

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

## Syllabus for B Tech First and Second semester (Effective from 2017 Admitted Batch Onwards)

### GROUP A

#### I SEMESTER

**Course Code: PH 11101**

**L-T-P-C**

**Course Title: PHYSICS**

**3-0-0-3**

**Mechanics:** Simple Harmonic Motion, Damped and forced oscillation; Resonance, Coupled oscillations, Normal modes. **06**

**Waves: Longitudinal and Transverse waves**, standing waves, phase velocity, Superposition of wave packets and group velocity, basic idea of E-M waves; Interference: Young's Experiments, Newton's ring; Diffraction: Fraunhofer and Fresnel Diffraction, Fraunhofer by rectangular and circular aperture. Resolution of microscope and telescope. Diffraction grating; Polarization: Plane and circular polarization and its application; Acoustics: Reverberation, reverberation-time, acoustic of building. **10**

**Special theory relativity:** Frames of reference, Galilean Relativity, Michelson-Morley experiment, postulates of Special Theory of Relativity, simultaneity, length contraction, time dilation, twin paradox, velocity addition, mass energy relation. **04**

**Modern Physics:** Failure of Classical Mechanics, Black body radiation and Planck's law. Photoelectric effect, Compton effect, Wave particle duality, de Broglie hypothesis and matter wave, uncertainty principle and its applications, wave function, expectation values, normalization of wave function; Schrödinger equation: time-independent Schrödinger equation and its applications to some simple potential problems. **16**

**Applications to materials:** Semiconductors, Fermi energy, doping of semiconductor, conductivity and mobility of electrons, Hall Effect; Magnetism: dipole moments, paramagnetism, diamagnetism, Curie's law, magnetization and hysteresis, Ferromagnetism and anti-ferromagnetism and ferrimagnetism; Basics of nano-technology. Basic of laser **06**

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## References:

1. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, McGraw Hill Education; Seventh edition (1st March, 2015)
2. Robert Eisberg and Robert Resnick, Quantum Physics of atoms, Molecules, Solids, Nuclei and Particles, Wiley; 2 edition (2010)
3. B. G. Streetman and S.K Banerjee, Solid state electronic devices, Prentice Hall India Learning Private Limited; 6 edition (2006)
4. N.K. Bajaj, The Physics of Waves and Oscillations, McGraw Hill Education; 1 edition (6th April, 2001)
5. A. R Ganesan and Eugene Hecht, Optics, Pearson Education; 4 edition (2008)
6. Ajay Ghatak, Optics, McGraw Hill Education India Private Limited; Sixth edition (1st August, 2016)
7. J. Griffiths David, **Introduction to Quantum Mechanics**, Pearson Education; Second edition (28th May, 2015)

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Course Code: PH 11201

L-T-P-C

Course Title: PHYSICS LABORATORY

0-0-3-2

## LIST OF EXPERIMENTS:

1. To determine the band gap energy and the resistivity of semiconductor by Four Probe Method.
2. To calculate the Hall Coefficient, Carrier Density, Carrier Mobility of the sample material.
3. Determination of the radius of curvature of the lower surface of a plano-convex lens by using Newton's Ring apparatus.
4. Measurement of Susceptibility of a liquid or a solution by Quincke's Method.
5. Determination of Planck's constant by using LED.
6. Measurement of Magnetoresistance of Semiconductors.
7. To study the forward and reverse characteristics of a p-n junction and zener diode.
8. To calculate the coercivity, saturation magnetization, retentivity of a sample by using Hysteresis Loop Tracer.
9.
  - i) To study the shape of the laser beam cross section and to evaluate beam spot size.
  - ii) To find the divergence angle of laser beam.
  - iii) To study the polarizing nature of laser.
10.
  - i) To study the variation of magnetic field with distance along the axis of a circular current carrying coil and to calculate diameter of the coil.
  - ii) To study the principle of superposition of magnetic field and in particular to study the axial variation of the magnetic field due to both the coils when the distance between them is
    - a) Less than the radius of the coils.
    - b) Equal to it.
    - c) More than it.

**Reference:** Please follow the manual book of the certain experiment.

## LIST OF PROPOSED EXPERIMENTS:

1. To measure slit-width and the separation between two slits of double slit, by observing diffraction and interference fringes and to compare them by microscopic measurement.

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2. Determination of the number of rulings per unit length of a given plane diffraction grating and then to find out the wave-lengths of given unknown lines.

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Course Code: MA 11101

L-T-P-C

Course Title: MATHEMATICS – I

3-1-0-4

## Module I: Sequence and Series

Sequences, Limits of a sequence and its properties, Series of positive terms, Necessary condition for convergence, Comparison test, D Alembert's ratio test, Cauchy's root test, Alternating series, Leibnitz's rule, Absolute and conditional convergence. **09+03**

## Module II: Single Variable Calculus

Limit, Differentiability, Continuity, Rolle's Theorem, Mean Value Theorem, Maxima and Minima, Taylor's Theorem, Power series, Riemann Integral, Fundamental Theorem of Calculus, Application of Riemann Integrals to length, area, volume and surface area of revolution. **13+04**

## Module III: Linear Algebra-I

System of linear equations,  $\mathbb{R}^n$  as a vector space and its subspaces, Spanning set, Linear independence, basis and dimension, range space and null spaces of matrices, rank, nullity, inverse and determinant of matrices, elementary transformations, inner products of vectors in  $\mathbb{R}^n$ , orthogonality, orthonormal sets and bases, Hermitian, Skew-Hermitian, Orthogonal matrices. **10+03**

## Module IV: Linear Algebra-II

Eigenvalues and eigenvectors, minimal and characteristic polynomial, diagonalizability, Cayley-Hamilton Theorem, quadratic form, reduction of a quadratic form into its normal form, vector spaces, subspaces of vector spaces, linear dependence and independence of vectors, linear span, basis and dimension of a vector space, linear transformations. **11+03**

### Text Books:

1. Robert Bartle & Donald Sherbert, Introduction to Real Analysis, John Wiley & Sons(2014).
2. G. B. Thomas, Jr. and R.L. Finney, Calculus and Analytic Geometry, 9<sup>th</sup> edn., Pearson Education India, 1996.

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3. G. Strang, Linear Algebra and Its Applications, 4<sup>th</sup> edn. Brooks/Cole India, 2006.

## Reference Books:

1. S. R. Ghorpade and B.V. Limaye, An Introduction to Calculus and Real Analysis, Springer India, 2006.
2. Hoffman K & Kunze R, Linear Algebra, Prentice Hall of India, New Delhi (1971).

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: CS 11101

L-T-P-C

Course Title: COMPUTER PROGRAMMING

3-0-0-3

## Module 1: Fundamentals of Computer

History of Computer, Classification of Computers, Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices, Binary Arithmetic & logic gates, High level language, compiler and assembler (basic concepts), Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart.

## Module 2: Fundamentals of C

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements; Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation; Input and Output: Standard input and output, formatted output -- printf, formatted input scanf.

## Module 3: Flow of Control, Functions

Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels; Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments.

## Module 4: Array, Pointer, Structures, Union, Files

One dimensional arrays, pointers and functions, multidimensional arrays; Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files.

### Text Books:

1. V. Rajaraman, Fundamental of Computers, PHI
2. E. Balaguruswamy, Programming in C, TMH
3. Y. Kanetkar, Let us C, BPB

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## **Reference Books:**

B. W. Kernighan and D. M. Ritchie, C Programming Language, 2nd Edition.

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Course Code: CS 11201

L-T-P-C

Course Title: COMPUTER PROGRAMMING LABORATORY

0-0-3-2

## Module 1

DOS System commands and Editors (Preliminaries) UNIX system commands and *vi* (Preliminaries)

## Module 2

Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number, generate Pascal's triangle, find roots of a quadratic equation

## Module 3

Programs to demonstrate control structure: text processing, use of break and continue, etc. Programs involving functions and recursion

## Module 4

Programs involving the use of arrays with subscripts and pointers and **dynamic memory allocation**, Programs using structures and files.

