

SYLLABUS

FIRST YEAR

CHY1001: Engineering Chemistry [2 1 2 4]

Classification of Fuels, Gross Calorific value and Net Calorific value. Solid, Liquid and Gaseous fuels. Concept of corrosion and its importance, types of corrosion, factors affecting corrosion, Corrosion control methods. Chemistry of primary and secondary batteries. Working principles of fuel cells and their applications. Water treatment technology. Theory and application phase rule (up to two component system). Advanced materials and polymers: ceramics, semiconductors, conducting polymers, composites, bio-materials, nanomaterials, and their properties and applications. Experiential learning on chemistry-Chemical Fuel: Determination of coefficient of viscosity of liquid; Determination cloud and pour point of a given sample of lubricating oil using cloud and pour point apparatus; Determine the water equivalent of bomb calorimeter using benzoic acid as fuel. Corrosion: Redox titrations for electrochemistry Water Treatment: Determination of hardness of water and ion exchange method, pH-metric titration; Conductometric acid base titrations Polymer and advanced material: Synthesis of polymer and advanced materials

References:

1. Jain P.C. and Jain M., Engineering Chemistry, Dhanpat Rai and Sons, Delhi, Revised, 15th Edn. 2006.
2. Engineering chemistry, Wiley India Pvt. Ltd., 2018.
3. Kuriacose J.C., Raja R. J., Chemistry in Engineering and Technology, Vol. I/II TMH 1988.
4. Fischer T., Materials Science for Engineering Students, Academic Press, London, 2009.
5. Fuel Science & Technology Hand Book, James G Speight; Marcel Dekker, New York.
6. <https://nptel.ac.in/courses/122/101/122101001/#>

MAS1001: Calculus and Matrices [2 1 0 3]

Differential calculus: Curvatures, Asymptotes; Partial differentiation, total derivatives, Taylor's theorem, maxima and minima, Lagrange's method. Integral Calculus: Double and Triple integrals, Change of the order of integration. Change of variables. Applications of Multiple integrals. Vector Calculus: Differentiation of vectors and their physical meaning. Line and surface integrals. Matrix Algebra: Rank, Inverse of a matrix, and solution of linear simultaneous equations. Eigenvalues and Eigenvectors of a matrix, Cayley-Hamilton theorem.

References:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th edition, John Wiley and Sons, Inc., U.K. 2011.
2. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House. 2005.
3. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, 11th Edition, Pearson Education. 2008.

EEE1002: Electrical & Electronics Systems [3 1 0 4]

Overview of Electrical System: Renewable and conventional energy sources, Transmission & Distribution Systems, Electrical Loads- Classification, types & characteristics. Electrical system for residential/industrial installations. DC and AC Circuits and Analysis: Mesh and Nodal analysis methods, Superposition theorem, Thevenin's theorem, and Maximum power transfer theorem. AC Circuits - Phasor representation, single-phase and 3-phase circuits. Measurement Systems and Instrumentation: Transducer characteristics, strain gauges, accelerometers, displacement sensor, pressure transducers, and temperature sensors. Signal acquisition - A/D converters. Fundamental of Electric Vehicles: Types of EVs, Constructional aspects, Hybrid EV Configurations, EV Battery, and Electric Motors. Semiconductors devices: PN Junction diode - construction, biasing, equation and its I-V characteristics, wave-shaping circuits, BJT: Operation and DC Biasing analysis. Introduction to Operational Amplifier. Digital System Design: Boolean algebra, De Morgan's Theorem, K-map for minimization of Boolean expressions, Adder and Subtractor, Introduction to Encoders, Decoders, Multiplexer, Demultiplexer. Introduction to Modern Electronic Systems: Introduction, block diagram, components, and operation of 5G, Drone Technology, IoT and 3-D Printers.

References

1. T.K. Nagasarkar and M.S. Sukhija. Basic Electrical Engineering (3e), Oxford University Press, 2017.
2. D.C. Kulshreshtha. Basic Electrical Engineering (2e), McGraw Hill Education India, 2019.

3. D.P. Kothari and I.J. Nagrath, Basic Electrical and Electronics Engineering, McGraw Hill Education India, 2014.
4. D.P. Kothari, K.C. Singal, and R. Ranjan, Renewable Energy Sources and Emerging Technologies (3e), PHI, 2022.
5. H.S. Kalsi, Electronic Instrumentation (4e), McGraw Hill Education India, 2019.
6. R.L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory (10e), Pearson, 2009.
7. R.A. Gayakwad Op-Amps and linear Integrated Circuit (4e), PHI.
8. S. Salivahanan and S. Arivazhagan. Digital circuits and Design (5e), Oxford University Press, 2018.

MEE1007: Creativity & Innovation [1 1 0 2]

What is creativity? Brain networks associated with creativity. Divergent thinking and innovation; Need of innovation: types of innovation; What type of innovation is needed in india? Innovation in solving problems, data analysis, automation & innovation, idea generation, design thinking, idea convergence and divergence, focused problems, prototype development, implementation of idea. Innovation in Indian and global context; automation, convergence of ideas, Innovation management; importance, difference with creativity, invention and discovery. Case studies in on business ideas on established startups. Economic aspects; venture capital, angel investors, Evaluation of effectiveness of innovation; Legal aspects: IPR. Prototyping; ability to materialize concepts and ideas through modeling and "Rapid prototype", Communicating ideas through visual maps and three-dimensional representations. Implementation; Controlling and combining multiple variables of a problem, Detecting the key proposals and synthesizing them in a final solution, Creating a system around the solution and developing a value proposition. Lean Canvas features and applications.

