B.Tech. Program: 1st Year Curriculum (Common to all branches of studies)

1.1. Course Structure:

Semester	Course Code	Course	L	T	P	C	Course Category
Sem. - I	**MA101**	Mathematics-I (Linear Algebra and Matrices)	3	1	0	4	MS
	PH100 / PH110	Mechanics and Thermodynamics / Waves and Electromagnetics	3	1	0	4	SC
	PH160 / PH170	Mechanics and Thermodynamics Laboratory / Waves and Electromagnetics Laboratory	0	0	2	1	SC
	IT101	Computer Programming and Problem Solving	3	0	0	3	OC
	IT161	Computer Programming and Problem Solving Laboratory	0	0	3	2	OC
	EC100 / EE 100	Basic Electronic Circuits / Basic Electrical Engineering	3	1	0	4	PC
	EC160 / EE160	Basic Electronic Circuits Laboratory / Basic Electrical Engineering Laboratory	0	0	3	2	PC
	HS101	Spoken and Written Communication	2	0	2	3	HS
	Semester - I : Total		**14**	**3**	**10**	**23**	
Sem. - II	**MA102 / MA104**	Mathematics-II (Calculus / Discrete Mathematics)	3	1	0	4	MS
	PH110 / PH100	Waves and Electromagnetics / Mechanics and Thermodynamics	3	1	0	4	SC
	PH170 / PH160	Waves and Electromagnetics Laboratory / Mechanics and Thermodynamics Laboratory	0	0	2	1	SC
	EE100 / EC100	Basic Electrical Engineering / Basic Electronic Circuits	3	1	0	4	OC
	EE160 / EC160	Basic Electrical Engineering Laboratory / Basic Electronic Circuits Laboratory	0	0	3	2	OC
	CS102	Introduction to Data Structures	3	0	0	3	OC
	CS162	Introduction to Data Structures Laboratory	0	1	2	2	OC
	HS102	Science Technology and Society	3	0	0	3	HS
	Semester - II : Total		**15**	**4**	**7**	**23**	
Year - I : Total			**29**	**7**	**17**	**46**	

1.2. Course Contents:

1.2.1. MA 101: Mathematics-I (Linear Algebra and Matrices) (3-1-0:4)

Course Description: This core course aims at introducing students to the fundamental concepts of linear algebra culminating in abstract vector spaces and linear transformations. The course starts with systems of linear equations, matrices, matrix algebra, eigenvalues and eigenvectors. The course then goes on to introduce some basic concepts of the theory of vector spaces in the concrete setting of real n dimensional vector space and linear transformations. At the end, numerical methods are introduced to apply the theory to real life problems. The subject material is of vital importance in all fields of mathematics and sciences in general.

Course objective: Students will be able to apply the concepts and methods described in the syllabus and solve problems using linear algebra.

Course Contents:

Unit 1: Matrices and Linear systems **[12 hrs.]**

Matrix operations(addition, multiplication), Block-Partitioned Matrices and Block Operations, Elementary Row and Column Operations, Determinant of a Square Matrix, Properties of the Determinant Function , Cofactor Expansion, Rank of a Matrix, The System of Linear Equations: Ax=b

Unit 2: Canonical Factorizations: **[12 hrs.]**

Eigenvalues and Eigenvectors, Companion Matrices and Characteristic Polynomial, Method of Danilevsky for Characteristic Polynomial, diagonalization-Matrices with a Full-Set of Eigenvectors, The Cayley-Hamilton Theorem, Triangulization and Unitary Diagonalization of a Matrix, Schur's Lemma and the Spectral Theorem, QR-Decomposition, QR-Algorithm for Hessenberg Matrices, Singular Value Decomposition.

Unit 3: Vector Spaces **[12 hrs.]**

Vector Space over the set real numbers (Field), Linear Independence of Vectors, Bases in a Vector Space, Dimension of a Vector Space, Direct Sum Decomposition of a Vector Space, Linear Transformations, Change of Bases, Canonical forms, Rank of a Linear Transformation.