## Text Books:

C Programming Language (2nd Edition By B. W. Kernighan & D. M. Ritchie)

## Reference Books:

E. Balaguruswamy, Programming in C, TMH

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: ME 11101

L-T-P-C

Course Title: ENGINEERING MECHANICS

3-0-0-3

**Introduction:** Concept of force, force system, Fundamental laws and principles, principle of transmissibility, particle, rigid body, accuracy limit and approximations.

**Coplanar Concurrent Force System:** Resultant of a force system, graphical principles- parallelogram law, triangle law, polygon rule, analytical method, conditions of equilibrium, space diagram and free body diagrams, Lami's theorem.

**Coplanar Non-Concurrent Force System:** Moment of a force, Varignon's theorem, couple, properties of couples, resultant of non-concurrent force system, conditions of equilibrium, equilibrant, equilibrium of two-force system and three-force system, types of supports, types of loads.

**Concept of Friction:** Laws of dry friction, angle of friction, coefficient of friction, belt friction. Problems related to equilibrium of coplanar force system with friction, ladder problems, belt friction problems.

**Centroids and Second Moment of Areas:**

(a) *Centroid:* Definition of centre of gravity, centroid of area, centroid of line, concept of line of symmetry, location of centroid by direct integration of rectangular, triangular, semi-circular and quarter circular areas, centroid of composite areas.

(b) *Second Moment of Area:* Definition, parallel axis theorem, polar moment of area, radius of gyration, second moment of area by direct integration of a rectangular, triangular, circular, semi-circular and quarter-circular area. Second moment of composite area.

**Kinematics:** Definition of kinematics, kinetics, displacement, velocity, acceleration, relationship between them, problems involving variable acceleration, equations of motion under constant acceleration, motion under gravity, projectile motion.

**Application of Newton's Second Law:** Newton's second law, definition of unit force, problems of rectilinear motion, motion of connected bodies.

**Application of Work-Energy Principle:** Definition of work, energy, power, efficiency, derivation of work-energy equation, problems of rectilinear motion, motion of connected bodies.

**Application of Impulse-Momentum Equation:** Definition of linear momentum, impulse, derivation of impulse-momentum equation, conservation of linear momentum, problems related to rectilinear motion, motion of connected bodies, conservation of momentum.

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## **Text Books:**

1. I. H. Shames, Engineering Mechanics—Statics and Dynamics, 4<sup>th</sup> Edition, Prentice Hall of India, 1996.

## **Reference Books**

1. F.P. Beer and E.R. Johnston, *Vector Mechanics for Engineers – Statics*, McGraw Hill Book Company, 2000.
2. J.L. Meriam and L.G. Kraige, *Engineering Mechanics – Statics*, John Wiley & Sons, 2002.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: ZZ 11201**

**L-T-P-C**

**Course Title: WORKSHOP PRACTICE I**

**0-0-3-2**

*The course is intended to expose the student to the manufacturing processes through hands on training in the sections of Workshop. After the course, the student acquires the skill in using various tools, measuring devices, and learns the properties of different materials at varying conditions.*

- 1) **Carpentry:** Study of tools and joints – planing, chiseling, marking and sawing practice, one typical joint- Tee halving/Mortise and Tenon/ Dovetail
- 2) **Fitting:** Study of tools- chipping, filing, cutting, drilling, tapping, about male and female joints, stepped joints- one simple exercise of single V joint for welding exercise.
- 3) **Welding:** Study of arc and gas welding, accessories, joint preparation, Exercise of a single V Joint.
- 4) **Smithy/Foundry:** Study of tools, forging of square or hexagonal prism/ chisel/bolt/ Study of tools, sand preparation, moulding practice.
- 5) **Sheet Metal work:** Study of tools, selection of different gauge sheets, types of joints, fabrication of a tray or a funnel
- 6) **Lathe Exercise:** Study of the basic lathe operations, a simple step turning exercise.
- 7) **Plumbing Practice:** Study of tools, study of pipe fittings, pipe joints, cutting, and threading
- 8) **Surveying/Masonry:** Introduction to land surveying and linear measurements/ English bond – Flemish bond –wall –junction – one brick – one and a half brick -Arch construction.

## **References**

1. Chapman W.A.J., Workshop Technology. Parts 1 & 2, 4th Edition, Viva Books P. Ltd.,New Delhi, 2002
2. Hajra Choudhury.Workshop Technology Vol 1 & 2, Media Promoters & Publishers P.Ltd, Bombay, 2004
3. Welding Handbook. Miami, American Welding Society, 2000
4. Metals Handbook. Vol 6, Welding, Brazing & Soldering. Metals Park, Ohio, American Society of Metals, 1998
5. Handbook of Civil Engineering by V.N. Vazirani & S.P. Chandola, Khanna Publishers.
6. Standard Handbook for Civil Engineers by Jonathan T. Ricketts, M. Kent Loftin, Frederick S. Merritt **Publisher:** McGraw-Hill: New York

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: HS 11101

L-T-P-C

Course Title: ENGLISH LANGUAGE & COMPOSITION

2-0-0-2

1. **Basics of English Language:** Synonyms, Antonyms and Words often confused, One word substitution, Idioms and phrases, Article and Adjectives, Pronoun, Preposition, Verb, Tense and ConCORDS. **08**

2. **Essays:** 1. *Of Studies* by Francis Bacon, 2. *On Doing Nothing* by JB Priestley, 3. *In Defense of Ignorance* by AG Gardiner, 4. *English in India* by R. K. Narayan **08**

3. **English in Use:** 1. *Ulysses* by A.L. Tennyson 2. *Goodbye Party for Miss Pushpa T.S.* by Nissim Ezekiel 3. *Where the Mind is Without Fear* by Rabindranath Tagore 4. *Stopping by Woods on a Snowy Evening* by Robert Frost

*Language through Audio/Visual*

*Wings of Fire:* A.P.J. Abdul Kalam

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## Essential Readings:

1. Wood, F.T. *A Remedial English Grammar for Foreign Students*. Macmillan.
2. Pleasures of Reading: An Anthology of Poems, Orient Longman.
3. Selected Essays and Short Stories, Oxford University Press.
4. Selected Poems, Oxford University Press.

## Suggested Readings:

1. Swan, Michael. *Practical English Usages*. Oxford University Press.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: HS 11102**

**L-T-P-C**

**Course Title: PROFESSIONAL ETHICS & VALUE EDUCATION**

**1-0-0-1**

## **UNIT 1: Course Introduction**

Understanding the need, basic guidelines, content and process for Value Education; Self Exploration–what is it? its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration;. Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfill the above human aspirations: understanding and living in harmony at various levels

## **UNIT 2: Understanding Harmony in the Human Being**

Harmony in Myself; Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’; Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha; Understanding the Body as an instrument of ‘I’; Understanding the characteristics and activities of ‘I’ and harmony in ‘I’; Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.

## **UNIT 3: Understanding Harmony in the Family and Society**

Harmony in Human Relationship; Understanding Harmony in the family – the basic unit of human interaction; Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship; Understanding the meaning of Vishwas; Difference between intention and competence; Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided

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Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family - Practice Exercises and Case Studies will be taken up in Practice Sessions.