References:

1. Tom Kelley and David Kelley, Creative Confidence: Unleashing the creative potential within us all, William Collins, 2013
2. Vinnie Jauhari & Sudhanshu Bhushan, "Innovation Management" Oxford University Press 2014.
3. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004
A. Dale Timpe, Creativity, Jaico Publishing House, 2003.
4. P. N. Rastogi, Managing Creativity for Corporate Excellence, Macmillan 2009.

CSE1002: Problem Solving Using Computers [2 1 0 3]

Digital computer fundamentals: Algorithms and flowcharts, the von Neumann architecture, programs, assembly language, high level programming languages; Imperative programming (Using C): data types, variables, Storage Classes, enumerated data types, operators, expressions, statements, control structures, functions, arrays and pointers, recursion, records (structures), files, input/output, some standard library functions and some elementary data structures.

References:

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw Hill Publication, 2019.
2. Y. P. Kanetkar, Let us C, 19th Edition, BPB Publication, 2022.
3. B. W. Kernighan, D. M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall of India, 2014.
4. B. Gottfried, Schaums Outline Series: Programming with C, 4th Edition, McGraw Hill Publication, 2018.

MEE1035: Engineering Graphics Lab [0 0 2 1]

Introduction to Engineering Graphics. Principle of Orthographic Projections Projection of Points located in different quadrants. Introduction to AutoCAD, Basic commands for 2D drawing. Projection of line with its inclination to the reference planes. Projections of planes with its inclination to the reference planes, Concept of auxiliary method for projections of the plane. Classification of solids, Projection of solids along with frustum with its inclination to one reference Plane.

References:

1. Computer Aided Engineering Drawing, K R Gopala Krishna and Sudheer Gopala Krishna, CBCS, 2015
2. Engineering Drawing and Graphics + AutoCAD, Venugopal, New Age International Publisher, 2009
3. Engineering Graphics, Basant Aggarwal & CM Aggarwal, McGraw Hill Publication, 2018..
4. Engineering Graphics with AUTO CAD, DM Kulkarni & AP Rastogi, PHI Learning Private Limited, 2010.
5. Engineering Graphics with AUTO CAD, TM Jeyapovan, Vikas Publishing House, 2015.

LLC1001: Technical Writing Clinic 1 [0 0 2 1]

Process & Types of Communication: Definition, Features, Modes & Barriers. Non-Verbal Communication: Types, Significance. Listening Skills: Listening, Hearing, Active Listening, Passive Listening. Speaking Skills: Making effective Presentations, Creating Power Point Presentations (PPTs), Presenting in Groups/Individually. Reading Skills: Reading Techniques, Skimming & Scanning, Comprehension & Precis Writing. Writing Skills: Basics of Resume Writing & Professional Social Media Profiling; Letter & Email Writing; Reviewing Research Papers, Blog Writing **References:**

1. Meenakshi Raman and S. Sharma, Technical Communication: Principles and Practice, (2/e), Oxford University Press, 2013.
2. Ronald B. Adler, George Rodman and Athena du Pré, Understanding Human Communication, Oxford University Press, 2020.
3. Sanjay Kumar and Pushplata, Communication Skills, Oxford University Press, 2016.
4. Sunita Mishra and C. Muralikrishna, Communication Skills for Engineers, Pearson, 2014.

EEE1030: Electrical & Electronics Lab [1 0 2 1]

Familiarization of different electrical and electronics components and instruments. Electrical System: Residential/industrial installations, understanding different electrical machines using cut-section models, P-V and I-V characteristics of Solar PV system. Measurement Systems: Virtual instrumentation using LABVIEW, real-time data acquisition, voltage measurement, temperature measurement. Electrical Vehicle: basic design of electric vehicle using BLDC motors. Electronic Devices and Circuits: VI characteristics of diode, BJT, and MOSFET. Inverting and non-inverting amplifier using op-amp. Digital Circuits: Verification and/or implementation of various digital circuits. Semiconductor fabrication process and computerized PCB design.

References:

1. D.P. Kothari and I.J. Nagrath, Basic Electrical and Electronics Engineering, McGraw Hill Education India, 2014.
2. D.P. Kothari, K.C. Singal, and R. Ranjan, Renewable Energy Sources and Emerging Technologies (3e), PHI, 2022.
3. H.S. Kalsi, Electronic Instrumentation (4e), McGraw Hill Education India, 2019.
4. R.L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory (10e), Pearson, 2009.
5. R.A. Gayakwad Op-Amps and linear Integrated Circuit (4e), PHI.

CSE1031: Problem Solving Using Computers Lab [0 0 2 1]

Digital computer fundamentals: Algorithms and flowcharts, the von Neumann architecture, programs, assembly language, high level programming languages; Imperative programming (Using C): data types, variables, Storage Classes, enumerated data types, operators, expressions, statements, control structures, functions, arrays and pointers, recursion, records (structures), files, input/output, some standard library functions and some elementary data structures.

References:

1. E. Balagurusamy, *Programming in ANSI C*, 8th Edition, McGraw Hill Publication, 2019.
2. Y. P. Kanetkar, *Let us C*, 19th Edition, BPB Publication, 2022.
3. B. W. Kernighan, D. M. Ritchie, *The C Programming Language*, 2nd Edition, Prentice Hall of India, 2014.
4. B. Gottfried, *Schaums Outline Series: Programming with C*, 4th Edition, McGraw Hill Publication, 2018.