Unit 4: Numerical methods **[6 hrs.]**

Iterative methods (Jacobi, Gauss-Seidel, Relaxation) for solving linear systems, computing of eigenvalues and eigenvectors.

Text Book:

1. *Introduction to Linear Algebra*, Gilbert Strang, 5th Ed, SIAM, 2016.

References:

1. *Linear Algebra*, Kunze Ray, Hoffman Kenneth 2nd Ed, Phi Learning, 2014.
2. *Fundamentals of Matrix Computations*, David S. Watkins, 3rd ed, Wiley.

1.2.2. PH100: Mechanics and Thermodynamics (3-1-0:4)

Course Description: This course provides engineering students with important foundational knowledge about mechanics, and thermodynamics and its application to common engineering systems. The course also includes weekly small-group problem-solving tutorial session.

Course Learning Outcomes: On successful completion of this course, students should be able to:

- demonstrate knowledge of the physical principles that describe mechanics, materials, heat transfer, and thermodynamics;
- apply physical principles to common physical systems;
- use the methods of algebra, vectors and calculus to make quantitative and qualitative predictions about the behavior of physical systems and
- associate the correct unit with every physical quantity they use.

Course Contents:

Unit-I: Mechanics [30 hrs.]

Review of Newtonian Mechanics- Vectors and their time derivatives, Inertial and non-inertial frames of reference, Centrifugal and Coriolis forces; Work-Energy Theorem; Conservation Principles, Collision problem in laboratory and centre of mass frame, Motion under Central Force and its universal features, Oscillatory Motion-Free, Damped and Driven.

Introduction to Quantum Mechanics- Double-slit experiment, de Broglie's hypothesis. Uncertainty Principle, Wave-Function and Wave-Packets, Phase- and Group-velocities. Schrödinger Equation. Probabilities and Normalization. Expectation values. Eigenvalues and Eigen-functions. Applications of Schrödinger Equation: Particle in a box, Finite Potential well, Harmonic oscillator, Hydrogen Atom problem.

Unit-II: Thermodynamics [12 hrs.]

Temperature and Zeroth Law of Thermodynamics, Work, Heat and First Law of Thermodynamics, Ideal Gas and Heat Capacities, Second Law of Thermodynamics, Carnot Cycle, Entropy, Thermodynamic variables and energies.

Text Books:

1. *An Introduction to Mechanics*; D. Kleppner and R. Kolenkow, Second Edition.*Concepts of Modern Physics*; A. Beiser, Sixth Edition.
2. *Heat and Thermodynamics*; M. W. Zemansky and R. H. Dittman, Seventh Edition.

1.2.3. PH160: Mechanics and Thermodynamics Laboratory (0-0-2:1)

List of Experiments:

S.No.	Experimental Set-up	Key Topics
1.	Study of Motion on Linear Air-Track (Virtually Frictionless Surface)	Constrained linear motion, Newton's Laws, Elastic and Inelastic Collision, Conservation of Momentum and Energy.
2.	Centripetal Force and Moment of Inertia	Centripetal force, Moment of Inertia, Restoring Force, Axis of Rotation, Centre of Gravity, Linear and angular speed.
3.	Study of damped oscillation with spring-mass system	Oscillatory motion, Damped oscillation.
4.	Coupled Pendulum Oscillation	Oscillation with coupled pendulum, Phase difference, Beat, Coupling parameters,
5.	Study of photoelectric effect and determination of Planck's constant.	Particle nature of Light, Photons, Energy Quantization.
6.	Franck Hertz Experiment	Excitation Energy, Electron collision, Energy Levels, Ionization Energy.
7.	Balmer Series and determination of Rydberg constant	Bohr Atomic Model, Visible Spectrum, Energy Levels, Diffraction, Rydberg constant.
8.	Heat capacity of gases	Equation of state for ideal gases, First law of thermodynamics, Degree of freedom, Mole volumes, Isobars, Isotherms, Isochors and adiabatic changes of state.
9.	Specific Heat of Solids	Heat, Specific Heat Capacity, Conservation of Energy, Calorification.
10.	Mechanical Equivalent of Heat	Mechanical equivalent of heat, Mechanical work, Thermal energy, Thermal capacity, First law of thermodynamics, Specific thermal capacity.