## **References:**

1. The text book R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
2. The teacher's manual R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

## II SEMESTER

**Course Code: MA 12101**

**L-T-P-C**

**Course Title: MATHEMATICS – II**

**3-1-0-4**

### **Module I: Vector Calculus-I**

Functions from  $\mathbb{R}$  to  $\mathbb{R}^n$ , Continuity and Differentiability, Curves, Tangents, Arc length, Curvature. **05+02**

### **Module II: Vector Calculus-II**

Functions from  $\mathbb{R}^n$  to  $\mathbb{R}^m$ , Continuity, Partial derivatives, Directional derivatives, Gradient, Differentiability, Divergence and curl, Taylor's theorem, Chain rule, Tangent plane and normal line, maxima and minima, Lagrange multipliers method. **10+04**

### **Module III: Integration in Multivariable Calculus**

Line Integrals, Double integrals, Surface integrals, Triple Integrals, Green's Theorem, Vector fields, Path independence of line integrals, Fundamental theorems of integral calculus for line integrals, Gauss' Divergence Theorem and Stokes Theorem. **10+04**

### **Module IV: Ordinary Differential Equations**

First order ordinary differential equations, Methods of solution, Existence and uniqueness of solution, Orthogonal Trajectories, Applications of first order differential equations. Linear higher order equations: Homogeneous and nonhomogeneous linear equations and their methods of solutions, operator method, fundamental system of solutions, Existence and uniqueness conditions, Wronskian, Non homogeneous equations, Applications, system of first order equations, phase plane, critical point and stability. **17+04**

### **Text Books:**

1. G. B. Thomas Jr. and R. L. Finney, Calculus and Analytic Geometry, 9<sup>th</sup> edition, Pearson Education, India, 1996.
2. T. M. Apostol, Calculus- Vol 2, 2<sup>nd</sup> Edition, Wiley India, 2003.
3. S. L. Ross, Differential Equations, 3<sup>rd</sup> edition, Wiley India, 1984.

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## Reference Books:

1. W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9<sup>th</sup> edn., Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
3. S. R. Ghorpade and B. V. Limaye, An Introduction to Multivariable Calculus and Analysis, Springer India, 2010.

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Course Code: CY 12101

L-T-P-C

Course Title: CHEMISTRY

3-0-0-3

## Module 1: Chemical Bonding

LCAO-MO methods in homo and heteronuclear diatomic molecules, VSEPR theory, hybridization, Walsh diagram, Bent's rule, structure and reactivity of covalently bonded molecules Bonding in Coordination Complexes: Crystal-Field theory, d-orbital Splitting in Octahedral, Tetrahedral, Square Planar geometries; Molecular Orbital Theory, Electronic Spectra: Selection Rules, d-d transitions, charge-transfer spectra. **07**

## Module 2: Spectroscopy

Electromagnetic spectrum, Quantization of energy, Born-Oppenheimer approximation, Franck Condon Principle, Vibrational spectra (IR) of diatomic molecule; Electronic spectroscopy, Lambert-Beer's Law, Applications in quantitative analysis. NMR Spectroscopy: Basic principles, concept of chemical shift, spin-spin splitting etc. Basics of mass spectrometry. Determination of structures of small molecules by UV, IR, NMR, MS spectra. **08**

## Module 3: Fuels

Introduction to fuels, Properties of liquid fuels (Flash point, Pour point, specific heat, calorific value, Ash content etc.), Storage of fuel oil; Properties of coal, origin, types, proximate & ultimate analysis of coal; Crude petroleum & gaseous fuels. Anti-knocking agents, octane number, cetane number, Aviation fuel, Biodiesel. **06**

## Module 4: Electrochemistry

Concepts of electrode potentials, Nernst equation, Reference electrodes, Ion selective electrodes, Determination of pH of a solution by glass electrode, Derivation of equation between  $E_{\text{cell}}$  & pH, Electrochemistry of secondary cells e.g., Lead-acid & Ni-Cd cells, Rechargeable lithium batteries, fuel cell-Electrochemistry of  $\text{H}_2\text{-O}_2$  fuel cell, methanol- $\text{O}_2$  fuel cell. **07**

## Module 5: Nanomaterials

Introduction, Chemical synthesis of nanomaterials; sol-gel method, Reverse micellar method, electrolytic method, Characterization of nanoparticles by BET method, characterization of

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nanomaterials by TEM, Applications of nanomaterials in Industry (e.g., Drug delivery, catalysis, solar cells etc.) **08**

## **Module 6: Polymer**

Introduction, types of polymerization, classification of polymers based on chain characteristics, source, method of synthesis and molecular forces involved, mechanism of polymerization reaction: cationic, anionic and catalytic polymerization; glass transition & crystalline melting point temperatures. Preparation, properties & uses of the following – Polyethylene, PVC, Polystyrene, PAN, Teflon, Nylon-6,6, polyester; Rubber-monomer, structure, compounding of rubber, vulcanization, synthetic rubbers- Buna-S, Buna-N, neoprene, butyl rubber & polyurethanes. **06**

### **Readings:**

1. P.C. Jain & M. Jain, "Engineering Chemistry", S. Chand & Co. Ltd.
2. Shashi Chawla, 'A Text Book of Engineering Chemistry', 3<sup>rd</sup> Edition, Dhanpat Rai & Co, New Delhi, 2007.
3. S. Vairam, P. Kalyani & Suba Ramesh, "Engineering Chemistry", 1<sup>st</sup> Edition, John Willey & Sons, India, 2011.
4. B.K. Sharma, "Engineering Chemistry", Krishna Prakashan Media (P) Ltd.

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**Course Code: CY 12201**

**L-T-P-C**

**Course Title: CHEMISTRY LABORATORY**

**0-0-3-2**

1. Determination of total hardness of water.
2. Alkaline hydrolysis of benzamide to benzoic acid
3. Determine the alkalinity of a given water sample
4. Conductometric titration of HCl Vs NaOH find the strength of HCl
5. Estimation of Fe (II) IN Mohr's Salt Solution using standard  $K_2Cr_2O_7$  Solution.
6. Estimation of Fe (II) IN Mohr's Salt Solution using standard  $KMnO_4$  Solution.
7. Estimation of sodium carbonate and sodium bicarbonate in a given mixture.
8. pH Measurements and Preparation of Buffers.
9. Separation of biomolecules (eg chlorophyll) by paper chromatography

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: EE 12101

L-T-P-C

Course Title: BASIC ELECTRICAL SCIENCE

3-0-0-3

## Module 1

### Two Terminal Element Relationships

**Inductance** - Faraday's law of electromagnetic induction, Lenz's law, self and mutual inductance, inductances in series and parallel, mutual flux and leakage flux; **Capacitance** - electrostatics-capacitance, parallel plate capacitor, capacitors in series and parallel, energy stored in electrostatic fields,  $v-i$  relationship for inductance and capacitance,  $v-i$  relationship for independent voltage and current sources; **Magnetic Circuits** - MMF, magnetic flux, and reluctance, energy stored in a magnetic field, solution of magnetic circuits; **Resistive Circuits** - solution of resistive circuits with independent sources, node analysis and mesh analysis, source transformation; **Circuit Theorems** - superposition theorem, KCL, KVL, Thevenin's theorem, Norton's theorem, maximum power transfer theorem; linear dependent sources - VCVS, VCCS, CCVS and CCCS. 16

## Module 2

*Semiconductor diode* - principle, characteristics, applications; rectifier circuits, Zener diode, LED, photo diode, IR diode; *Bipolar Junction Transistor* - principle, operation, characteristics (CB, CE, CC), principle of working of CE, CB and CC amplifiers, Transistor as a switch – switching delays, inverter operation; principle of operation of lead-acid batteries, areas of application of Lead-acid batteries and application requirements – in UPS, DG Sets, Automobiles, Emergency lamps, Solar Power Systems etc.