Math Bridge for BioTech

Set, Relation and Functions - Set Theory: Definition and Representation, Types of Sets, Operations on Sets. Relations: Definition, types of Relations. Functions: Definition, Classification, Domain and Range, Types of Functions. Matrices and Determinants: Concept and Definition of Matrix, Types of Matrices, Operations on matrices, Determinant of a matrix, Inverse of a square matrix, Properties of Matrices and Determinants. Differential and Integral Calculus: Differentiability, Derivatives of some elementary functions, product and quotient rules, chain rule, Limits and continuity, Indefinite integral, Definite integral. Differential equations: Introduction to ordinary and partial differential equations. Solutions to first order differential equations, Exact differential equations, integrating factor, and inspection method. Probability: Counting principle, Permutation

and Combination, Concept of Probability, Trial and Events, Sample space, Types of events, Classical and Axiomatic definition of Probability, Additive and Multiplicative Law, Conditional Probability. Trigonometry and Vector Algebra - Trigonometry: Angles - Measurements - Degrees - Radians - Quadrants - Trigonometric ratios - Ratios of particular angles, Representation of vectors, types of vectors, operation on vectors, direction ratios and direction cosines.

References:

1. Mathematics Textbooks of Class IX, NCERT, 2022
2. Mathematics Textbooks of Class XII, NCERT, 2022
3. AICTE module for bridge course in Mathematics, 2022
4. <https://www.aicte-india.org/sites/default/files/final%20maths.pdf>

PHY1001: Engineering Physics [2 1 2 4]

Double slit interference, coherence, intensity in double slit interference, thin film interference, Newton's rings, diffraction and wave theory of light, single-slit diffraction, intensity in single-slit diffraction (using phasor method), diffraction at a circular aperture, double-slit interference and diffraction, combined-intensity in double-slit diffraction (qualitative approach), diffraction of light through multiple slits, diffraction gratings, polarization of electromagnetic waves, polarizing sheets, polarization by reflection, Black body radiation and Planck's hypothesis, Stefan's Law, Wien's displacement law, Photoelectric effect, Compton effect, photons and electromagnetic waves, wave properties of particles, de Broglie hypothesis, Davisson-Germer experiment, quantum particle (wave packet, phase velocity, group velocity), the uncertainty principle. An interpretation of quantum mechanics, wave function and its significance, Schrödinger equation, particle in a box, particle in a well of finite height (qualitative), Tunneling through a potential barrier and its applications, X-ray spectrum, Moseley's law, spontaneous and stimulated transitions, metastable states, population inversion, laser system, Free electron theory, Fermi level, Density of states, Electron in a Periodic potential-Bloch's theorem, Kronig- Penny Model (Qualitative Treatment), origin of Energy Band Formation in Solids, Classification of Materials into Conductors, Semi-Conductors & Insulators, Effective mass of an Electron. Experiments on interference, diffraction (single slit and grating), polarization, ultrasonic waves, quantum physics (photo electric effect, Black body radiation, tunneling in Zener diode) and electronic materials (energy band gap, Hall-effect).

References:

1. Halliday D., Resnick R., Krane K. S., *Physics* (5e), Wiley, 2016.
2. Beiser A., Mahajan S., Rai Chaudhary S., *Concepts of Modern Physics*, (7e), McGraw Hill Education, 2017.
3. Serway R. A., Jewett J. W., *Physics for Scientists and Engineers with Modern Physics*, Thomson, 2013.

MAS1002: Computational Mathematics [2 1 0 3]

Numerical Methods: Finite difference and interpolation for equal and unequal intervals, Numerical differentiation and integration. Solution of algebraic and transcendental equations, solutions of ordinary differential equations. Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism of graphs, Euler and Hamiltonian paths, Graph coloring. Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences.

References:

1. Liu and Mohapatra, "Elements of Discrete Mathematics", McGraw Hill, 2018
2. Jean Paul Trembley, R Manohar, Discrete Mathematical Structures with Application to Computer Science, McGraw-Hill, 2019
3. R.P. Grimaldi, Discrete and Combinatorial Mathematics, Addison Wesley, 2020
4. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, PHI Learning Private Limited, Delhi India.
5. Numerical Methods: M.K. Jain, S.R.K. Iyenger and R.K. Jain, 2021
6. Sastry S. S., Introductory methods of Numerical analysis, (4e), PHI, 2007.

CHY1002: Environmental Studies [2 0 0 2]

Meaning, multidisciplinary nature of environmental science, applications in engineering disciplines, environmental ethics, sustainable development, Natural (renewable and non-renewable) resources, Resource consumption, Biodiversity and conservation methods, different types of energy,

Conventional sources & Non- Conventional sources of energy, Types and Structure of Ecosystem, Environmental Pollution and control, Disaster Management meaning, natural disasters especially earthquakes & Manmade disasters, Environmental Engineering:- Water demand, Water quality standards, basics of water treatment, Conservation of water, Characteristics of sewage, treatment and disposal, Environmental crisis & legislations, Environmental acts, Laws and Policies, EIA, Case studies of the past related to environmental issues, crisis, disasters, hazard, pollution, climate change & its effects, Practical activity related to environmental problems and its impacts on environment.

References:

1. Rajagopalan, R., Environmental Studies: From Crisis to Cure, (2e), Oxford University Press, 2016.
2. De, A. K. and De, A. K., Environmental Studies (2e), New Age Publishers, New Delhi, 2009.
3. Bharucha E., Text book of Environmental Studies for undergraduate courses, (4e), Universities Press, Hyderabad, 2013.

