

First Year Course Curriculum

FIRST SEMESTER:

Sl. No.	Depth / Breadth	Subject Number	Subject Name	L-T-P	Credit
1.	D	MA10001	Mathematics - I	3-1-0	4
2.	D	PH10001 / CY10001	Physics / Chemistry	3-1-0	4
3.	D	HS11001	English for Comm.	3-0-2	4
4	D	EE10001 / CS10001	Electrical Technology / Prog. and Data Structures	3-1-0	4
5.	D	EE19001 / CS19001	Electrical Technology / Prog. & Data Struct. Lab.	0-0-3	2
6.	D	ME19001 / CE19001	Intro. Manufacturing Proc. / Engg. Drawing & Graphics	1-0-3	3
7.	D	PH19001 / CY19001	Physics / Chemistry Lab	0-0-3	2
8.		EA19001	EAA-I	0-0-3	1
			TOTAL	16-3-9	24

SECOND SEMESTER:

Sl. No.	Depth / Breadth	Subject Number	Subject Name	L-T-P	Credit
1.	D	MA10002	Mathematics – II	3-1-0	4
2.	D	CY10001 / PH10001	Chemistry / Physics	3-1-0	4
3.	D	CS10001 / EE10001	Prog. & Data Struct. / Electrical Technology	3-1-0	4
4.	D	ME10001	Mechanics	3-1-0	4
5.	D	CS19001 / EE19001	Prog. & Data Struct. / Electrical Tech. Lab	0-0-3	2
6.	D	CE19001 / ME19001	Engg Drawing & Graphics/ Intro. to Manufacturing Proc.	1-0-3	3
7.	D	CY19001 / PH19001	Chemistry / Physics Lab	0-0-3	2
8.		EA19002	EAA-II	0-0-3	1
			TOTAL	10-2-15	24

Syllabus for I year subjects and Basic Electronics (3rd semester course)

MA 10001 Mathematics-I (3-1- 0 4)

Differential Calculus: Rolle's theorem, Cauchy's mean value theorem (Lagrange's mean value theorem as a special case), Taylor's and Maclaurin's theorems with remainders, indeterminate forms, concavity and convexity of a curve, points of inflexion, asymptotes and curvature.

Limit, continuity and differentiability of functions of several variables, partial derivatives and their geometrical interpretation, differentials, derivatives of composite and implicit functions, derivatives of higher order and their commutativity, Euler's theorem on homogeneous functions, harmonic functions, Taylor's expansion of functions of several variables, maxima and minima of functions of several variables - Lagrange's method of multipliers.

Ordinary Differential Equations: First order differential equations - exact, linear and Bernoulli's form, second order differential equations with constant coefficients, method of variation of parameters, general linear differential equations with constant coefficients, Euler's equations, system of differential equations.

Complex Variables: Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy-Goursat theorem, independence of path, existence of indefinite integral, Cauchy's integral formula, derivatives of analytic functions, Power series, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.

Integral Calculus: Fundamental theorem of integral calculus, mean value theorems, evaluation of definite integrals - reduction formulae.

Text Books Recommended:

1. Differential and Integral Calculus Vol.I and Vol. II by N. Piskunov
2. Differential Calculus by Shanti Narayan
3. Integral Calculus by Shanti Narayan
4. Advanced Engineering Mathematics by E. Kreyszig

MA 10002 Mathematics-II (3-1-0 4)

Linear Algebra: Algebra of matrices. Vector spaces - linear dependence of vectors, basis, linear transformations, rank and inverse of a matrix, solution of algebraic equations - consistency conditions, Hermitian, skew Hermitian and unitary matrices, bilinear forms, eigenvalues and eigenvectors.

Integral Calculus: Convergence of improper integrals, tests of convergence, Beta and Gamma functions - elementary properties. Differentiation under integral sign, differentiation of integrals with variable limits - Leibnitz rule. Rectification, double and triple integrals, computations of area, surfaces and volumes, change of variables in

double integrals - Jacobians of transformations, integrals dependent on parameters - applications.

Vector Calculus: Scalar and vector fields, level surfaces, directional derivative, Gradient, Curl, Divergence, Laplacian, line and surface integrals, theorems of Green, Gauss and Stokes, line integrals independent of path.

Numerical Analysis: Finite differences, Newton's forward and backward interpolation formulae, central difference interpolation formulae. Trapezoidal and Simpson's 1/3rd rules for numerical integration. Solution of polynomial and transcendental equations - bisection, Newton-Raphson and regula falsi methods. Numerical solution of system of linear equations – Gauss, Gauss-Jordan elimination and Gauss-Seidel iteration methods.