Digital Electronics - Number Systems and Conversions- Logic Gates and Truth Tables – Boolean Algebra; Basics of voltmeter, ammeter, wattmeter, multimeter, and energy meter; Measurement of Voltage, Current, and Resistance; introduction to oscilloscope. 12

## Module 3

Structure and components of an electrical energy system – generation, transmission, distribution and utilisation overview, DC power versus AC power, DC transmission versus AC transmission; **Single phase A.C. circuits** - alternating quantities, average value, form and peak factors for square, triangle, trapezoidal, and sinusoidal waveforms, phasor representation of sinusoidal quantities, phase difference, addition and subtraction of sinusoids, symbolic representation - Cartesian, polar and exponential forms, analysis of A.C. R, RL, RC, RLC circuits using phasor

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concept, concept of impedance, admittance, conductance and susceptance, power in single phase circuits – instantaneous power, average power, active power, reactive power, apparent power, power factor, complex power, solution of series, parallel and series-parallel A.C. circuits; **Three phase A.C. circuits** - phase sequence, star delta transformation, balanced three phase A.C. source supplying balanced three phase star connected and delta connected loads, measurement of power in a three phase system. 14

## References:

- 1 A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.
- 2 A. Chakrabarti and S. Nath, Basic Electrical and Electronics Engineering, Tata McGraw - Hill Education.
- 3 J. W. Nilsson and S. Riedel, Electric Circuits, Pearson.
- 4 R. L. Boylestead and L. Nashelsky, Electronic Devices and Circuit Theory, Pearson.
- 5 M. M. Mano and M. D. Ciletti, Digital Design, Pearson.
- 6 E. W. Golding and F. C. Widdis, Electrical Measurements and Measuring Instruments, Wheeler.
- 7 C. S. Rangan, G. R. Sarma, and V. S. V. Mani, Instrumentation Devices and Systems, McGraw-Hill.
- 8 K. S. S. Kumar, Electric Circuits and Networks, Pearson.
- 9 A. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: BT 12101**

**L-T-P-C**

**Course Title: INTRODUCTION TO LIFE SCIENCES**

**2-0-0-2**

**Prerequisite:** Nil

## **Module 1: Origin of life and Evolution**

Origin and evolution of life, Theories for origin of life - Primordial soup theory, Miller-Urey experiment, Theory of Biogenesis: Louis Pasteur experiment, Darwinian selection, Oparin - Haldane Hypothesis, Embryonic development: A brief introduction **06**

## **Module 2: Biology of cell and basic genetics**

Classification of life: Prokaryotes, Eukaryotes, Achaea, Membrane bi-layer and transport, Concept of Bio-energetics, Functions of different organelles in the cells, Mitosis and Meiosis, Classical genetics, Mendel's laws of inheritance-Law of segregation and law of independent assortment. **08**

## **Module 3: Biomolecules and central dogma**

Structure and function of biomolecules-DNA, RNA, Carbohydrates, Lipids, Proteins, Functions of biomolecular, A brief introduction to replication, transcription, translation and gene expression and metabolism, cellular respiration. **08**

## **Module 4: Basic techniques in Biology**

Basic concepts of various microscopy, Gel electrophoresis, Centrifugation technique: Svedberg coefficient and application, Recent advances in Biological Sciences: Biomedical devices, Break through research in biology (Nobel prize winning works). **06**

### **Text books:**

1. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, 4th Edn, WH Freeman and Company, 2005.
2. J.M. Berg, J.L. Tymoczko, and L. Stryer, Biochemistry, 6th Edn., WH Freeman and Company, 2007.
3. B. Alberts, A. Johnson, J. Lewis, and M. Raff, Molecular Biology of the Cell, 5<sup>th</sup> Edn., Garland Science, 2008.

### **Reference books:**

# **NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM**

1. M.J. Pelczar, E.C.S. Chan, and N.R. Krieg, Microbiology, 5th Edn., McGraw-Hill,2007.
2. H. Lodish, A. Berk, C. A. Kaiser, and M. Krieger, Molecular Cell Biology, 6<sup>th</sup> Edn., W. H. Freeman, 2007.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: ZZ 12202

L-T-P-C

Course Title: WORKSHOP PRACTICE- II

0-0-3-2

## **PART I (Electrical and Electronics Engineering)**

- 1) a) To identify different types of cables/wires and switches and usage of those.  
b) Familiarization of wiring tools, lighting and wiring accessories, various types of wiring systems; e.g. cleat wiring, casing, and capping etc.
- 2) a) Familiarization of electronic components' colour code.  
b) Assembling of a given circuit on a bread board.  
c) Study of soldering components, solders, tools, heat sink.  
d) Complete one given circuit using PCB; e.g. doorbell/LED flasher.
- 3) a) Wiring of one lamp/CFL/tube light controlled by one switch.  
b) Wiring of one lamp/CFL/tube light controlled by two SPDT switch.  
c) Assembling of CFL and tube light.
- 4) a) Study of electric shock phenomenon and preventions.  
b) Earthing and its construction.
- 5) a) Familiarization with types of fuses; e.g. MCB, ELCB.  
b) Wiring of fluorescent lamp controlled by one switch from panel with ELCB and MCB.
- 6) a) Indian Electricity rules: electric symbols.  
b) Study of estimation and costing of wiring.
- 7) Familiarization with ammeter, voltmeter, wattmeter, and multi-meter.
- 8) Familiarization with single phase and three phase energy meters.
- 9) Wiring of multi-pin extension board.
- 10) Familiarization with domestic appliances; e.g. mixer machine, electric iron, fan motor, pump motor, battery.
- 11) Wiring of backup power supply; e.g. inverter for domestic installations.

## **PART II (Electronics and Communication Engineering)**

- 1) Familiarization with Electronic components such as Resistors, Capacitors, Diodes, Transistors etc.  
(a) Colour Coding, Identification of terminals in Diodes etc.

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- 2) Familiarization with electronic devices and measuring equipments like Cathode Ray Oscilloscope, Digital Storage Oscilloscope, Function Generator, DC power supply, Multimeter etc.
  - (a) Study of measurement of waveform characteristics like Amplitude, Frequency etc. in Oscilloscope.
  - (b) Study of measurement of various parameters like Voltage, Current, Frequency, Continuity, Resistance etc. using Multimeter.
- 3) Study of Testing of different kinds of Active and Passive Components using Multimeter.
- 4) Familiarization with basics of Digital Electronics
  - (a) Basic Gates-Logical diagram, Truth table etc
  - (b) Universal Gates- Logical diagram, Truth table etc.
- 5) Familiarization with Soldering and De-soldering using a circuit.
  - (a) Breadboard Assembling- RC Coupled Amplifier.
- 6) (a) Study of V-I characteristics of P-N Junction Diode.
  - (b) Study of V-I characteristics of Zener Diode.

## References:

1. K. B. Raina and S. K. Bhattacharya, Electrical Design Estimating and Costing, New Age International Publishers, New Delhi.
2. S. L. Uppal, Electrical Wiring, Estimating and Costing, Khanna Publishers.
3. J. H. Watt and T. Croft, American Electricians' Handbook: A Reference Book for the Practical Electrical Man, McGraw-Hill.
4. G. R. Slone, Tab Electronics Guide to Understanding Electricity and Electronics, McGraw-Hill.
5. J. C. Whitaker, The Resource Handbook of Electronics, CRC Press.
6. Electronic Devices and Circuit Theory, Robert L. Boylestad
7. J. C. Whitaker, The Resource Handbook of Electronics, CRC Press.
8. Millman & Halkias: Electronic Devices & Circuits, MGH, 2007

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: ME 12201**

**L-T-P-C**

**Course Title: ENGINEERING GRAPHICS**

**1-0-3-3**

**Introduction:** Overview of the course, Examination and Evaluation patterns.

Lines Lettering and Dimensioning: Types of lines, Copying, Lettering, Dimensioning, Geometrical Constructions, Polygons, Scales, and Curves.

**Orthographic projection:** Principles of Orthographic projection, Projections of points, Straight Lines and traces, Projections of Laminas, Projections of Solids.

**Development of Surfaces:** Draw the development of surfaces for Prisms, Cylinders, Pyramids and Cones.

**Section of Solids:** Sectional planes, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section. Development of truncated objects.

**Isometric views:** Isometric axis, Isometric Planes, Isometric View, Isometric projection, Isometric views.

**Auto-CAD practice:** Introduction to Auto-CAD, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES tool bar, Standard Tool bar, LAYERS, Assignment on basic objects.