1.2.4. PH110: Waves and Electromagnetics (3-1-0:4)

Course Description: The objective of this course is to give an idea how the electromagnetic wave behaves. This also provides an understanding of theories of electrostatics, magnetism and electrodynamics with their applications. The course also includes weekly small-group problem-solving tutorial session.

Course Learning Outcomes: The course will enhance the problem solving capacity of the student.

Course Contents:

Unit 1: Mathematical Foundations [6 hrs.]

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, Continuity equation.

Unit 2: Review of Electrostatics [9 hrs.]

Electrostatics in Vacuum-Discrete and Distributed Charges, Electrostatic Force, Scalar & Vector Potentials, Electrostatic Energy, Poisson and Laplace equation and its applications; Electrostatics in Dielectric Medium-Electric Polarization; Electric Displacement Vector, Dielectric Susceptibility, Energy in Dielectric Medium.

Unit 3: Review of Magnetostatics [9 hrs.]

Magnetic Fields and Forces, Biot-Savart law and Ampere's law, Magnetic Vector Potential, Magnetization-Diamagnetism, Paramagnetism and Ferromagnetism, Ampere's Law in Magnetized Materials-Auxiliary Field H, Magnetic permeability and susceptibility.

Unit 4: Review of Electrodynamics [9 hrs.]

Electromotive force, Time-varying fields, Faraday's' law of electromagnetic induction, Self and Mutual Inductance, Displacement Current, Maxwell's equations in Free Space & Inside Matter, Energy and Momentum in Electrodynamics.

Unit 5: Electromagnetic Waves [9 hrs.]

Wave equation, Propagation of Electromagnetic waves in Free Space and in Conducting Medium-Reflection and Refraction, Transmission and Dispersion.

Textbook:

1. *Introduction to Electrodynamics*, Griffiths. D. J, Prentice Hall, 2007.

References:

1. W. H. Hayt and J. A. Buck, *Engineering Electromagnetics*, Tata McGraw Hill Education Pvt. Ltd, 2006.
2. Purcell. E.M, *Electricity and Magnetism*, Berkley Physics Course, V2, Tata McGraw Hill, 2008.
3. Feynman. R.P, Leighton. R.B, Sands. M, *The Feynman Lectures on Physics*, Narosa Publishing House, Vol. II, 2008. Hill, 2008.

4. G. B. Arfken, H. J. Weber and F. E. Harris, *Mathematical Methods for Physicists*, Academic Press, 2013.

1.2.5. PH170: Waves and Electromagnetics Laboratory (0-0-2:1)

List of Experiments:

S.No.	Experimental Set-up	Key Topics
1.	Measurement of elementary charge using Millikan oil drop experiment.	Electric field, Viscosity, Stokes' law, Droplet method Electron charge.
2.	To study electric field lines and equipotential lines.	Electric Field Lines, Equipotential Lines, Surface Potential.
3.	Measurement of Dielectric constant of dielectric materials.	Capacitance, Dielectric Constant, Electric Field in Dielectric Medium, Electric Permittivity of a material.
4.	Magnetic field of paired coils in a Helmholtz arrangement with a Teslameter.	Maxwell's equations, Wire loop, Flat coils, Biot-Savart's law. Earth's magnetic field.
5.	Study of Faraday Law and Induced e.m.f.	Faraday and Lenz Laws, Induced e.m.f., Magnetic flux
6.	Study of Hysteresis in Ferromagnetic Materials.	Induction, Magnetic flux, Coil, Magnetic field strength, Magnetic field of coils, Remanence, Coercive field strength.
7.	Microwave optic system to study properties of electromagnetic waves.	Electromagnetic waves-Reflection, Refraction, Polarization, Interference, Diffraction, Transmission and Reception.
8.	Solar-Cell Trainer kit.	Particle nature of electromagnetic waves, Solar Energy, Electric Energy.
9.	Study of dispersion of light in Prism Spectrometer	Dispersion, Refraction, Refractive Index.
10.	Measurement of Permeability and Permittivity of Air and determination of speed of Light.	Permittivity and Permeability, Electrostatic force, Magnetic Force, Speed of Light.