Text Books Recommended:

1. Differential and Integral Calculus Vol.I and Vol. II by N. Piskunov
2. Advanced Engineering Mathematics by E. Kreyszig
3. Integral Calculus by Shanti Narayan

ME10001

Mechanics

(3 - 1 - 0 : 4 Credits)

Force systems : Moment of a force about a point and about an axis; couple moment; reduction of a force system to a force and a couple.

Equilibrium : Free body diagram; equations of equilibrium; problems in two and three dimensions; plane frames and trusses.

Friction : Laws of Coulomb friction., problems involving large and small contact surfaces; square threaded screws; belt friction; rolling resistance.

Kinematics and Kinetics of particles : Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables; central force motion.

Properties of areas : Moments of inertia and product of inertia of areas, polar moment of inertia, principal axes and principal moments of inertia.

Concept of stress and strain : Normal stress, shear stress, state of stress at a point, ultimate strength, allowable stress, factor of safety; normal strain, shear strain, Hooke's law, Poisson's ratio, generalized Hooke's law; analysis of axially loaded members.

Torsion : Torsion of cylindrical bars, torsional stress, modulus of rigidity and deformation.

Flexural loading : Shear and moment in beams; load, shear and moment relationship; shear and moment diagrams; flexure formula; shear stress in beams; differential equation of the elastic curve, deflection of beams.

Transformation of stress and strain : Transformation of stress and strain, principal stresses, principal strains, Mohr's circle for stress and strain.

Combined loading : Axial and torsional; axial and bending; axial, torsional and bending.

Column : Buckling of slender columns, Euler bucking load for different end conditions.

Books:

Vector Mechanics for Engineers, F.P. Beer and E.R. Johnston, Tata McGraw-Hill (7th)

Edition)

Reference books ;

Engineering Mechanics, Irving H. Shames, Prentice Hall of India

Engineering Mechanics, J.L. Meriam and L.G. Kraige, John Wiley and Sons

Books :

Mechanics of deformable bodies, E.P. Popov

Reference books:

Mechanics of materials, F.P. Beer and E.R. Johnston

Mechanics of materials, Timoshenko and Gere

Introduction to solid mechanics, Irving H. Shames

Strength of materials, William A Nash

Elements of strength of materials, Timoshenko and Young

ME19001 Introduction to Manufacturing Processes (1-0-3 : 3 Credit)

Theory Component : Basic concepts and principles of manufacturing

Pre-forming processes: Casting, forging, rolling, drawing, extrusion, press tool work, plastic moulding and powder metallurgy.

Joining processes: Welding, brazing and crimping Semi-finishing and finishing processes : Machining (Turning, shaping, drilling, Milling and grinding).

Non-traditional processes: Abrasive jet machining, Ultrasonic machining, Electro-discharge machining, Electro-chemical machining and laser beam machining.

Product Quality: Possible defects and their detection, assessment and remedy.

Laboratory Component : Suggested Assignments

Machining :

1. Introducing to various machine tools and demonstration on machining
2. Making a steel pin as per drawing by machining in centre lathe
3. External screw thread by single point chasing in lathe
4. Making a cast iron Vee block by shaping
5. Making a regular polygon prism (MS) by milling
6. Making a gauge as per drawing
7. Study of machining in machining in machining centre (CNC) and Electrodischarge machining (EDM)

Foundry Practice

8. Orientation, demonstration and practice on metal casting
9. Practicing sand moulding using split and uneven parting line pattern
10. Practice on CO2 moulding and machine moulding
11. Mechanised sand preparation and melting practice

Welding Practice

12. Practice on Oxy-acetylene gas welding and manual metal arc welding (running bead)
13. Practice on oxy-acetylene gas cutting and arc welding for butt welding
14. Introduction and demonstration on submerged arc welding and plasma spray coating

Metal Forming

15. Demonstration of deep drawing process

Books:

Principles of Manufacturing Materials and Process, J S Campbell, Tata McGraw Hill
Processes and Materials of Manufacture, Roy A Lindberg, Printice Hall of India Pvt. Ltd.
Manufacturing Engineering and Technology, S Kalpakjian, Addison Wesley Publishing
Company
Materials and Processes in Manufacturing, E P DeGarmo, J T Black, R A Kohser,
Prentice Hall of India Pvt. Ltd.

Physics 3 - 1 - 0 : 4 Credits

Overview of vibrations with emphasis on damped and forced oscillations, resonance, coupled oscillations, normal modes.

