| B.TECH. I  Semester-1 | L | T | P | C |
|---|---|---|---|---|
| **CS 101: Fundamentals of Computer Programming** | 3 | 0 | 2 | 4 |

| Unit - 1 | 14 Hours |
|---|---|

*Basic Structure of Computers*

Functional Units of a Computer: Input Unit, Memory Unit, Arithmetic and Logic Unit, Output Unit, Control Unit; Number Representation & Arithmetic Operations: Integers, Floating-Point Numbers; Character Representation; Familiarization with program and programming

*C Language: Variables, Operators and Expressions | Control Flow, Functions and Program Structure*

Variables constants and declarations. Arithmetic, relational and logical operators: Precedence order.

Control flow statements: For loop, While loop, If, If-else, Switch. Arrays: One dimensional and two dimensional arrays. Characters and strings.

Functions: Pass by value, pass by reference, Recursive functions, Scope of variables.

Sorting algorithms: Selection sort, Insertion sort

| Unit - 2 | 16 Hours |
|---|---|

*C Language: Pointers and Arrays, Structures, Input and Output*

Introduction to pointers: Basic pointers, Pointers to arrays and two dimensional arrays, Pointer arithmetic, Malloc, stack vs heap,

Structures: Basic introduction, Pointers to structures, Basic linked lists

File processing (IO processing): Opening, closing and reading files, Structured and Unstructured file reading

| Unit - 3 | 12 Hours |
|---|---|

*Introduction to Python*

General Information

Core Python: Variables, Strings, Tuples, Lists, Arithmetic Operators, Comparison Operators, Conditionals, Loops, Type Conversion, Mathematical Functions, Reading Input, Printing Output, Error Control

Functions & Modules: Functions, Modules. Mathematics Modules: math Module, cmath Module numarray Module: General Information, Creating an Array, Accessing & Changing Array Elements, Operations on Arrays, Array Functions, Copying Arrays. Scoping of Variables. Writing & Running Programs

**Total Contact Time: 42 Hours**

| Recommended Books |
|---|
| 1. "Computer Organization and Embedded Systems", Carl Hamacher, 6th Edition, TMH. |
| 2. "Programming with C Schaum's outline Series", Gottfried B.S., Outline Series, 2/E, TMH, 2006. |
| 3. "The C Programming language", Brian W. Kernighan, Dennis M. Ritchie, 2/E, Prentice Hall PTR publication, 1988. |
| 4. "Programming in ANSI C", E. Balagurusamy, 6/E, Tata Mc-Graw Hill, 2012. |
| 5. "Programming in C", Pradip Dey, 2/E, Oxford University Press, 2012. |
| 6. "Numerical Methods in Engineering with Python", J. Klusalaas, Cambridge University Press. |
| 7. "Introduction to Computer Science", ITL Education Solutions Limited, Pearson Education, Fourth Impression, 2009. |

| B.TECH. I Semester-1 | L | T | P | C |
|---|---|---|---|---|
| EC 102: Digital Design | 3 | 0 | 2 | 4 |

| Unit - 1 | 14 Hours |
|---|---|

*Digital Systems and Binary Numbers*: Digital Systems, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic

*Boolean Algebra and Logic Gates*: Introduction, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates, Integrated Circuits

*Gate-Level Minimization*: Introduction, The Map Method, Two- and Three-Variable Maps, Four-Variable K-Map, Product-of-Sums Simplification, Don't-Care Conditions, NAND and NOR Implementation, Other Two-Level Implementations, Exclusive-OR Function

| Unit - 2 | 14 Hours |
|---|---|

*Combinational* Logic: Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers

*Synchronous Sequential Logic*: Introduction, Sequential Circuits, Storage Elements: Latches, Storage Elements: Flip-Flops, Analysis of Clocked Sequential Circuits (state equations, state table, state diagram, flip-flop input equations, analysis with D, JK & T flip-flops), State Reduction and Assignment, Design Procedure(synthesis using D, JK & T flip-flops, excitation tables).