## **Text books:**

Bhatt N. D, Elementary Engineering Drawing, Charotar Publishing House, Anand, 2002

## **References:**

1. Narayana K L & Kannaiah P, Engineering Graphics, Tata McGraw Hill, New Delhi, 1992
2. Luzadder W J, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2001
3. Venugopal K, Engineering Drawing & Graphics, New Age International Pvt. Ltd., New Delhi, 1994

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

## GROUP B

### I SEMESTER

**Course Code: MA 11101**

**L-T-P-C**

**Course Title: MATHEMATICS – I**

**3-1-0-4**

#### **Module I: Sequence and Series**

Sequences, Limits of a sequence and its properties, Series of positive terms, Necessary condition for convergence, Comparison test, D Alembert's ratio test, Cauchy's root test, Alternating series, Leibnitz's rule, Absolute and conditional convergence. **09+03**

#### **Module II: Single Variable Calculus**

Limit, Differentiability, Continuity, Rolle's Theorem, Mean Value Theorem, Maxima and Minima, Taylor's Theorem, Power series, Riemann Integral, Fundamental Theorem of Calculus, Application of Riemann Integrals to length, area, volume and surface area of revolution. **13+03**

#### **Module III: Linear Algebra I**

System of linear equations,  $\mathbb{R}^n$  as a vector space and its subspaces, Spanning set, Linear independence, basis and dimension, range space and null spaces of matrices, rank, nullity, inverse and determinant of matrices, elementary transformations, inner products of vectors in  $\mathbb{R}^n$ , orthogonality, orthonormal sets and bases, Hermitian, Skew-Hermitian, Orthogonal matrices.

**10+03**

#### **Module IV: Linear Algebra II**

Eigenvalues and eigenvectors, minimal and characteristic polynomial, diagonalizability, Cayley-Hamilton Theorem, quadratic form, reduction of a quadratic form into its normal form, vector spaces, subspaces of vector spaces, linear dependence and independence of vectors, linear span, basis and dimension of a vector space, linear transformations. **11+03**

#### **Text Books:**

1. Robert Bartle & Donald Sherbert, Introduction to Real Analysis, John Wiley & Sons(2014).

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

2. G. B. Thomas, Jr. and R.L. Finney, Calculus and Analytic Geometry, 9<sup>th</sup> edn., Pearson Education India, 1996.
3. G. Strang, Linear Algebra and Its Applications, 4<sup>th</sup> edn. Brooks/Cole India, 2006.

## Reference Books:

1. S. R. Ghorpade and B.V. Limaye, An Introduction to Calculus and Real Analysis, Springer India, 2006.
2. Hoffman K & Kunze R, Linear Algebra, Prentice Hall of India, New Delhi (1971).

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: CY 11101

L-T-P-C

Course Title: CHEMISTRY

3-0-0-3

## Module 1: Chemical Bonding

LCAO-MO methods in homo and heteronuclear diatomic molecules, VSEPR theory, hybridization, Walsh diagram, Bent's rule, structure and reactivity of covalently bonded molecules Bonding in Coordination Complexes: Crystal-Field theory, d-orbital Splitting in Octahedral, Tetrahedral, Square Planar geometries; Molecular Orbital Theory, Electronic Spectra: Selection Rules, d-d transitions, charge-transfer spectra. **07**

## Module 2: Spectroscopy

Electromagnetic spectrum, Quantization of energy, Born-Oppenheimer approximation, Franck Condon Principle, Vibrational spectra (IR) of diatomic molecule; Electronic spectroscopy, Lambert-Beer's Law, Applications in quantitative analysis. NMR Spectroscopy: Basic principles, concept of chemical shift, spin-spin splitting etc. Basics of mass spectrometry. Determination of structures of small molecules by UV, IR, NMR, MS spectra. **08**

## Module 3: Fuels

Introduction to fuels, Properties of liquid fuels (Flash point, Pour point, specific heat, calorific value, Ash content etc.), Storage of fuel oil; Properties of coal, origin, types, proximate & ultimate analysis of coal; Crude petroleum & gaseous fuels. Anti-knocking agents, octane number, cetane number, Aviation fuel, Biodiesel. **06**

## Module 4: Electrochemistry

Concepts of electrode potentials, Nernst equation, Reference electrodes, Ion selective electrodes, Determination of pH of a solution by glass electrode, Derivation of equation between  $E_{\text{cell}}$  & pH, Electrochemistry of secondary cells e.g., Lead-acid & Ni-Cd cells, Rechargeable lithium batteries, fuel cell-Electrochemistry of  $\text{H}_2\text{-O}_2$  fuel cell, methanol- $\text{O}_2$  fuel cell. **07**

## Module 5: Nanomaterials

Introduction, Chemical synthesis of nanomaterials; sol-gel method, Reverse micellar method, electrolytic method, Characterization of nanoparticles by BET method, characterization of

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

nanomaterials by TEM, Applications of nanomaterials in Industry (e.g., Drug delivery, catalysis, solar cells etc.) **08**

## **Module 6: Polymer**

Introduction, types of polymerization, classification of polymers based on chain characteristics, source, method of synthesis and molecular forces involved, mechanism of polymerization reaction: cationic, anionic and catalytic polymerization; glass transition & crystalline melting point temperatures. Preparation, properties & uses of the following – Polyethylene, PVC, Polystyrene, PAN, Teflon, Nylon-6,6, polyester; Rubber-monomer, structure, compounding of rubber, vulcanization, synthetic rubbers- Buna-S, Buna-N, neoprene, butyl rubber & polyurethanes. **06**

### **Readings:**

1. P.C. Jain & M. Jain, "Engineering Chemistry", S. Chand & Co. Ltd.
2. Shashi Chawla, 'A Text Book of Engineering Chemistry', 3<sup>rd</sup> Edition, Dhanpat Rai & Co, New Delhi, 2007.
3. S. Vairam, P. Kalyani & Suba Ramesh, "Engineering Chemistry", 1<sup>st</sup> Edition, John Willey & Sons, India, 2011.
4. B.K. Sharma, "Engineering Chemistry", Krishna Prakashan Media (P) Ltd.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: CY 11201**

**L-T-P-C**

**Course Title: CHEMISTRY LABORATORY**

**0-0-3-2**

1. Determination of total hardness of water.
2. Alkaline hydrolysis of benzamide to benzoic acid
3. Determine the alkalinity of a given water sample
4. Conductometric titration of HCl Vs NaOH find the strength of HCl
5. Estimation of Fe (II) IN Mohr's Salt Solution using standard  $K_2Cr_2O_7$  Solution.
6. Estimation of Fe (II) IN Mohr's Salt Solution using standard  $KMnO_4$  Solution.
7. Estimation of sodium carbonate and sodium bicarbonate in a given mixture.
8. pH Measurements and Preparation of Buffers.
9. Separation of biomolecules (eg chlorophyll) by paper chromatography

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: EE11101

L-T-P-C

Course Title: BASIC ELECTRICAL SCIENCE

3-0-0-3

## Module 1

### Two Terminal Element Relationships

**Inductance** - Faraday's law of electromagnetic induction, Lenz's law, self and mutual inductance, inductances in series and parallel, mutual flux and leakage flux; **Capacitance** - electrostatics-capacitance, parallel plate capacitor, capacitors in series and parallel, energy stored in electrostatic fields,  $v-i$  relationship for inductance and capacitance,  $v-i$  relationship for independent voltage and current sources; **Magnetic Circuits** - MMF, magnetic flux, and reluctance, energy stored in a magnetic field, solution of magnetic circuits; **Resistive Circuits** - solution of resistive circuits with independent sources, node analysis and mesh analysis, source transformation; **Circuit Theorems** - superposition theorem, KCL, KVL, Thevenin's theorem, Norton's theorem, maximum power transfer theorem; linear dependent sources - VCVS, VCCS, CCVS and CCCS. 16

## Module 2

*Semiconductor diode* - principle, characteristics, applications; rectifier circuits, Zener diode, LED, photo diode, IR diode; *Bipolar Junction Transistor* - principle, operation, characteristics (CB, CE, CC), principle of working of CE, CB and CC amplifiers, Transistor as a switch – switching delays, inverter operation; principle of operation of lead-acid batteries, areas of application of Lead-acid batteries and application requirements – in UPS, DG Sets, Automobiles, Emergency lamps, Solar Power Systems etc.