CIV1201: Engineering Materials & Mechanics [3 1 0 4]

Working Fluid: Properties of steam, Steam tables, Steam Generators, Classification, Construction and working of Simple boiler. Laws of thermodynamics, Refrigeration and Air Conditioning: Definition, concept, Vapour Compression cycle, C.O.P., working principles and schematic diagrams of Refrigerator, Air Conditioner. Internal Combustion Engine: Classification, Otto and Diesel cycles, Construction and working of SI and CI engine, Two stroke and Four stroke engine, Calculation of thermal efficiency of cycles. Power Transmission: Classification and applications of mechanical drives like belts, ropes, chains and gear drives and their velocity ratios, length of belts, ratio of tensions in belts and ropes, gear train. Machine Tools: Construction, Working and specification of Lathe, Drilling machine and Milling machine. Foundry: Foundry tools and equipment's, Procedure for moulding. Welding: Definition, Gas and Arc welding, Soldering and Brazing. Forging: Definition, applications, tools, Different Forging operations.

References:

1. S.K.Duggal, Building Materials, New Age International Publisher, 2021.
2. S.C. Rangwala, Engineering Materials, Charotar Publication, 2017.
3. M. L. Gambhir and N. Jamwal, Building Materials Products, Properties and Systems, McGraw Hill Education, 2017.
4. S. Ramamrutham, Engineering Mechanics, Dhanpat Rai Publishing Company (P) Ltd, 2018
5. R. S. Khurmi, A Textbook of Engineering Mechanics, S Chand Publication, 2018.
6. S. Timoshenko, D. H. Young, J. V. Rao, Engineering Mechanics, McGraw Hill Education, 2017
7. R.C. Hibbeler, Engineering Mechanics: Principles of Static and Dynamics, Pearson India, 2017.

MEE1006: MATLAB for Engineers [2 0 0 2]

Introduction to MATLAB environment and commands, Interactive Computation, Matrices and Vectors, Matrix and Array Operations, Character strings, Command- Line Functions, Saving and Loading Data, Programming in MATLAB: Scripts and Functions, Curve Fitting, and Numerical Techniques, Solving Equations (ODE and IDE), Computer Algebra and The Symbolic Math Toolbox, Using MATLAB for Simple engineering problems. Engineering Applications: Introduction to MATLAB SIMULINK and examples, MATLAB Toolboxes: Signal Processing Toolbox, Image Processing Toolbox, Statistics and Machine Learning Toolbox, Neural Network Toolbox, Control System Toolbox, Optimization Toolbox.

References:

1. Getting Started With MATLAB, Rudra Pratap, Oxford Press.
2. Stephen J. Chapman. MATLAB Programming for Engineers (6e), Cengage Learning, 2020. ISBN: 978- 0- 357-03039-4.
3. Bansal R.K., Goel A.K., and Sharma M.K. MATLAB and Its Applications in Engineering (2e). Pearson 2016.
4. MATLAB An Introduction with Applications, Rao V Dukkipati, New Age International Publishers,
5. Gonzalez and Woods. Digital Image Processing Using MATLAB (4e), Pearson, 2018.

BIT1001: Biology for Engineers [2 0 0 2]

Biomolecules such as Carbohydrates, Nucleic acids, Proteins, Enzymes, and their applications. Human organ system and biodesign: Brain as a CPU system, Eye as a Camera system, Heart as a pump system,

Lungs as purification system. Bioinspired materials: Echolocation (sonars), Photosynthesis (photovoltaic cells), bird flying (aircrafts), Lotus leaf effect (self-cleaning surfaces). Human Blood substitutes - hemoglobin-based oxygen carriers. Trends in Bioengineering: Bioprinting techniques and materials, 3D printing of ear, bone and skin, electrical tongue and electrical nose in food science, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing bio-concrete and bioremediation.

References:

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
3. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
4. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
5. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
6. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
7. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
8. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
9. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
10. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011.

LAW1010: Constitution of India [1 0 0 1]

Historical Background & Preamble, Constitutional Governance, Constitutionalism and Theory of Statehood, Constitutional Supremacy and Constitution as a Grundnorm, Organs of the State and their Governance (Legislature, Executive and Judiciary), Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Writ Petition and Public Interest Litigation, Landmark Judgements in India.

References:

1. N. Shukla, Constitution of India. Eastern Book Agency, 2014.
2. P. Jain, Indian Constitutional Law, Lexis Nexis, 2023.
3. D. Basu, Introduction to the Indian Constitution of India, (20th Ed. 2009)
4. M. Seervai, Constitutional Law of India, Universal Law Publishing Co, Reprint 2013.
5. M. Bakshi, The Constitution of India, Universal Law Publishing Co., 2014

MCE1030: IoT Fab Lab [0 0 2 1]

Arduino - Introduction to Arduino and its different modules. Basic programming environment of Arduino. Interfacing of different sensors (IR, Ultrasonic and Temperature sensors) and actuators (Motors, LED/LCD, and Buzzer) with Arduino. Mini project using Arduino. Raspberry Pi (RPi)- Introduction, Interfacing different elements with RPi. 3D Printing - Introduction, (Interfacing of 3D Printer with CAD models), Hands on 3D printing.