1.2.6. IT101: Computer Programming and Problem Solving (3-0-0:3)

Course Objectives: To understand computer programming concepts and its roles in problem solving. To understand and develop well-structured programs.

Course contents:

Unit 1: Introduction to Computers

Computer Systems, Computing Environments.

Unit 2: Introduction to Programming

Programming methods, paradigms, problem solving techniques, algorithm development, flow charts, Editor, compiler, debugger, Software development.

Unit 3: Basics of Procedural Programming

Constants, variables, expressions, operators, assignment, basic input and output, built-in functions, program debugging.

Unit 4: Variables and Operators

Basic data types, precedence and order of evaluation, pointers, memory allocation of variables.

Unit 5: Control Structures

Selection statements, iteration statements.

Unit 6: Functions and Program Structure

Return values, actual and formal parameters, parameter passing: call by value versus call by reference, external variables, scope rules, header files, and recursion.

Unit 7: Arrays

Character arrays, one and two dimensional arrays; pointer arrays, command-line arguments.

Unit 8: I/O

ASCII data files, file pointers, end-of-file.

Unit 9: Basic Data Structures

Structures, defining new types, enumerations, dynamic memory allocation, dynamic arrays, linked lists and other pointer-based structures.

Text Book:

1. *C How to Program*, 7th Ed, P Deitel and H Deitel, Prentice Hall of India, 2012.

Reference Books:

1. *C programming language*, 2nd Ed, Kernighan, Brian W. & Ritchie, Dennis M, New Delhi. Prentice Hall of India, 1998.
2. *A Book on C*, 4 th Ed, Kelley, A.L. and Pohl Ira, Pearson India, 2002.
3. *A Structured Programming Approach Using C*, 1st Ed.,Forouzan, Behrouz, Course Technology, 2012.

4. *Practical C Programming*, 3rd Ed, Oualline, Steve, Shroff Publishers, 2000.
5. *C programming: The essentials for engineering and scientists*, Brooks, David R. New York. Springer, 1999.
6. *Programming In ANSI C* by E Balagurusamy.

1.2.7. IT161: Computer Programming and Problem Solving Laboratory (0-0-3:2)

Course Objective:

The purpose of this course is to enhance their analyzing and problem solving skills and use implements a list of programs in C or Python programming language. A possible list of programs are as follows.

Part A (two months):

1. Program to find area and circumference of circle
2. Program to convert temperature from degree centigrade to Fahrenheit.
3. Program to calculate sum of 5 subjects and find percentage.
4. Program to show swap of two no's without using third variable.
5. Program to reverse the digits of a given number.
6. Program to print a table of any number.
7. Program to find greatest in 3 numbers.
8. Program to find that entered year is leap year or not.
9. Program to shift input data by two bits to the left.
10. Program to display arithmetic operator using switch case.
11. Program to print stars Sequences (right triangular, Isosceles triangle, etc.).
12. Program to print Fibonacci series up to 100.
13. Program to find factorial of a number.
14. Program to find whether given no. is a prime no. or not.
15. Program to add two number using pointers.
16. Program to find the largest number in an array.
17. Program for removing the duplicate element in an array.
18. Program to add two matrices.
19. Program to multiply two matrices.
20. Program to find transpose of a matrix.
21. Program to swap two numbers using functions.
22. Program to show call by reference.
23. Program to find whether a string is palindrome or not.

24. Program to find occurrences of vowels, consonants, words, spaces and special characters in the given statement.
25. Program to create enumerated data type for 12 months. Display their values in integer constants.
26. Program for linear and binary search.
27. Program for bubble sort and insertion sort.
28. Program that would sort a list of names in alphabetical order.
29. Program to use (++,--) operator with return value of function.
30. Program to read characters from a text file and print number of vowels, consonants and other characters in the file. Assume that the file will consist of mostly English-language letters.

Part B (one and half months)

A small project is given in groups (at most 4 persons in each group). The objective is to apply knowledge of programming language primitives such as functions, structures and/or files in day today applications.