Digital Electronics - Number Systems and Conversions- Logic Gates and Truth Tables – Boolean Algebra; Basics of voltmeter, ammeter, wattmeter, multimeter, and energy meter; Measurement of Voltage, Current, and Resistance; introduction to oscilloscope 12

## Module 3

Structure and components of an electrical energy system – generation, transmission, distribution and utilisation overview, DC power versus AC power, DC transmission versus AC transmission; **Single phase A.C. circuits** - alternating quantities, average value, form and peak factors for square, triangle, trapezoidal, and sinusoidal waveforms, phasor representation of sinusoidal quantities, phase difference, addition and subtraction of sinusoids, symbolic representation -

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Cartesian, polar and exponential forms, analysis of A.C. R, RL, RC, RLC circuits using phasor concept, concept of impedance, admittance, conductance and susceptance, power in single phase circuits – instantaneous power, average power, active power, reactive power, apparent power, power factor, complex power, solution of series, parallel and series-parallel A.C. circuits; **Three phase A.C. circuits** - phase sequence, star delta transformation, balanced three phase A.C. source supplying balanced three phase star connected and delta connected loads, measurement of power in a three phase system. **14**

## References:

- 1 A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.
- 2 A. Chakrabarti and S. Nath, Basic Electrical and Electronics Engineering, Tata McGraw - Hill Education.
- 3 J. W. Nilsson and S. Riedel, Electric Circuits, Pearson.
- 4 R. L. Boylestead and L. Nashelsky, Electronic Devices and Circuit Theory, Pearson.
- 5 M. M. Mano and M. D. Ciletti, Digital Design, Pearson.
- 6 E. W. Golding and F. C. Widdis, Electrical Measurements and Measuring Instruments, Wheeler.
- 7 C. S. Rangan, G. R. Sarma, and V. S. V. Mani, Instrumentation Devices and Systems, McGraw-Hill.
- 8 K. S. S. Kumar, Electric Circuits and Networks, Pearson.
- 9 A. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: ZZ 11202

L-T-P-C

Course Title: WORKSHOP PRACTICE- II

0-0-3-2

## **PART I (Electrical and Electronics Engineering)**

1. a) To identify different types of cables/wires and switches and usage of those.  
b) Familiarization of wiring tools, lighting and wiring accessories, various types of wiring systems; e.g. cleat wiring, casing, and capping etc.
2. a) Familiarization of electronic components' colour code.  
b) Assembling of a given circuit on a bread board.  
c) Study of soldering components, solders, tools, heat sink.  
d) Complete one given circuit using PCB; e.g. doorbell/LED flasher.
3. a) Wiring of one lamp/CFL/tube light controlled by one switch.  
b) Wiring of one lamp/CFL/tube light controlled by two SPDT switch.  
c) Assembling of CFL and tube light.
4. a) Study of electric shock phenomenon and preventions.  
b) Earthing and its construction.
5. a) Familiarization with types of fuses; e.g. MCB, ELCB.  
b) Wiring of fluorescent lamp controlled by one switch from panel with ELCB and MCB.
6. a) Indian Electricity rules: electric symbols.  
b) Study of estimation and costing of wiring.
7. Familiarization with ammeter, voltmeter, wattmeter, and multi-meter.
8. Familiarization with single phase and three phase energy meters.
9. Wiring of multi-pin extension board.
10. Familiarization with domestic appliances; e.g. mixer machine, electric iron, fan motor, pump motor, battery.
11. Wiring of backup power supply; e.g. inverter for domestic installations.

## **PART II (Electronics and Communication Engineering)**

1. Familiarization with Electronic components such as Resistors, Capacitors, Diodes, Transistors etc.  
(a) Colour Coding, Identification of terminals in Diodes etc.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

2. Familiarization with electronic devices and measuring equipments like Cathode Ray Oscilloscope, Digital Storage Oscilloscope, Function Generator, DC power supply, Multimeter etc.
  - (a) Study of measurement of waveform characteristics like Amplitude, Frequency etc. in Oscilloscope.
  - (b) Study of measurement of various parameters like Voltage, Current, Frequency, Continuity, Resistance etc. using Multimeter.
3. Study of Testing of different kinds of Active and Passive Components using Multimeter.
4. Familiarization with basics of Digital Electronics
  - (a) Basic Gates-Logical diagram, Truth table etc
  - (b) Universal Gates- Logical diagram, Truth table etc.
5. Familiarization with Soldering and Desoldering using a circuit.
  - (a) Breadboard Assembling- RC Coupled Amplifier.
6. (a) Study of V-I characteristics of P-N Junction Diode.
  - (b) Study of V-I characteristics of Zener Diode.

## References:

1. K. B. Raina and S. K. Bhattacharya, Electrical Design Estimating and Costing, New Age International Publishers, New Delhi.
2. S. L. Uppal, Electrical Wiring, Estimating and Costing, Khanna Publishers.
3. J. H. Watt and T. Croft, American Electricians' Handbook: A Reference Book for the Practical Electrical Man, McGraw-Hill.
4. G. R. Slone, Tab Electronics Guide to Understanding Electricity and Electronics, McGraw-Hill.
5. J. C. Whitaker, The Resource Handbook of Electronics, CRC Press.
6. Electronic Devices and Circuit Theory, Robert L. Boylestad
7. J. C. Whitaker, The Resource Handbook of Electronics, CRC Press.
8. Millman & Halkias: Electronic Devices & Circuits, MGH, 2007

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: ME 11201**

**L-T-P-C**

**Course Title: ENGINEERING GRAPHICS**

**1-0-3-3**

**Introduction:** Overview of the course, Examination and Evaluation patterns.

**Lines Lettering and Dimensioning:** Types of lines, Copying, Lettering, Dimensioning, Geometrical Constructions, Polygons, Scales, and Curves.

**Orthographic projection:** Principles of Orthographic projection, Projections of points, Straight Lines and traces, Projections of Laminas, Projections of Solids.

**Development of Surfaces:** Draw the development of surfaces for Prisms, Cylinders, Pyramids and Cones.

**Section of Solids:** Sectional planes, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section. Development of truncated objects.

**Isometric views:** Isometric axis, Isometric Planes, Isometric View, Isometric projection, Isometric views.

**Auto-CAD practice:** Introduction to Auto-CAD, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES tool bar, Standard Tool bar, LAYERS, Assignment on basic objects.

## **Text books:**

1. Bhatt N. D, Elementary Engineering Drawing, Charotar Publishing House, Anand, 2002

## **References:**

- 1 Narayana K L & Kannaiah P, Engineering Graphics, Tata McGraw Hill, New Delhi, 1992
- 2 Luzadder W J, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2001
- 3 Venugopal K, Engineering Drawing & Graphics, New Age International Pvt. Ltd., New Delhi, 1994

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: BT 11101**

**L-T-P-C**

**Course Title: INTRODUCTION TO LIFE SCIENCES**

**2-0-0-2**

**Prerequisite:** Nil

## **Module 1: Origin of life and Evolution**

Origin and evolution of life, Theories for origin of life - Primordial soup theory, Miller-Urey experiment, Theory of Biogenesis: Louis Pasteur experiment, Darwinian selection, Oparin - Haldane Hypothesis, Embryonic development: A brief introduction **06**

## **Module 2: Biology of cell and basic genetics**

Classification of life: Prokaryotes, Eukaryotes, Achaea, Membrane bi-layer and transport, Concept of Bio-energetics, Functions of different organelles in the cells, Mitosis and Meiosis, Classical genetics, Mendel's laws of inheritance-Law of segregation and law of independent assortment. **08**

## **Module 3: Biomolecules and central dogma**

Structure and function of biomolecules-DNA, RNA, Carbohydrates, Lipids, Proteins, Functions of biomolecular, A brief introduction to replication, transcription, translation and gene expression and metabolism, cellular respiration. **08**

## **Module 4: Basic techniques in Biology**

Basic concepts of various microscopy, Gel electrophoresis, Centrifugation technique: Svedberg coefficient and application, Recent advances in Biological Sciences: Biomedical devices, Break through research in biology (Nobel prize winning works) **06**

### **Text books:**

1. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, 4th Edn, WH Freeman and Company, 2005.
2. J.M. Berg, J.L. Tymoczko, and L. Stryer, Biochemistry, 6th Edn., WH Freeman and Company, 2007.
3. B. Alberts, A. Johnson, J. Lewis, and M. Raff, Molecular Biology of the Cell, 5<sup>th</sup> Edn., Garland Science, 2008.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

## Reference books:

M.J. Pelczar, E.C.S. Chan, and N.R. Krieg, Microbiology, 5th Edn., McGraw-Hill, 2007.