References:

1. Simon Monk, 2015. The TAB Book of Arduino Projects, McGraw-Hill Education.
2. Simon Monk., 2016. Programming the Raspberry Pi: getting started with Python. McGraw-Hill Education.
3. Norris, Donald. The internet of things: Do-it-yourself at home projects for arduino, raspberry pi, and BeagleBone black. McGraw-Hill Education, 2015.
4. Scott Fitzgerald and Michael Shiloh, 2012. The Arduino Projects Book, Arduino.
5. France, Anna Kaziunas. Make: 3D printing: The essential guide to 3D printers. Maker Media, Inc., 2013.
6. Cline, L.S., 2017. 3D Printer Projects for Makerspaces. McGraw-Hill Education.

22

DOA1001: Universal Human Values [0 0 2 1]

Universal Human Value: Introductions, Sanskars-Educational, Aspirations and Concerns,

Self-Management, Health, Trust, Relationships, Harmony, society and nature, Need for a holistic perspective and way of living, Right Understanding (Knowing)- Knower, Known & the Process.

References:

1. R R Gaur, R Asthana, G P Bagaria, (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi, 2019.
2. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

THIRD SEMESTER

VDT2101

Electronic Devices-I

[3 1 0 4]

Semiconductor Physics fundamentals: intrinsic and extrinsic semiconductors. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility, and resistivity; sheet resistance. **PN Junctions:** PN junction formation, depletion region, and forward/reverse bias. Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models; Diode circuits: rectifiers, clippers, and clampers. Avalanche breakdown, Zener diode, Schottky diode. **Junction Field Effect Transistors (JFETs):** JFET fundamentals: construction and operation. JFET characteristics and applications. **Metal Oxide Semiconductor FETs:** MOSFET fundamentals; n-channel and p-channel MOSFETs; MOSFET characteristics and regions of operation. MOSFET small-signal analysis, Common source, common gate, and common drain amplifier configurations. MOSFET Applications: MOSFET-based digital circuits. MOSFET as a switch and its role in digital systems. **Bipolar Junction Transistors (BJTs):** BJT fundamentals: construction and operation. BJT characteristics and comparison with MOSFETs.

References:

1. R. L. Boylestad, L. Nashelsky, *Electronic Devices and Circuit Theory*, (10e), Pearson, 2009.
2. A. S. Sedra, K. C. Smith, *Microelectronic Circuits, Technology and System Applications*, (7e), Oxford University Press, 2014.
3. B.G. Streetman, and S. K. Banerjee, *Solid State Electronic Devices*, (7e), Pearson, 2014.
4. S. M. Sze and K. N. Kwok, *Physics of Semiconductor Devices*, (3e), John Wiley & Sons, 2006.
5. P. R. Gray, P. J. Hurst, S. H. Lewis, *Analysis and design of analog integrated circuits* (5e), Hoboken, NJ: Wiley, 2015.
6. D. A. Neamen, *Semiconductor physics and devices: Basic principles* (4e). Boston, MA: McGraw-Hill, 2012.

VDT2102

Digital Electronics

[3 1 0 4]

Introduction of Combinational logic design: Overview of Boolean Algebra and K-Map, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder. MSI devices: Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Barrel shifter and ALU. **Sequential logic design:** latch, Flip-flop, S-R FF, D FF, JK FF, T FF, and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Timing Analysis of sequential circuits. **Designing of State Machines:** Finite state machines, Design of synchronous FSM, State Reduction, Timing issues in synchronous circuits. Algorithmic State Machines, Designing synchronous circuits like Pulse train generator, Pseudorandom Binary Sequence generator, Clock generation. Design of asynchronous circuits. **Logic Families and Semiconductor Memories:** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices, Logic implementation using Programmable Devices.

References:

1. A. A. Kumar, *FUNDAMENTALS OF DIGITAL CIRCUITS*. Prentice Hall India Pvt., Limited, (2e), 2016.
2. R. P. Jain, *Modern Digital Electronics*. McGraw-Hill Education (India) Pvt Limited, (4e), 2003.

3. W.H. Gothmann, *Digital Electronics- An introduction to theory and practice*, PHI, (2e), 2006.
4. R.P. Jain, *Modern digital Electronics*, Tata McGraw Hill, (4e), 2009.
5. S. Brown and Z. Vranesic, *Fundamentals of Digital logic with Verilog Design*, McGraw Hill, (3e) 2013.

VDT2103

Circuits & network theory

[3 0 2 4]

Network theorems and elements: Superposition, Thevenin's and Norton's Theorem, maximum power transfer theorem. Networks with dependent sources. **Transients analysis:** Impulse, Step, Ramp and sinusoidal response analysis of first order and second order circuits. Time domain & transform domain (Laplace) analysis. Initial and final values of networks; **Two port networks:** Two Port General Networks: Two port impedance, admittance, hybrid, ABCD parameters and their inter relations. Equivalence of two ports. **Interconnection of two port networks:** filters, image impedance symmetric T and pi networks; **Network functions:** Terminals and terminal pairs, Driving point Impedance, admittance and transfer functions. Procedure for finding network functions for general two terminal pair networks, Stability & causality, Hurwitz polynomial, positive real function; **Network synthesis:** The four-reactance function forms, specification for reactance function. Foster form of reactance networks. Cauer form of reactance networks Synthesis of R-L and R-C and L-C networks in Foster and Cauer forms.

References:

1. Van Valkenburg, Mac Elwyn, *Network analysis*, (3e), Prentice Hall of India, 2000.
2. A. Sudhakar, S. P. Shyammohan, *Circuits and Network*, (5e), Tata McGraw-Hill, New Delhi, 2017.
3. William H. Hayt, Jr. Jack E. Kemmerly, Steven M. Durbin, *Engineering Circuit Analysis*, (8e), McGraw-Hill Education, 2012.
4. Ashfaq Husain, *Networks and Systems*, (2e), Khanna Book Publishing, 2021.
5. Ravish S. Salivahanan, S. Pravin Kumar, *Circuit Theory*, Vikas Publishing.