1.2.8. EC100: Basic Electronic Circuits (3-1-0:4)

Course Contents:

Unit 1: Introduction to Passive Circuit Elements & Sources [2 hrs.]

Resistor, Capacitor, Inductor, Voltage and Current sources, Controlled Sources, Thevenin and Norton Theorem.

Unit 2: Basics of Semiconductors [2 hrs.]

Semiconducting Materials, Intrinsic and Extrinsic Semiconductors, Charge-carrier Density and Distribution, Fermi level.

Unit 3: Diodes [6 hrs.]

p-n Diode, Zener Diode, *I-V* Characteristics, Diode Models, Rectifiers and Voltage Regulators, Clippers and Clampers, Introduction to Special Purpose Diodes: Varactor Diode, LEDs, Solar Cells, Photo-diodes, Tunnel Diode, Schottky Diode.

Unit 4: Bipolar Junction Transistors (BJTs) [10 hrs.]

BJT structure, Basic BJT operation mechanism, Input and Output characteristics of common-emitter configuration, Transistor Bias Circuits-Base Bias, Emitter Bias, Voltage-Divider Bias, Emitter Feedback Bias, Collector Feedback Bias, Emitter-Collector Feedback Bias, ac Models, Voltage Amplifiers, Common Collector and Common Base Amplifiers, Power Amplifiers, and Frequency Response.

Unit 5: Field Effect Transistors [8 hrs.]

JFETs-Device structure, Drain Curves, Transconductance Curve, Biasing Circuits, JFET Amplifiers, MOSFETs-Device structure, Depletion-Mode MOSFET, D-MOSFET Curves, Amplifiers, Enhancement-Mode MOSFET, Digital Switching, CMOS, Power FETs.

Unit 6: Operational Amplifier [8 hrs.]

Differential Amplifiers, Op-Amp pin configuration, Ideal and Practical Characteristics of Op-Amp, Inverting and Non-Inverting Amplifiers, Active Filters, Summing Amplifier, Differential and Integrating Amplifiers, Comparators, Frequency response of an Op-Amp.

Unit 7: Oscillators **[6 hrs.]**

Amplifier with feedback, Condition of harmonic oscillation, Wein Bridge Oscillator, RC Oscillators, Colpitts Oscillators, 555 Timer and Circuits.

Text Books:

1. *Electronic Principles*, 7th Ed, Albert Malvino, and David Bates, Tata McGraw-Hill, 2007.
2. *Electronic Devices*; 9th Edition, Thomas L. Floyd, Pearson.
3. *Op-Amps and Linear Integrated Circuits*, Ramakant A. Gayakward, 4 Edition, Pearson.
4. *Microelectronic Circuits: Theory and Applications,* A.S. Sedra and K.C. Smith, Oxford University Press, Sixth Edition.

1.2.9. EC160: Basic Electronic Circuits Laboratory (0-0-3:2)

The objective of the laboratory is to provide experimental hand-on experiences to the topics covering the course 'Basic Electronic Circuits'. The experiment modules are designed to give students the opportunity to construct circuits and verify theoretical relationships involving diodes, bipolar transistors, small-signal amplifiers and operational amplifiers. The students are expected to compare experimental results with theoretical concepts, speculate reasons for discrepancies, and learn from deductive reasoning. In this lab, students become familiar with making basic electrical measurements using laboratory instruments such as digital multimeters (DMMs), power supplies, function generators and oscilloscopes. By the end of their lab coursework, students should be able to design, assemble, and use basic electronic circuits and have the skills necessary to measure and characterize their designs.

List of experiments:

1. Introduction to circuit elements and basic equipments: Resistors, Capacitors, Inductors, Diodes, Transistors, Oscilloscope, Function generator, Power supply, Cables and Switches.
2. Study of transient- and steady-state response of RC circuits and design RC Filters.
3. Study of current-voltage characteristics of a p-n junction and Zener diode at room temperature.
4. Design a regulated power supply using Zener diode.
5. Study of input and output current-voltage characteristics of *n-p-n* bipolar junction transistors in common-emitter configuration and determine transistor parameters.
6. Design a Common-Emitter Transistor (*n-p-n*) Amplifier Circuit, obtain the frequency response curve of the amplifier and determine the mid-frequency gain, *A*mid, lower and higher cut-off frequency of the amplifier circuit.
7. Design and study Inverting and Non-Inverting Operational Amplifiers.