| Unit - 3 | 14 Hours |
|---|---|

*Registers and Counters*: Registers, Shift Registers (serial transfer, serial addition, universal shift register), Ripple Counters (Binary ripple counter, BCD ripple counter), Synchronous Counters (Binary counter, Up-Down binary counter, BCD counter, Binary counter with parallel load), Other Counters (Counter with unused states, Ring counter Johnson counter)

*Memory and Programmable Logic*: Introduction, Random-Access Memory (Block diagram, Write and Read operations, Timing waveforms, Types), Memory Decoding (Internal construction, Coincident decoding, Address multiplexing), Error Detection and Correction (Hamming code, Single-Error Correction, Double-Error Detection), Combinational PLDs: Read-Only Memory, Programmable Logic Array, Programmable Array Logic, Introduction to Sequential Programmable Devices

| Total Contact Time: 42 Hours |
|---|

| Recommended Books |
|---|
| Text-Book |
| 1. "Digital Design", Mano Morris, 6th Edition, Pearson Education, 2005. |
| Reference Books |
| 1. "Digital Logic and Computer Design", Mano Morris, 3rd Edition, Pearson Education, 2005. |
| 2. "Digital Electronics Practice Using Integrated Circuits", Jain and Anand, TMH, 2004 |
| 3. "Logic and Computer Design Fundamentals", Kime Charles, Pearson Education, 2004. |
| 4. "Digital Circuits and Logic Design", Lee Samual, PHI, 1998. |
| 5. "Digital Fundamentals", Floyd and Jain, Pearson Education, 2006. |

| B.TECH. I Semester-1 | L | T | P | C |
|---|---|---|---|---|
| AS 103: Engineering Physics | 3 | 0 | 2 | 4 |

| Electromagnetism | 8 Hours |
|---|---|

*ELECTROSTATICS*: Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications – Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications. Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics – Dielectric polarization – Dielectric strength – Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

*MAGNETOSTATICS*: Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

| Quantum Physics | 8Hours |
|---|---|

Black body radiation, Dual nature of matter and radiation, Compton effect, Pair production, de Broglie waves, Uncertainty principle.

Wave equation: Probability and wave function, Time dependent and time independent Schrödinger equations, Particle in a box

| Solid State Physics | 10 Hours |
|---|---|

Basics of crystal structure, Bravais lattice, Unit cell, Packing fraction, Miller indices. X-Ray properties, X-ray diffraction and Bragg's law.

Bonding in solids: Ionic, Covalent, Metallic, Vander Waal and Hydrogen.

Free-electron theory of metals, Band theory of solids, Semiconductors: Intrinsic & extrinsic, The p-n junction, p-n junction with an applied voltage, capacitive effects in p-n junction, Hall effect, Superconductivity: Type I and type II, Meissner effect.

| Laser Physics & Fibre Optics | 8 Hours |
|---|---|

Introduction to Laser, Characteristics of Lasers, Spontaneous and stimulated emissions, Einstein'scoefficients, Population inversion and lasing action.

Laser systems: Ruby laser, He-Ne Laser, Semiconductor Laser, Advanced lasers, Holography.

Fermat's principle and Snell's law-optical fibre, Principle and construction, Acceptance cone, Numerical aperture, V-Number, Types of fibres,

Fabrication: Double Crucible Technique, Vapour phase Oxidation Process, Fibre optic communication principle, Fibre optic sensors, Other applications of optical fibres.

| Physics of Materials and devices | 8 Hours |
|---|---|

Introduction to Nanomaterials, Quantum confinement effects, 2-D materials, Nanotubes, Nanowires, Band gap engineering of nanomaterials for nano-devices, nano-sensors, Materials for organic electronics, OLEDs, Graphene based FETs.