Lab:

Experiments are carried out on hardware and software to analyze the circuits & networks.

VDT2120

Analog and Digital Signal Processing and Communication

[3 0 0 3]

Introduction to Signal Processing and Communication: Overview of signal processing and communication systems, Basics of analog and digital signals. **Analog Signal Processing:** Filters (FIR and IIR), Filter fundamentals and types, Design and analysis of both FIR and IIR filters. **Frequency Domain Analysis:** FFT, Introduction to the Fast Fourier Transform (FFT), FFT applications in signal processing and communication. **Analog Communication Systems:** Amplitude Modulation (AM) and Frequency Modulation (FM), Analog demodulation techniques. **Digital Signal Processing: Filters (FIR and IIR): Design and analysis of digital FIR and IIR filters, Applications in signal processing. Digital Modulation and Demodulation Techniques:** Digital modulation schemes: Phase Shift Keying (PSK), Frequency Shift Keying (FSK), and Quadrature Amplitude Modulation (QAM), Digital demodulation techniques. **Communication Protocols and Emerging Technologies:** Overview of communication protocols, Exploration of emerging trends in communication technologies.

References:

1. Frédéric Cohen Tenoudji, *Analog and digital signal analysis*, (1e), Springer International Publishing Switzerland, 2016.

1. K. S. Kundert and O. Zinke, *The Designer's Guide to Verilog-AMS*. Springer, (1e) 2004.
2. S. Palnitkar, *Verilog HDL*, (2e), Pearson education, 2003.
3. J. Bhasker, *A Verilog HDL Primer*, Star Galaxy Pub., (3e), 2005.
4. S. Brown and Z. Vranesic, *Fundamentals of Digital logic with Verilog Design*, McGraw Hill, (3e) 2013.
5. M. Morris Mano, Michael D. Ciletti, *Digital Design: With an introduction to Verilog HDL*, Pearson, (6e), 2017.

VDT2221

HF & RF Circuits

[4 0 0 4]

Introduction to HF and RF Electronics: The Electromagnetic Spectrum, units and Physical Constants, Microwave bands – RF behaviour of Passive components: Tuned resonant circuits, Vectors, Inductors and Capacitors **Introduction to Transmission Line:** Examples of transmission lines- Transmission line equations Single and Multiport Networks: The Smith Chart Network properties and Applications, Scattering Parameters. **Matching and Biasing Networks:** Impedance matching using discrete components – Micro strip line matching networks, Amplifier classes of Operation and Biasing networks. **RF Passive & Active Components:** Filter Basics – Lumped filter design – Distributed Filter Design – Diplexer Filters- Crystal and Saw filters- Active Filters - Tunable filters – Directional Couplers – Hybrid Couplers – Isolators. RF Diodes **Transistor Amplifier and Oscillator Design:** Characteristics of Amplifiers - Amplifier Circuit Configurations, Amplifier Matching Basics, Low phase noise oscillator design, High frequency Oscillator configuration and types.

References:

1. Reinhold Ludwig, Pavel Bretchko, *RF Circuit design: Theory and applications*, Pearson Education Asia Publication, New Delhi 2001.
2. Devendra K. Misra, *Radio Frequency and Microwave Communication Circuits – Analysis and Design*, Wiley Student Edition, John Wiley & Sons.
3. Mathew M. Radmangh, *Radio frequency and Microwave Electronics*, PE Asia Publ., 2001.
4. Christopher Bowick, Cheryl Aljuni and John Biyler, *RF Circuit Design*, Elsevier Science, 2008.
5. Joseph Carr., *Secrets of RF Design*, (3e), Tab Electronics.
6. Less Besser and Rowan Gilmore, *Practical RF Circuit Design for Modern Wireless Systems*, Vol.2.

VDT2240

Data Structures & Algorithms

[3 0 0 3]

Introduction to C++: An overview of C++ programming language basic terms and operations. **Linked List:** Representing the linked list in memory with traversing and searching a linked list. **Stack, Queues and Recursion:** Array/ Linked representation of stack and Queues with its applications. **Trees:** Tree Definitions, Type of Trees, Traversal Algorithms, **Heaps and Priority Queues:** Heaps, the Natural Mapping, Insertion into a Heap, Removal from a Heap, Path length: Huffman's algorithm. **Sorting and Searching:** Various sorting algorithms like Bubble Sort etc., Searching and data modification, Hashing. **Graphs:** Types of Graphs, The Adjacency Matrix for a Graph, The Incidence Matrix for a Graph, The Adjacency List for a Graph, Dijkstra's Algorithm, Graph Traversal Algorithms. **Analysis of algorithm:** Synergy between data structures and algorithm, Factors to be considered in the choice of data structures and algorithms.

References:

1. J. R. Hubbard, *Data Structures and Algorithms*, Schaum's Outlines. McGraw-Hill, New York, USA, 2000.
2. Michael T. Goodrich, Roberto Tamassia, David M. Mount, *Data Structures and Algorithms in C++*, 2, illustrated Edition, John Wiley & Sons, 2010.
3. R. Lewis, L. Deneberg, *Data Structures and their Algorithms*, Addison-Wesley UK, 1991.
4. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C++*, University Paperback, Pearson, 2014.
5. Clifford A. Shaffer, *Data Structures & Algorithm Analysis in C++*, (3e), Dover Publication US, 2011.