8. Design two stage RC coupled common emitter transistor (*n-p-n*) amplifier circuit and to study its frequency response curve.
9. Design and study Integrator and Differentiator Operational Amplifier Circuits.
10. Design an Active Low pass Filter Circuit using Op-Amplifier.

References:

1. *Electronic Principles*, 7th Ed., Albert Malvino and David Bates, Tata McGraw-Hill, 2006.
2. *Laboratory Manual*, Basic Electronic Circuits Laboratory, IIIT Vadodara.

1.2.10. EE100: Basic Electrical Engineering (3-1-0:4)

Course Contents:

Unit 1*:* DC Circuits **[8 hrs.]**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Unit 2: AC Circuits **[8 hrs.]**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Unit 3: Transformers **[6 hrs.]**

Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Unit 4: Electrical Machines **[8 hrs.]**

Single-phase induction motor: Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Construction and working of synchronous generators.

Unit 5: Power Systems **[6 hrs.]**

Power generation techniques, Transmission, Distribution, Grid, Cost of Electricity.

Unit 6: Power Converters **[6 hrs.]**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Text / Reference Books:

1. D. P. Kothari and I. J. Nagrath, "*Basic Electrical Engineering*", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "*Basic Electrical Engineering*", McGraw Hill, 2009.
3. L. S. Bobrow, "*Fundamentals of Electrical Engineering*", Oxford University Press, 2011.

4. E. Hughes, "*Electrical and Electronics Tec*hnology", Pearson, 2010.
5. V. D. Toro, "*Electrical Engineering Fundament*als", Prentice Hall India, 1989.

1.2.11. EE160: Basic Electrical Engineering Laboratory (0-0-3:2)

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

1.2.12. HS101: Spoken and Written Communication (2-0-2:3)

Course Contents:

Unit-I:

Course instructor should make the students aware of the elements of communication, the role of English language for effective communication, the process of communication and factors that influence communication (sender, receiver, channel, code, topic, message, context, feedback,

noise, filters & barriers), importance of audience and purpose, the information gap principle, verbal and non-verbal communication: body language, general communication and business communication. An ability to communicate well is a key soft skill. Many other skills depend on good communication skills. By learning the processes involved in communication, the students shall be able to appreciate the importance of good communication skills in becoming a successful professional.

Unit – II:

Course instructor should introduce the students to the science of Articulatory Phonetics. It would be a basic training for mastering English sound system, particularly putting emphasis on British English, as well as basic knowledge on the Phonetics of English language. The focus shall be on IPA (International Phonetic Alphabet) symbols, the anatomy of speech organs, production and organization of speech sounds and phonetic transcriptions. Understanding the phonetics of English shall help students in using dictionaries effectively and pronouncing words correctly.

Unit-III:

Course Instructor should make an optimal use of cinema for increasing the students' familiarity with English. Testing be done on the basis of the student's comprehension of the plot and their ability to describe scenes from the film. Classroom exercise of asking students to comment on the plot or scenes of a given film – not in writing but by standing before the entire class and speaking in English — be frequently carried out. The aim of this unit is to make the student feel confident about her/his ability to form sentence in English for discursive communication.

Unit-IV:

Course Instructor should use audio tapes, Ted Lectures, radio news broadcast or celebrated speeches, etc for exposing the students' to a real time' and good spoken English. Class room tests be set to check the students' ability to respond to their listening experience in writing. This will help the Course Instructor to continually assess the requirements of the students and provide corrective advise. Testing the writing skills of students will require setting several questions of very short composition tasks, from 50 words to 150 words. The topics chosen for the composition tasks should be selected from the topics covered in the classroom discussions or from the life on the campus.