H. Lodish, A. Berk, C. A. Kaiser, and M. Krieger, Molecular Cell Biology, 6<sup>th</sup> Edn., W. H. Freeman, 2007.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

## II SEMESTER

**Course Code: PH 12101**

**L-T-P-C**

**Course Title: PHYSICS**

**3-0-0-3**

**Mechanics:** Simple Harmonic Motion, Damped and forced oscillation; Resonance, Coupled oscillations, Normal modes. **06**

**Waves: Longitudinal and Transverse waves,** standing waves, phase velocity, Superposition of wave packets and group velocity, basic idea of E-M waves; Interference: Young's Experiments, Newton's ring; Diffraction: Fraunhofer and Fresnel Diffraction, Fraunhofer by rectangular and circular aperture. Resolution of microscope and telescope. Diffraction grating; Polarization: Plane and circular polarization and its application; Acoustics: Reverberation, reverberation-time, acoustic of building. **10**

**Special theory relativity:** Frames of reference, Galilean Relativity, Michelson-Morley experiment, postulates of Special Theory of Relativity, simultaneity, length contraction, time dilation, twin paradox, velocity addition, mass energy relation. **04**

**Modern Physics:** Failure of Classical Mechanics, Black body radiation and Planck's law. Photoelectric effect, Compton effect, Wave particle duality, de Broglie hypothesis and matter wave, uncertainty principle and its applications, wave function, expectation values, normalization of wave function; Schrödinger equation: time-independent Schrödinger equation and its applications to some simple potential problems. **16**

**Applications to materials:** Semiconductors, Fermi energy, doping of semiconductor, conductivity and mobility of electrons, Hall Effect; Magnetism: dipole moments, paramagnetism, diamagnetism, Curie's law, magnetization and hysteresis, Ferromagnetism and anti-ferromagnetism and ferrimagnetism; Basics of nano-technology. Basic of laser **06**

### **Reference:**

1. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, Mc Graw Hill Education; Seventh edition (1st March, 2015)
2. Robert Eisberg and Robert Resnick, Quantum Physics of atoms, Molecules, Solids, Nuclei and Particles, Wiley; 2 edition (2010)

# **NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM**

3. B. G. Streetman and S.K Banerjee, Solid state electronic devices, Prentice Hall India Learning Private Limited; 6 edition (2006)
4. N.K. Bajaj, The Physics of Waves and Oscillations, McGraw Hill Education; 1 edition (6th April, 2001)
5. A. R Ganesan and Eugene Hecht, Optics, Pearson Education; 4 edition (2008)
6. Ajay Ghatak, Optics, McGraw Hill Education India Private Limited; Sixth edition (1st August, 2016)
7. J. Griffiths David, Introduction to Quantum Mechanics, Pearson Education; Second edition (28th May, 2015)

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: PH 12201

L-T-P-C

Course Title: PHYSICS LABORATORY

0-0-3-2

## LIST OF EXPERIMENTS:

1. To determine the band gap energy and the resistivity of semiconductor by Four Probe Method.
2. To calculate the Hall Coefficient, Carrier Density, Carrier Mobility of the sample material.
3. Determination of the radius of curvature of the lower surface of a plano-convex lens by using Newton's Ring apparatus.
4. Measurement of Susceptibility of a liquid or a solution by Quincke's Method.
5. Determination of Planck's constant by using LED.
6. Measurement of Magnetoresistance of Semiconductors.
7. To study the forward and reverse characteristics of a p-n junction and zener diode.
8. To calculate the coercivity, saturation magnetization, retentivity of a sample by using Hysteresis Loop Tracer.
9.
  - i) To study the shape of the laser beam cross section and to evaluate beam spot size.
  - ii) To find the divergence angle of laser beam.
  - iii) To study the polarizing nature of laser.
10.
  - i) To study the variation of magnetic field with distance along the axis of a circular current carrying coil and to calculate diameter of the coil.
  - ii) To study the principle of superposition of magnetic field and in particular to study the axial variation of the magnetic field due to both the coils when the distance between them is
    - a) Less than the radius of the coils.
    - b) Equal to it.
    - c) More than it.

**Reference:** Please follow the manual book of the certain experiment.

## LIST OF PROPOSED EXPERIMENTS:

To measure slit-width and the separation between two slits of double slit, by observing diffraction and interference fringes and to compare them by microscopic measurement.

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Determination of the number of rulings per unit length of a given plane diffraction grating and then to find out the wave-lengths of given unknown lines.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: MA 12101

L-T-P-C

Course Title: MATHEMATICS – II

3-1-0-4

## Module I: Vector Calculus-I

Functions from  $\mathbb{R}^n$  to  $\mathbb{R}^m$ , Continuity and Differentiability, Curves, Tangents, Arc length, Curvature. **05+02**

## Module II: Vector Calculus-II

Functions from  $\mathbb{R}^n$  to  $\mathbb{R}^m$ , Continuity, Partial derivatives, Directional derivatives, Gradient, Differentiability, Divergence and curl, Taylor's theorem, Chain rule, Tangent plane and normal line, maxima and minima, Lagrange multipliers method. **10+04**

## Module III: Integration in Multivariable Calculus

Line Integrals, Double integrals, Surface integrals, Triple Integrals, Green's Theorem, Vector fields, Path independence of line integrals, Fundamental theorems of integral calculus for line integrals, Gauss' Divergence Theorem and Stokes Theorem. **10+04**

## Module IV: Ordinary Differential Equations

First order ordinary differential equations, Methods of solution, Existence and uniqueness of solution, Orthogonal Trajectories, Applications of first order differential equations. Linear higher order equations: Homogeneous and nonhomogeneous linear equations and their methods of solutions, operator method, fundamental system of solutions, Existence and uniqueness conditions, Wronskian, Non homogeneous equations, Applications, system of first order equations, phase plane, critical point and stability. **17+04**

### Text Books:

1. G. B. Thomas Jr. and R. L. Finney, Calculus and Analytic Geometry, 9<sup>th</sup> edition, Pearson Education, India, 1996.
2. T. M. Apostol, Calculus- Vol 2, 2<sup>nd</sup> Edition, Wiley India, 2003.
3. S. L. Ross, Differential Equations, 3<sup>rd</sup> edition, Wiley India, 1984.

### Reference Books:

# **NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM**

1. W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9<sup>th</sup> edn., Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
3. S. R. Ghorpade and B. V. Limaye, An Introduction to Multivariable Calculus and Analysis, Springer India, 2010.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: CS 12101

L-T-P-C

Course Title: COMPUTER PROGRAMMING

3-0-0-3

## Module 1: Fundamentals of Computer

History of Computer, Classification of Computers, Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices, Binary Arithmetic & logic gates, High level language, compiler and assembler (basic concepts), Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart.

## Module 2: Fundamentals of C

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements; Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation; Input and Output: Standard input and output, formatted output -- printf, formatted input scanf.

## Module 3: Flow of Control, Functions

Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels; Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments.

## Module 4: Array, Pointer, Structures, Union, Files

One dimensional arrays, pointers and functions, multidimensional arrays; Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files.

