circuits such as staircase switch, majority detector, equality detector, multiplexer and demultiplexer; experiments using flip-flops: sequential circuits such as non-overlapping pulse generator, ripple counter, synchronous counter, pulse counter and numerical display.

References:

1. A. P. Malvino, Electronic Principles. New Delhi: Tata McGraw-Hill, 1993.
2. R. A. Gayakwad, Op-Amps and Linear Integrated Circuits. New Delhi: Prentice Hall of India, 2002.
3. R.J. Tocci: Digital Systems; PHI, 6e, 2001.

CS 101 Introduction to Computing (3 0 0 6)

Pre-requisites: Nil

Introduction: What is a program? Digital computer fundamentals; languages; OS.
Imperative programming: Types; Operations; Expressions; Control-flow constructs; Functions and program structure; I/O operations; Files etc.
Basic data structure: Arrays; lists, pointers, records etc.

The C programming language will be used to describe the algorithms. Exposure to FORTRAN, programming environments will also be provided.

Text:

1. Rajaraman V., *Computer Programming in C*, Prentice Hall India, 1994.

Reference:

1. Kernighan B. and Ritchie D., *The Programming Language*, Prentice Hall India, 1995.

CS 110 Computer Laboratory (0 0 3 3)

Laboratory experiments will be set in consonance with the material covered in CS 101. This will include assignments in a programming language like C.

Reference:

2. Kernighan B., Ritchie D., *The Programming Language*, Prentice Hall India, 1995.

PH 102 Physics II (2 1 0 6)

Pre-requisites: Nil

Vector Calculus: Gradient, Divergence and Curl. Line, Surface and Volume integrals. Gauss's divergence theorem and Stokes' theorem in Cartesian, Spherical polar and cylindrical polar coordinates. Dirac Delta function.
Electrodynamics: Coulomb's law and Electrostatic field, Fields of continuous charge distributions. Gauss's law and its applications. Electrostatic Potential. Work and Energy. Conductors, capacitors. Laplace's equation. Method of images. Dielectrics. Polarization. Bound charges. Energy in dielectrics. Boundary conditions. Lorentz force. Biot-Savart and Ampere's laws and their applications. Vector Potential. Force and torque on a magnetic dipole. Magnetic materials. Magnetization, Bound currents. Boundary conditions. Motional EMF, Ohm's law. Faraday's law. Lenz's law. Self and Mutual inductance. Energy stored in magnetic field. Maxwell's equations.
Optics: huygens' principle. Young's experiment. Superposition of waves. Concepts of coherence sources. Interference by division of wavefront. Fresnel's biprism, Phase change on reflection. Lioyd's mirror. Interference by division of amplitude. Parallel film. Film of varying thickness. Colours of thin films. Newton's rings. The Michelson interferometer. Fraunhofer diffraction. Single slit, double slit and N-slit patterns. The diffraction grating.

Text:

1. D. J. Griffiths, *Introduction to Electrodynamics*, Prentice Hall, New Delhi, 1995.
2. F. A. Jenkins and H. E. White, *Fundamentals of Optics*, McGraw-Hill, 1981.

Reference:

1. R. P. Feynman, R. B. Leighton and M. Sands, *The Feynman Lecture in Physics*, Vol I, Narosa Publishing House, New Delhi, 1998
2. I. S. Grant and W. R. Philips, *Electromagnetism*, John Wiley, 1990.
3. E. Hecht, *Optics*, Addison-Wesley, 1987.

PH110 Physics laboratory (0 0 3 3)

Instructions to Students, Introduction to Error Analysis

Decay of Current in Capacitive Circuit, Forced and Damped Oscillations, Compound Pendulum, Study of Hall Effect, Speed of Light in Glass, Magnetic Field along the Axis of Coil, Fraunhofer Diffraction: Single Slit, Velocity of Sound in Air, Photovoltaic Effect: Solar Cell

CH 102 Chemistry-II (3 0 0 6)

Pre-requisites: Nil

Fats, Oils and detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, soaps, synthetic detergents, alkyl and aryl sulphonates. Synthetic polymers: polymerization, methods of polymerization, step growth polymerization, structure and physical properties, natural and synthetic rubbers. Synthetic dyes: color and constitution (electronic concept). Classification of dyes, synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorecein, alizarin and Indigo. Electrochemistry: Conductance of solutions, equivalent and molar conductivities and its variation with concentration.

Kohlrausch's law-ionic mobilities, Transference number of ions. Activities in electrolytic solutions, application of Debye-Huckel theory. The Walden's rule. Debye-Huckel-Onsager treatment. Electrochemical cells, Nernst equation. Application of EMF measurements. Liquid junction potential, Commercial cells – the primary and secondary cells. Fuel cells. Polarisation and overvoltage. Reactions at a transition metal center – Oxidative addition, Reductive elimination, Metathesis, Insertion, Elimination, Transmetallation, Nucleophillic and Electrophilic addition and abstraction – Homogeneous catalysis – Alkene isomerization, Alkene hydrogenation, Alkene metathesis, ROMP, RCM, CM. Catalysis in C-C Coupling reactions – Heck, Stille Coupling, Sonogashira Coupling, Suzuki Coupling, Kumada Coupling, Negishi Coupling, Hiyama Coupling. Examples of organometallic catalysis inside hollow supramolecules as nanoscalar molecular flasks.

Text Books:

1. J. O'M. Bockris and A. K. N. Reddy, *Modern Electrochemistry, Volume 1 and 2,* Kluwer Academic, 2000.
2. K. L. Kapoor, *A Textbook of Physical Chemistry*, 2nd Ed, Macmillan India, 1986.
3. R. H. Crabtree, *Organometallic Chemistry of the Transition Metals*, 2nd Ed, Wiley-Interscience, 1995.
4. N. N. Greenwood and A. Earnshaw, *Chemistry of the Elements,* 2nd Ed, London: Butterworth Heinmann, 1997.
5. R. V. Gadag and A. N. Shetty, *Engineering Chemistry*, I. K. International, 2006.
6. Malcolm P. Stevens, *Polymer Chemistry,* 3rd Ed, Oxford University Press Inc, 1998.