Unit-V:

Students should be provided four to five extended samples of written English such as short stories or newspaper editorials for them to mark their difficulties – words, idioms, sentence structures, etc. This will help the students in improving their ability to do focused reading of serious written literature. Testing of the reading comprehension skills be tested by giving them in advance of the test several passages for reading. The Course Instructor may select one or more of those seen passages' for the examination purpose.

Text Books:

1. *Prism: Spoken and Written Communication*, Prose & Poetry published by Orient Longman, 2008.
2. *Technical Communication: Principles and Practice,* Second Edition by Meenakshi Raman and Sangeeta Sharma, Oxford Publications, 2009.

Books, Essays and Short Stories Recommended:

1. *English and Communication Skills for Students of Science and Engineering*. Dhanavel, S.P. Units 1-5, Chennai: Orient, .Blackswan Ltd., 2009.
2. *Scientific English: A Guide for Scientists and Other Professionals*. 2 nd ed. Day, R A., Hyderabad: Universities Press, 2000.
3. *A Course in Phonetics*, Fifth Edition, Ladefoged, Peter (Harcourt, Brace, Jovanovich: Fort Worth), 2006.
4. Of Ambition- Francis Bacon
5. Of Innovations- Francis Bacon
6. With the Photographer – Stephen Leacock
7. Speech on Indian Independence – Jawaharlal Nehru
8. Socrates and the Schoolmaster – F. L. Brayne
9. The Bet – Anton Chekov
10. An Astrologer‘s Day – R. K. Narayan
11. The Gift of the Magi – O’ Henry
12. The Monkey's Paw- W.W. Jacobs

1.2.13. MA102: Mathematics-II (Calculus) (3-1-0:4)

Course Contents:

Unit 1: Fundamentals

Limits, continuity, differentiability, mean value theorems, and Taylor‘s theorem; fundamental theorem of integral calculus, definite integrals, trapezoidal and Simpson’s rule; sequences and series, tests for convergence: absolute and conditional convergence; power series and radius of convergence.

Unit 2: Functions of Several Variables

Partial derivatives, chain rule, gradient and directional derivative; Taylor’s theorem for functions of several variables; maxima, minima and saddle points.

Unit 3: Vector Calculus

Gradient, divergence and curl. double, triple, line and surface integrals; theorems of Green, Gauss, Stokes and their applications.

Unit 4: Introduction to Complex Variables

Complex numbers and the complex plane, derivative and analytic functions.

Unit 5: Differential Equations

First order equations, second linear differential equations, partial differential equations basic concepts and important examples, Laplace and Fourier transforms.

Text Book:

1. *Calculus and Analytical Geometry*, 9th Ed, G B Thomas and R L Finney, Addison-Wesley, 1999.

Reference Book:

1. *Differential and Integral Calculus*, 3th Ed, Schaum's Outline Series, McGraw Hill, 1992.
2. *Advanced Engineering Mathematics*, 8th Ed, R. Kreyszig, John Wiley, 1999.

1.2.14. MA104: Mathematics-II (Discrete Mathematics) (3-1-0:4)

Course Contents:

Unit 1: Foundation

Propositional and predicate logic, logical equivalences, predicates and quantifiers, translation from language to logical expressions, nested quantifiers, set theory, set operations, set identities and functions, inverse and composition functions, graph of functions.

Unit 2: Number Theory

Division operator, prime factorization, properties of prime numbers, prime number theorem, GCD and LCM, modular arithmetic and applications, sequences and summations.

Unit 3: Counting

Permutation and combinations, pigeonhole principle, inclusion-exclusion principle, binomial theorem, Pascal identity and triangle.

U**nit 3: Mathematical Reasoning and Induction**

Rules of inference, direct proof, proof by contradiction, proof by contrapositive, mathematical induction and second law of mathematical induction.

Unit 5: Recursion

Definition, recursive algorithm, recurrence relations, solving recurrence relations.

Unit 6: Relations

Relations and their properties, applications and representations, equivalence relations, partial ordering, Hasse diagram.

Unit 7: Graphs

Introduction and terminology, representation, isomorphism, connectivity, Warshall's algorithm, Euler and Hamilton path, shortest path.