Wave motion: longitudinal and transverse waves, wave equation, plane waves, phase velocity, superposition of waves, wave packets and group velocity, two and three dimensional waves, polarization.

Electromagnetic waves: Maxwell's equations, wave equation, plane electromagnetic waves, energy-momentum, Poynting's theorem, electromagnetic boundary conditions, reflection and refraction, interference, Young's experiment, interferometers, diffraction, Fraunhofer diffraction (single slit), dispersion, radiation.

Wave mechanics: Failure of classical physics, qualitative review of relevant experiments, de Broglie waves, uncertainty principle, wave function and Schrodinger equation, probability interpretation, particle on a chain, potential barrier and quantum tunneling, potential well, qualitative summary of simple harmonic oscillator and Hydrogen atom. Occupation probability and examples.

References

1. Optics by Hecht
2. Feynman Lectures in Physics, Volume I
3. Lecture Notes in Physics by Saraswat and Sastry

Physics Lab 0 - 0 - 3 : 2 Credits

Oscillations and Waves

1. Compound pendulum
2. Torsional pendulum
3. Forced oscillation
4. Coupled oscillations
5. Phase velocity of rope waves
6. Ultrasonic Interferometer

Wave Optics

7. Newton's rings
8. Single slit Fraunhofer diffraction
9. Double/Multiple slit Fraunhofer diffraction
10. Diffraction grating
11. Polarimetry

Quantum Physics

12. Franck Hertz experiment
13. Measurement of Planck's constant

Demonstration Experiments

14. Fresnel biprism
15. Michelson Interferometer
16. Fabry-Perot Interferometer

Reference

Physics Laboratory Workbook for 1st Year UG Students

CHEMISTRY 1ST YEAR SYLLABUS

Chemistry	<p>Thermodynamics of Chemical Processes: Review of 1st law, Concept of entropy, Chemical potential, Equilibrium conditions for closed systems, Phase and reaction equilibria, Maxwell relations, .</p> <p>Electrochemical Systems: Electrochemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and pH.</p> <p>Kinetics of Chemical Reactions: Reversible, consecutive and parallel reactions, Steady state approximation, Chain reactions</p> <p>Bonding in s,p,d-systems: Molecular orbitals of Diatomics, d-orbital splitting in Crystal field (Oh, Td).</p> <p>Oxidation-Reduction: Metal Oxidation States, Redox-Potential, Diagrammatic Presentation of Potential data.</p> <p>Chemistry of Metals: Coordination Compounds (Ligands & Chelate effect), Metal Carbonyls (preparation, stability, applications),</p> <p>Wilkinson's Catalyst (Alkene Hydrogenation), Hemoglobin, Myoglobin & Oxygen Transport.</p> <p>Organic Chemistry: Optical isomers & chirality: CIP rules, R, S-configuration, Fischer-, Wedge-, Newmann-, Sawhorse projection.</p> <p>Conformational analysis: acyclic systems, cyclohexane systems, structure-reactivity relationship.</p> <p>Nucleophilic substitution at the saturated Carbon atom: SN1, SN2, SN2', SNi, SNi', Effect of structure, Nucleophile, Leaving group, Reaction media, Stereochemical implication.</p> <p>Elimination reactions: E1, E2, and E1CB</p> <p>Basic pericyclic reactions: Types pericyclic reactions, Diels-Alder reaction, Electrocyclic reaction, Sigmatropic rearrangement.</p> <p>Selected Organic Reactions in Biological Systems. Environmental aspects of</p>
------------------	---

	NO _x , CO, CO ₂ . Books: Atkins' Physical Chemistry Physical Chemistry by R.A. Alberty, R.J. Silbey Shriver & Atkins: Inorganic Chemistry Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson, P.L. Gaus A Guidebook to Mechanism in Organic Chemistry by Peter Sykes Organic Chemistry by J. Clayden, S. Warren, N. Greeves, P. Wothers
--	---

Chemistry Laboratory	Surface tension and parachor, Measurement of the coefficient of viscosity, Conductometric titration, pH-metric/potentiometric titration, Determination of Solubility product, Kinetics of ester hydrolysis, Determination of Standard EMF of a Daniel Cell, Determination of Partial Molal volume of Ethanol/water mixture by densitometer, Spectrophotometry, Flame Photometry, Nepheloturbidimetry, Identification of Organic Compounds Using melting point, solubility, functional group test, IR spectroscopy, Identification of a single organic compound from a given list.
-----------------------------	---

Electrical Technology

EE14001

3 - 1 - 0 : 4Credits

Prerequisites: None

Theory Component : Introduction :

Sources of energy; General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables, Steam, Hydel, Gas and Nuclear power generation.