VDT2241

Optical Components and Sensors

[3 0 0 3]

Review of Semiconductor device Physics, Semiconductor Opto electronics- Solid State Materials, Emitters, Detectors and Amplifiers, **Semiconductor Emitters-** LEDs, Diodes, SLDs, CCDs, **Semiconductor lasers-** basic Structure, theory and device characteristics, DFB, DBR, Quantum well lasers, Laser diode arrays, VCSEL etc. Photoconductors, photo diodes, PIN , APD ,Photo transistors, solar cells, CCDs, IR and UV detectors. Optical filters, Directional couplers, Dividers, Multiplexers, Phase and Amplitude Modulators, Polarization and polarization controllers, etc. Photonics Signal processing, Nonlinear optics- Frequency Converters, Phase conjugation, optical Correlation. Optical sensing principles (temperature, strain, stress, pressure, refractive index, etc.). Fibre types and materials for optical fibre sensing (silica based, polymer based, etc.). Point sensors (Fibre Bragg gratings, long period gratings, and microfibres/nanowires). Distributed sensors (Brillouin scattering based, Raman scattering based, Rayleigh scattering. Fibre gyroscopes. Fibre-based gas and chemical sensors. Optical fibre sensors for extreme and harsh environments (high temperature and strain, shock, high radiation). Principles and application of optical fibre sensors in medicine and life sciences.

References:

1. J Wilson and J F B J is Hawkers, *Opto electronics - An introduction*, (2e), Prentice-Hall India, 1993.
2. S. O. Kasap, *Optoelectronics and Photonics: Principles and practices*, Pearson 2012
3. J. C. Palais, *Introduction to optical electronics*, (5e), Prentice Hall, 2004.
4. Jörg Haus, *Optical Sensors -Basics and Applications*, (1e), Weinheim : Wiley-VCH Verlag GmbH & Co, 2010.
5. Jasprit Singh, *Semiconductor opto electronics*, (1e), McGraw-Hill, Inc, 1995.
6. P Bhattacharya, *Semiconductor optoelectronic devices*, (2e), Pearson, 1996.

VDT2242

FPGA based system design

[3 0 0 3]

Introduction to programmable logic devices: Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Generic Array Logic, Complex Programmable Logic Devices, Field Programmable Gate Array (FPGA). **The Structure of FPGA:** FPGA architecture, Programmable Logic Block Architectures, Programmable Interconnects, Programmable I/O blocks in FPGAs. **FPGA Programming Technologies:** SRAM Programmable FPGAs. Anti-Fuse Programmed FPGAs. **FPGA Design Flow:** Architecture design. Project design using Verilog. RTL simulation, synthesizing, implementation, gate level simulation of design. Reusing of internal hard modules during design and implementation. **Design Applications:** FPGA manufacturers (Xilinx, Altera, Actel, Lattice Semiconductor, Atmel). General Design Issues, Counter Examples, Designing Adders and Accumulators with the ACT Architecture.

References:

1. Charles H. Roth Jr, Lizy Kurian John, *Digital Systems Design*, (2e), Cengage Learning, 2012.
2. Stephen M. Trimberger, *Field Programmable Gate Array Technology*, (1e), Springer International Edition, 1994.
3. J. Oldfield, R. Dorf, O. M. C. Safari, *Field-Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems*, (1e), Wiley-Interscience, 1995.
4. V. Oldfield, Richard C. Dorf, *Field Programmable Gate Arrays*, (1e), Wiley India, 2008.
5. Ian Grout, *Digital Systems Design with FPGAs and CPLDs*, (1e), Elsevier, Newnes, 2008.

VDT2230

SPICE Lab

[0 0 2 1]

Experiments are carried out on software to analyze the characteristics of semiconductor devices and use these devices for various circuit implementations.

VDT2231

Computer and Processor Architecture Lab

[0 0 2 1]

An Introduction to Computer Architecture, Microprocessor, Assembly language programming, and Verilog. Experiments to be performed using 80x86 / Arm / OpenSPARC.

VDT2270

Project based learning lab 2

[0 0 2 1]

Based on planning and designing of the solution. Evaluation will be based on report and presentation.

OPEN ELECTIVES

ECE0001

Introduction To Communication Systems

[3 0 0 3]

Optical Fiber Communications: Types of Optical Fibers, Numerical Aperture, Time Delay and Group Delay, Concept of V number, Attenuation and Dispersion (dispersion shifted and dispersion flattened fibers), Macro and Micro Bending, Pulse Broadening, Optical Sources and Detectors, Optical Communication System. Satellite Communications: Satellite orbits, Keplers laws, speed, period, angle of elevation, orbital effects in communication satellites, launching of a satellite, Earth Station technology, Space Segment, Modern Trends in Satellite Communications.

References:

1. J. M. Senior, *Optical Fiber Communications- Principles and Practise*, (3e), Pearson Education India, 2010.
2. R.P. Khare, *Fiber Optics and Optoelectronics*, (1e), Oxford University Press, 2004.
3. R. N. Mutagi, *Satellite Communications Principles and Applications*, (1e), Oxford University Press, 2016.
4. Wilbur L. Pritchard et al, *Satellite Communication Systems Engineering*, (2e), Prentice Hall, 1993.