Text Book:

1. *Discrete Mathematics and its Application*, 7th Ed, K. Rosen, Tata McGraw Hill, **2011.**

Reference Book:

1. *Discrete Mathematical Structure*, 4th Ed, B. Kolman, R.C. Busby and S. C. Ross, PHI, 2000.

2. *Discrete Mathematics*, Richard Johnsonbaugh, Prentice Hall, 2007.
3. *Mathematics: A Discrete Introductio*n, 3rd Ed., Edward R. Scheinerman, Cengage Learning, 2006.
4. *Mathematical Structure for Computer Science*, 6th Ed, J. Gersting, Freeman, 2006.

1.2.15. CS102: Introduction to Data Structure (3-0-0:3)

Course Contents:

Unit 1: Introduction

Representation of data on a computer, data types & array and linked list representations ways of representing programs and associated data on computers.

Unit 2: Analysis Tools

Notion of the running time of an algorithm, recurrences, parameters of performance.

Unit 3: Dictionary Operations

Find, max, min, successor, predecessor (query operations); insert, delete (modify operations) LIST DATA: Stacks, queues, variants implementation using arrays and linked lists.

Unit 4: Sorting

Comparison based sorting algorithms, other sorting algorithms, lower bounds for comparison-based sorting algorithms best-case, worst-case and average-case running times; quicksort, heap Sort, insertion sort, bubble sort etc.

Unit 5: Disjoint set data structure

Make-set, Union and Find Operations.

Unit 6: Trees

Heaps, Binary search trees (BST), heights of BST BALANCED BSTs: Red Black trees, AVL Trees, 2,3,4-trees, B Trees.

Unit 7: Graphs

Representation using adjacency matrices and adjacency lists, Graph searching algorithms BFS and DFS.

Text Book:

1. *Data Structures and Algorithms*, Aho, Hopcroft and Ullman, Addison-Wesley, 1999.

Reference Book:

1. *Introduction to Algorithms*, 3th Ed, Cormen, Lieserson and Rivest, PHI, 2011.

1.2.16. CS162: Introduction to Data Structure Laboratory (0-1-2:3)

Lab and take home assignments based on the course “Data Structures”. Possible set of assignments may include the following list of experiments.

List of Experiments:

1. Design and Implement List data structure using i) array ii) singly linked list.
2. Design and Implement basic operations on doubly linked list.
3. Design and Implement stack using i) array ii) singly linked list.
4. Design and Implement Queue using i) array ii) singly linked list.
5. Design and Implement basic operations on Circular Queue.
6. Implementation of Searching algorithms (Linear search, Binary search).
7. Implementation of various sorting algorithms (Insertion sort, Bubble sort, Quick sort, Heap sort, Merge sort, counting sort, radix sort etc.).
8. Design and Implement basic operations (insertion, deletion, search, findmin and findmax) on Binary Search trees.
9. Design and Implement basic operations of various balanced BSTs, e.g., AVL tree, 2-3 Trees.
10. Implementation of Breadth First Search Techniques.
11. Implementation of Depth First Search Techniques.

1.2.17. HS102: Science Technology and Society (3-0-0:3)

Course Contents

Unit 1:

- Introduction to STS as a field of study and research in the twentieth century.
- Philosophical, Historical and Sociological Approaches to Science and Technology and Society.
- The growth and identity of Modern Science and Technology in India.

Unit 2: Science Communication- Institutions, ideologies, practices

- The diversity of science communication in colonial India.
- Science communication and the Nehruvian Agenda.
- The ideology and image of developmental science.
- The agenda of People's Science.
- Liberalization and the commoditization of science and technology.

Text Book:

1. *Science, Technology and Medicine in Colonial India* – David Arnold (Cambridge, 2004).
2. *Western Science in Modern India, Metropolitan Methods, Colonial Practices* – Pratik Chakrabarti, (Permanent Black, 2004).

Reference Book:

1. *A Concise History of Science in India* – D. M. Bose, S. N. Sen, and B.V. Subarayappa (Universities Press, 2009)