DC Networks :

Kirchoff's laws, node voltage and mesh current methods, Delta-star and star-delta conversion, Superposition principle, Thevenin's and Norton's theorems. Maximum power transfer theorem, circuits with non-linear resistance.

Transients :

Solution of first order transient problems in R-L and R-C network with non zero initial condition and step input function.

Single phase AC Circuits :

Single phase EMF generation, average and effective values of sinusoids, the j operator, complex representation of impedances, phasor diagram, power factor, power in complex notation, steady state analysis of parallel and series circuits. series and parallel resonance.

Three phase AC Circuits :

Three phase EMF generation, delta and Y – connections, line and phase quantities, solution of three phase circuits, balanced and unbalanced, phasor diagram, measurement of power in three phase circuits, balanced and unbalanced, three phase four wire circuits.

Magnetic Circuits :

Ampere's circuital law, B – H curve, solution of magnetic circuits, Faraday's law of electromagnetic induction, self and mutual inductance, energy stored in magnetic field, hysteresis and eddy current losses, magnetic force of attraction and its application.

Transformers :

Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, ideal auto-transformers.

Induction Motor :

The revolving magnetic field, principle of operation, ratings, equivalent circuit, Torque-speed characteristics, starters for cage and wound rotor type induction motors.

DC Motors: Expression of induced voltage and torque. Starting and speed control of separately excited dc motors

Electrical Measuring Instruments :

DC PMMC instruments, shunt and multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watt-hour meter, extension of instrument ranges.

Text Book :

1. Hughes Electrical & Electronic Technology Eight Edition Pearson
2. Problems in Electrical Engineering Parker Smith

References:

1. Engineering Circuit Analysis by Hayt & Kemmerly, McGrawhill
2. Electrical Machines by Nagarth & Kemmerly, Prentice Hall of India

Electrical Technology Laboratory (0-0-3 2 credits) :Suggested Experiments

- 1.To measure the armature and field resistance of a DC machine.
- 2.Connection and measurement of power consumption of a fluorescent lamp and voltage – current characteristics of incandescent lamps.

- 3.Verification of Thevenin's and superposition theorems (with DC sources only).
- 4.Two wattmeter method of measuring power in three phase circuit (resistive load only).
- 5.Measurement of current, voltage and power in R-L-C series circuit excited by single phase AC supply.
- 6.Open circuit, short circuit and load tests on a single phase transformer.
- 7.Connection and starting of a three phase induction motor using direct on line (DOL) or star – delta starter.
8. Connection starting and speed control of a separately excited DC motor (no load operation only)

CE13001 : Engineering Drawing and Graphics (1-0-3, 3 credits)

Introduction to IS code of drawing; Conics and Engineering Curves – ellipse, parabola, hyperbola, cycloid, trochoid, involute; Projection of lines – traces, true length; Projection of planes and solids; solid objects – cube, prism, pyramid, cylinder, cone and sphere; Projection on Auxiliary planes; Isometric projection, isometric scale; Section of solids – true shape of section; Introduction to CAD tools – basics; Introduction of Development and Intersection of surfaces.

TEXT BOOK

Engineering Drawing : Plane and Solid Geometry
Authors : N. D. Bhatt and V. M. Panchal
Publisher : Charotar Publishing House, Anand

REFERENCE BOOKS:

1. Textbook on Engineering Drawing
Authors : K L Narayana and P. Kannaiah
Publisher : Scitech, Chennai
2. Fundamentals of Engineering Drawing (with an introduction to interactive computer graphics for design and production)

Authors : Warren J. Luzadder and John J. Duff
Publisher : Prentice Hall of India, New Delhi

Faculty members feel that the name of the subject may be given as “Engineering Drawing and Computer Graphics”.

Core Course

English for Communication

(3-0-2)

Section A (lecture topics)

- Introduction to communication
- Language and grammar skills
- Speaking skills
- Writing skills

Section B (Sessionals)

- Building Vocabulary
- Building sentences
- Grammar
- Pronunciation drills
- Phonetics, vowels, Diphthongs, consonants
- Stress, Rhythm and intonation
- Conversational skills
- Meta Language
- The writing process
- Writing with a thesis
- Writing topic sentences
- Writing a paragraph
- Linking paragraph

CS11001/CS11002 PROGRAMMING AND DATA STRUCTURES

(3-1-0 : 4 Credit)

Introduction to digital computers; introduction to programming – variables, assignments; expressions; input/output; conditionals and branching; iteration; functions; recursion; arrays; introduction to pointers; structures; introduction to data-procedure encapsulation; dynamic allocation; linked structures; introduction to data structures – stacks and queues; time and space requirements.