### Text Books:

1. V. Rajaraman, Fundamental of Computers, PHI
2. E. Balaguruswamy, Programming in C, TMH
3. Y. Kanetkar, Let us C, BPB

# **NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM**

## **Reference Books:**

B. W. Kernighan and D. M. Ritchie, C Programming Language, 2nd Edition.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: CS 12201**

**L-T-P-C**

**Course Title: COMPUTER PROGRAMMING LABORATORY**

**0-0-3-2**

## **Module 1**

DOS System commands and Editors (Preliminaries) UNIX system commands and *vi* (Preliminaries)

## **Module 2**

Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number, generate Pascal's triangle, find roots of a quadratic equation

## **Module 3**

Programs to demonstrate control structure: text processing, use of break and continue, etc. Programs involving functions and recursion

## **Module 4**

Programs involving the use of arrays with subscripts and pointers and **dynamic memory allocation**, Programs using structures and files.

## **Text Book:**

C Programming Language (2nd Edition By B. W. Kernighan & D. M. Ritchie)

## **Reference Books:**

E. Balaguruswamy, Programming in C, TMH

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: ME 12101

L-T-P-C

Course Title: ENGINEERING MECHANICS

3-0-0-3

**Introduction:** Concept of force, force system, Fundamental laws and principles, principle of transmissibility, particle, rigid body, accuracy limit and approximations.

**Coplanar Concurrent Force System:** Resultant of a force system, graphical principles- parallelogram law, triangle law, polygon rule, analytical method, conditions of equilibrium, space diagram and free body diagrams, Lami's theorem.

**Coplanar Non-Concurrent Force System:** Moment of a force, Varignon's theorem, couple, properties of couples, resultant of non-concurrent force system, conditions of equilibrium, equilibrant, equilibrium of two-force system and three-force system, types of supports, types of loads.

**Concept of Friction:** Laws of dry friction, angle of friction, coefficient of friction, belt friction. Problems related to equilibrium of coplanar force system with friction, ladder problems, belt friction problems.

**Centroids and Second Moment of Areas:**

(a) *Centroid:* Definition of centre of gravity, centroid of area, centroid of line, concept of line of symmetry, location of centroid by direct integration of rectangular, triangular, semi-circular and quarter circular areas, centroid of composite areas.

(b) *Second Moment of Area:* Definition, parallel axis theorem, polar moment of area, radius of gyration, second moment of area by direct integration of a rectangular, triangular, circular, semi-circular and quarter-circular area. Second moment of composite area.

**Kinematics:** Definition of kinematics, kinetics, displacement, velocity, acceleration, relationship between them, problems involving variable acceleration, equations of motion under constant acceleration, motion under gravity, projectile motion.

**Application of Newton's Second Law:** Newton's second law, definition of unit force, problems of rectilinear motion, motion of connected bodies.

**Application of Work-Energy Principle:** Definition of work, energy, power, efficiency, derivation of work-energy equation, problems of rectilinear motion, motion of connected bodies.

**Application of Impulse-Momentum Equation:** Definition of linear momentum, impulse, derivation of impulse-momentum equation, conservation of linear momentum, problems related to rectilinear motion, motion of connected bodies, conservation of momentum.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

## **Text Books:**

I. H. Shames, Engineering Mechanics—Statics and Dynamics, 4<sup>th</sup> Edition, Prentice Hall of India, 1996.

## **Reference Books:**

1. F.P. Beer and E.R. Johnston, *Vector Mechanics for Engineers – Statics*, McGraw Hill Book Company, 2000.
2. J.L. Meriam and L.G. Kraige, *Engineering Mechanics – Statics*, John Wiley & Sons, 2002.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: ZZ 12201**

**L-T-P-C**

**Course Title: WORKSHOP PRACTICE I**

**0-0-3-2**

*The course is intended to expose the student to the manufacturing processes through hands on training in the sections of Workshop. After the course, the student acquires the skill in using various tools, measuring devices, and learns the properties of different materials at varying conditions.*

- 1) **Carpentry:** Study of tools and joints – planing, chiseling, marking and sawing practice, one typical joint- Tee halving/Mortise and Tenon/ Dovetail
- 2) **Fitting:** Study of tools- chipping, filing, cutting, drilling, tapping, about male and female joints, stepped joints- one simple exercise of single V joint for welding exercise.
- 3) **Welding:** Study of arc and gas welding, accessories, joint preparation, Exercise of a single V Joint.
- 4) **Smithy/Foundry:** Study of tools, forging of square or hexagonal prism/ chisel/bolt/ Study of tools, sand preparation, moulding practice.
- 5) **Sheet Metal work:** Study of tools, selection of different gauge sheets, types of joints, fabrication of a tray or a funnel
- 6) **Lathe Exercise:** Study of the basic lathe operations, a simple step turning exercise.
- 7) **Plumbing Practice:** Study of tools, study of pipe fittings, pipe joints, cutting, and threading
- 8) **Surveying/Masonry:** Introduction to land surveying and linear measurements/ English bond – Flemish bond –wall –junction – one brick – one and a half brick -Arch construction.

## **References:**

1. Chapman W.A.J., Workshop Technology. Parts 1 & 2, 4th Edition, Viva Books P. Ltd., New Delhi, 2002
2. Hajra Choudhury. Workshop Technology Vol 1 & 2, Media Promoters & Publishers P.Ltd, Bombay, 2004
3. Welding Handbook. Miami, American Welding Society, 2000
4. Metals Handbook. Vol 6, Welding, Brazing & Soldering. Metals Park, Ohio, American Society of Metals, 1998
5. Handbook of Civil Engineering by V.N. Vazirani & S.P. Chandola, Khanna Publishers.
6. Standard Handbook for Civil Engineers by Jonathan T. Ricketts, M. Kent Loftin, Frederick S. Merritt **Publisher:** McGraw-Hill: New York

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

Course Code: HS 12101

L-T-P-C

Course Title: English Language & Composition

2-0-0-2

- 1. Basics of English Language:** Synonyms, Antonyms and Words often confused, One word substitution, Idioms and phrases, Article and Adjectives, Pronoun, Preposition, Verb, Tense and ConCORDs. **08**
- 2. Essays:** **1.** *Of Studies* by Francis Bacon, **2.** *On Doing Nothing* by JB Priestley, **3.** *In Defense of Ignorance* by AG Gardiner, **4.** *English in India* by R. K. Narayan **08**
- 3. English in Use:** **1.** *Ulysses* by A.L. Tennyson **2.** *Goodbye Party for Miss Pushpa T.S.* by Nissim Ezekiel **3.** *Where the Mind is Without Fear* by Rabindranath Tagore **4.** *Stopping by Woods on a Snowy Evening* by Robert Frost  
*Language through Audio/Visual*  
*Wings of Fire:* A.P.J. Abdul Kalam **12**

## Essential Readings:

1. Wood, F.T. *A Remedial English Grammar for Foreign Students*. Macmillan.
2. Pleasures of Reading: An Anthology of Poems, Orient Longman.
3. Selected Essays and Short Stories, Oxford University Press.
4. Selected Poems, Oxford University Press.

## Suggested Readings:

1. Swan, Michael. *Practical English Usages*. Oxford University Press.

# NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM

**Course Code: HS 12102**

**L-T-P-C**

**Course Title: Professional Ethics & Value Education**

**1-0-0-1**

## **UNIT 1: Course Introduction**

Understanding the need, basic guidelines, content and process for Value Education; Self Exploration–what is it? its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration;. Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfill the above human aspirations: understanding and living in harmony at various levels

## **UNIT 2: Understanding Harmony in the Human Being**

Harmony in Myself; Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’; Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha; Understanding the Body as an instrument of ‘I’; Understanding the characteristics and activities of ‘I’ and harmony in ‘I’; Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Swasthya - Practice Exercises and Case Studies will be taken up in Practice Sessions.

## **UNIT 3: Understanding Harmony in the Family and Society**

Harmony in Human Relationship; Understanding Harmony in the family – the basic unit of human interaction; Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship; Understanding the meaning of Vishwas; Difference between intention and competence; Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided

# **NATIONAL INSTITUTE OF TECHNOLOGY SIKKIM**

Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family - Practice Exercises and Case Studies will be taken up in Practice Sessions.

## **References:**

1. The text book R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
2. The teacher's manual R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010