ECE0002

Introduction to Game Theory

[3 0 0 3]

Introduction Examples: Markets/ Politics/ Auctions; **Prisoners' Dilemma**, Best Response and Nash Equilibrium, Dominant Strategies, Stag Hunt – Coordination and Bank Runs. **Multiple Nash Equilibria**, Tragedy of Commons, Cournot Duopoly, Mixed Strategies, Battle of Sexes, Best Response Dynamic, Paying Taxes; **Portfolio Management Game**, Rationality, Choice and Common Knowledge, Iterated Elimination of Domination Strategies, Auction: As a Normal Form Game, Traffic at Equilibrium and Braess's Paradox; **Extensive Form Games**, Strategies in Extensive form Games, Sub Game Perfect Equilibrium, The Art of War, Ultimatum Game, Stackelberg Model, **Bayesian Games**, Bayesian Nash Equilibrium, Yield vs Fight, Bayesian Cournot Game, Bayesian Games with mixed strategies, Auctions, Sealed Bid First Price Auction, Expected Revenue, Bayesian Second Price Auction, Second Price Auction, All Pay Auction; **Evolutionary Biology**, Evolutionary stable Strategy (ESS), Repeated Games, Multiple Equilibriums, Chain-Store Paradox, Non – Cooperative Bargaining; Extensive Form Game with Incomplete Information, Introduction to perfect Bayesian Equilibrium, Obtaining PBE, Gift Game.

References:

1. Martin Osborne, *An Introduction to Game Theory*, (1e), Oxford University Press, 2003.
2. Ken Binmore, *Game Theory: A Very Short Introduction*, (1e), Oxford University Press, 2007.
3. Steven Tadelis, *Game Theory: An Introduction*, (2e) Princeton University Press, 2013.
4. Philip D. Straffin, *Game Theory and Strategy*, (1e) Mathematical Association of America, 1993.
5. Joel Watson, *Strategy: An Introduction to Game Theory*, (3e) W.W. Norton & Company, 2013.
6. Roger B. Myerson, *Game Theory: Analysis of Conflict*, (1e) Harvard University Press, 1997.

ECE0003

***Stress Free living**

[3 0 0 3]

*(in collaboration with Abhigya Club & faculty from Hare Krishna Movement Jaipur)

Spirituality in Business and Workplace: Current Challenges in Business Management & Society, Relevance of Ancient Indian Wisdom for contemporary society, Spirituality in Business, The notion of Spirituality, An introduction to Bhagavad Gita & its relevance. **Perspectives on Leadership & Work:** Failed Leadership: Causes & Concerns, Leadership Perspectives in the Gita, Axioms of Work & Performance, The Notion of Meaningful Work. **Perspectives on Individuals:** Mind as a key player in an individual, Meditation as tools for self-management, Yoga as tools for self-management, Role of Yoga in addressing stress & burnout of managers, Self-Management by understanding the world within,

Values & their role in Self-management, Shaping the personality through Trigunas. **Perspectives on Life and Society:** Perspectives on Sustainability, Death as a creative destruction process, The Law of Conservation of Divinity, Conclusions.

References:

1. Prabhupada, His Divine Grace A.C. Bhaktivedanta. Bhagavad Gita As It Is. Mumbai: Bhaktivedanta Book Trust, 2009.
2. Prabhupada, His Divine Grace A.C. Bhaktivedanta. The Science of Self-Realization. Mumbai: Bhaktivedanta Book Trust, 2002.

ECE0051 Excel Fundamentals for Data Analysis [3 0 0 3]

Data analysis: Overview, data analysis with Excel. Conditional formatting, sorting and filtering data, Cleaning and manipulating text data. Working with numbers and dates. Calculation with named ranges. Automating data validation. Working with Tables. Logical and lookup function. Data visualization and validation.

References:

1. L. Winston Wayne, Microsoft Excel 2019: Data Analysis & Business Model, PHI.
2. Data Analysis with Excel, tutorialspoint, https://www.tutorialspoint.com/excel_data_analysis
3. Manisha Nigam, Data Analysis with Excel, BPB Publications.

ECE0052 Introduction to Word Processing [3 0 0 3]

MS Word Basics: Getting Started, Explore Window, Backstage View, Entering Text, Move Around, Save Document, Opening a Document, Closing a Document, Context Help, **Editing Documents:** Text Insert/Select/Delete/Move/Copy & Paste/Find & Replace/ Spell Check/ Zoom In-Out/ Special Symbols/ Undo Changes operations. **Formatting Text:** Setting Text Fonts, Text Decoration, Change Text Case, Change Text Color, Text Alignments, Indent Paragraphs, Create Bullets, Set Line Spacing, Borders and Shades, Set Tabs, Apply Formatting. **Formatting Pages:** Adjust Page Margins, Header and Footer, Add Page Numbers, Insert Page Breaks, Insert Blank Page, Cover Pages, Page Orientation. **Working With Tables:** Create a Table, Rows & Columns, Move a Table, Resize a Table, Merging Cells, Split a Table, Split Cells, Add Formula, Borders & Shades. **Advanced Operations:** Quick Styles, Use Templates, Use Graphics, Auto Correction, Auto Formatting, Table of Contents, Preview Documents, Printing Documents, Email Documents, Translate Document, Compare Documents, Document Security, Set Watermark.

References:

1. Al Sweigart, *Word For Dummies*, (1e), Wiley India Pvt Ltd., 2021, ISBN-13: 1119829178.
2. Peter John, *Microsoft Word & Excel 2021 For Beginners & Advanced Learners*, (1e), Wiley India Pvt Ltd, 2016. ISBN-13: 979-8483206361.
3. James Holler, *Microsoft Word 2023: The Most Updated Crash Course from Beginner to Advanced*, Independently published, 2022. ISBN-13: 979-8364609687.