| Total Contact Time: 42 Hours |
|---|

| Recommended Books |
|---|
| 1. David J. Griffith, "Introduction to Electrodynamics"; Addison-Wesley, 2012. |
| 2. Resnick and Haliday, "Physics Part I and II", Wiley Eastern, 2008. |
| 3. A. Beiser, "Concept of the Modern Physics", McGraw-Hill, 2008 |
| 4. A. Ghatak, "Introduction to Modern Optics", McGraw-Hill, 2012. |
| 5. W. T. Silfvast, "Laser Fundamentals", Cambridge, 2004. |

6. C. Kittel, "Introduction to Solid State Physics", Wiley Publications, 2009.

7. Charles P. Poole and F. J. Owens, "Introduction to Nanotechnology", Wiley Publications, 2007.

8. S. Datta, "Electronic Transport in Mesoscopic Systems", Cambrige University Press, 2013.

9. V. V. Mitin, V. A. Kochelap, M. A. Stroscio, "Introduction to Nanoelectronics Science, Nanotechnology, Engineering, and Applications", Cambridge University Press, 2008.

10. Mark Ratner, D. Ratner, "Nanotechnology A Gentle introduction to the Next Big Idea", Pearson Education, 2003.

| B.TECH. I Semester-1 | L | T | P | C |
|---|---|---|---|---|
| **AS 104: Engineering Mathematics** | 3 | 0 | 0 | 3 |

| **Differential Calculus** | **8 Hours** |
|---|---|
| Review of calculus, Successive Differentiation, Leibnitz's theorem, Power series, Taylor's and Maclaurin's theorems for one variable. | |
| **Differential Equation** | **10 Hours** |
| Review of differential equation-exact differential equation and linear differential equations, Second order differential equations with constant coefficients, Differential equations with variable coefficients- methods of undetermined coefficients and variation of parameters. Applications-damped forced oscillations and LCR circuit problems. | |
| **Multiple Integrals** | **6 Hours** |
| Evaluation of double integrals–change of order of integration–change of variables between Cartesian and polar co-ordinates, Evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates. | |
| **Vector Calculus** | **6 Hours** |
| Scalar and vector fields, Gradient-directional derivative, level surfaces, tangent planes and normal lines, Divergence and Curl-physical interpretation, line integral-independence of path, surface and volume integrals | |
| **Linear Algebra** | **12 Hours** |
| Elementary row operations, Gauss-elimination and Gauss Jordon method, consistency of linear systems, inverse of a matrix, Eigenvalues & Eigenvectors, Cayley-Hamilton theorem, Vector Spaces, Linear Independence, Basis and Ranks, Norms, Angles and Orthogonality, Orthogonal Projections, Singular Value Decomposition. | |
| **Total Contact Time: 42 Hours** | |

| **Recommended Books** |
|---|
| 1. K. A. Stroud and Dexter J. Booth, Advanced Engineering Mathematics, 6th edition, Red Globe Press. |
| 2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley. |
| 3. Dennis G. Zill, Advanced Engineering Mathematics, 6th Edition, John and Bartlett. |
| 4. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers. |
| 5. Jain and Iyenger, Advanced Engineering Mathematics, Narosa Publications, New Delhi. |

| B.TECH. I  Semester-1 | L | T | P | C |
|---|---|---|---|---|
| EC 105: ICT Workshop - I | 0 | 0 | 4 | 2 |