(A programming language like C/C++ may be used as a basis language. The same language must be used for the laboratory).

CS19001/CS19002 PDS Laboratory

(0-0-3 : 2 Credit)

The topics taught in the theory course would be appropriately be sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below:

1. Familiarization of a computer and the environment and execution of sample programs
2. Expression evaluation
3. Conditionals and branching
4. Iteration
5. Functions
6. Recursion
7. Arrays
8. Structures
9. Linked lists
10. Data structures

References

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

<http://www.facweb.iitkqp.ernet.in/~pds/notes/>

Introduction to Electronics

(3-1-0: 4 Credit)

(for Electrical Engg. Science branches and MSc Physics students only)

Semiconductor materials: intrinsic and extrinsic semiconductors; drift and diffusion currents; excess carriers. P-N junction: junction in equilibrium, junction in reverse bias and transition (junction) capacitance, junction in forward bias, ideal current-voltage relationship, *p-n* junction diode, breakdown voltage, switching transients. Diode circuit analysis: iterative analysis, piecewise linear model, small-signal model. Diode applications: rectifier circuits (half-wave and full-wave rectifiers, rectifiers with capacitor filter), voltage regulator (using Zener diode), clipper (limiter) circuits; clamper circuits. Bipolar junction transistors (BJTs): structure and modes of operation, *n-p-n* and *p-n-p* transistor in active mode, DC analysis of both transistor circuits, BJT as an amplifier,

small-signal equivalent circuits, single-stage BJT amplifier (common-emitter mode), BJT as a switch. Metal oxide semiconductor field-effect transistors (MOSFETs): structure and physical operation of *n*-type and *p*-type MOSFET, DC analysis of MOSFET circuits, MOSFET as an amplifier, small-signal equivalent circuits, single-stage MOSFET amplifier (common-source mode), MOSFET as a switch. Operational amplifier (op amp): ideal op amp, inverting amplifier, amplifier with a T-network, effect of finite gain, summing amplifier; non-inverting amplifier, voltage follower, op amp applications - current-to-voltage converter, voltage-to-current converter, difference amplifier, instrumentation amplifier, integrator and differentiator. Feedback: basic concepts of negative feedback; four ideal feedback topologies. Oscillators: basic principles of sinusoidal oscillation, Wien Bridge, phase-shift, Colpitts and Hartley oscillators. Digital Electronics: Boolean algebra and rules of simplification, combinational circuits - adder, decoder, encoder, multiplexer and demultiplexer. Sequential circuits - flip-flops, counters and shift registers.

Basic Electronics

(3-1-0: 4 Credit)

Introduction: Electronic system as a conglomeration of several subsystems, such as transducer, amplifier, filter, oscillator, data converter, display device, power supply etc., examples of typical electronic systems (mobile phone, portable CD player etc.), basic concept of signal, noise, etc. Semiconductor devices: Diode, BJT, MOSFET, their structures and principle of operations. Amplifiers: Functionality, specifications (voltage gain, current gain, input resistance, output resistance, dynamic range, bandwidth, linearity, power efficiency etc.), effect of cascading, various applications and typical

circuits. Filters: Low pass, high pass, band pass and band stop filters, single and higher order passive filter topologies (RC and LC), specifications (cutoff frequency, roll off, etc.). Feedback: Basic concept of negative and positive feedback, application of negative feedback in amplifiers, effect on gain, bandwidth, input resistance, output resistance and desensitivity to parameter variations. Oscillators: Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, applications and typical circuits. Operational amplifier: Differential mode of operation, common mode rejection, typical op-amp specifications (open loop gain, differential input resistance, unity gain-bandwidth etc.), inverting amplifier, non-inverting amplifier, integrator, differentiator, summing amplifier etc., concept of active filters. Power electronics: Half wave and full wave rectification, filtering, regulation with zener diode and linear regulators, , switched mode power supply. Digital electronics: Review of Boolean algebra and signed number representation schemes in binary, implementation of Boolean functions using various logic gates, concept of combinatorial and sequential circuits, registers and counters from functional viewpoint, concept of programmable processors and microcontrollers. Introduction to analog-to-digital and digital-to-analog data converters, their speed and resolution, basic concept of aliasing in the sampling process.