| | |
|---|---|
| **Component Identification &Testing** <br> **Bread-Board Connections** | **6 Hours** |
| Resistors, Capacitors, Diodes, Transistors etc. | |
| **Introduction to Various Instruments** | **8 Hours** |
| Digital Multimeter, DC Power Supply, Function Generator, CRO/DSO etc. | |
| **Ports and Connectors** | **2 Hours** |
| Banana Plugs, Alligator clips, Test Clips, Binding Posts, BNC Connector, Power Connectors, Audio Connectors, RJ-type Modulo Connectors, USB Connector etc. <br> Parallel Port, Serial Port, USB Port, Ethernet Port, Audio Port, Video Port | |
| **Introduction to Soldering and Desoldering** | **6 Hours** |
| **Introduction to PCB Design** | **6 Hours** |
| Introduction, PCB Design Overview, PCB Design Glossary, Prototyping and the PCB Design Flow, How to Prototype PCB Designs | |
| **Introduction to Arduino** | **16 Hours** |
| Basics of Arduino <br> Interfacing of various components with Arduino | |
| **Project** | **12 Hours** |
| **Total Contact Time: 56 Hours** | |

| **Recommended Books** |
|---|
| 1. Electronic Principles, Albert Malvino and David J Bates, McGraw Hill(7th Edition) |
| 2. https://www.arduino.cc/ |
| 3. http://www.ni.com/en-in/innovations/white-papers/10/pcb-design-fundamentals---main-page.html |

| B.TECH. I  Semester-1 | L | T | P | C |
|---|---|---|---|---|
| EC 106: Engineering Circuit Analysis | 2 | 0 | 0 | 2 |

**Prerequisite**

Units and Scales, Charge, Current, Voltage, and Power, Voltage and Current Sources, Ohm's Law
The Capacitor, The Inductor, Inductance and Capacitance Combinations, Consequences of Linearity, Duality

| Unit - 1 | 14 Hours |
|---|---|

Nodes, Paths, Loops, and Branches, Kirchhoff's Current Law, Kirchhoff's Voltage Law, The Single Loop Circuit, The Single-Node-Pair Circuit, Series and Parallel Connected Sources, Resistors in Series and Parallel, Voltage and Current Division

Nodal Analysis, The Supernode, Mesh Analysis, The Supermesh, Nodal vs. Mesh Analysis: A Comparison

Linearity and Superposition, Source Transformations, Thévenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion, Selecting an Approach: A Summary of Various Techniques

| Unit - 2 | 14 Hours |
|---|---|

The Source-Free RL Circuit, Properties of the Exponential Response, The Source-Free RC Circuit, A More General Perspective, The Unit-Step Function, Driven RL Circuits, Natural and Forced Response, Driven RC Circuits, Predicting the Response of Sequentially Switched Circuits

The Source-Free Parallel Circuit, The Overdamped Parallel RLC Circuit, Critical Damping, The Underdamped Parallel RLC Circuit, The Source-Free Series RLC Circuit, The Complete Response of the RLC Circuit, The Lossless LC Circuit

Single Time-Constant (STC) circuits: Evaluating the Time-Constant, Classification of STC circuits, Frequency response of STC circuits, Step response of STC circuits, Pulse response of STC circuits

**Total Contact Time: 28 Hours**

**Recommended Books**

1. "Engineering Circuit Analysis", W. H. Hyat, J. E. Kimmerly, S. M. Durbin, 8thEdition, TMH.
2. "Electric Circuits", Joseph A Edminister, SI (metric) edition, Schaum's outline series, McGraw hill, 2nd edition 1983.
3. "Network Analysis", Van Valkenburg M E, 3rd Edition, PHI, 2002.
4. "Basic electrical engineering", Kothari and Nagrath, 2nd edition, 2007, Tata McGraw-Hill Education
5. "Microelectronic Circuits", A. S. Sedra and K. C. Smith, Oxford University Press, 7th Edition.

| B.TECH. I Semester-1 | L | T | P | C |
|---|---|---|---|---|
| HM 107: Indian Constitution | 2 | 0 | 0 | 2 |

| Unit – 1: Basic Information about Indian Constitution | 6 Hours |
|---|---|
| Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India. | |

| Unit – 2: Union Executive and State Executive | 8 Hours |
|---|---|
| Powers and Functions of Lok Sabha and Rajya Sabha, Selection of President, Powers and Functions of the President, Prime Minister, Cabinet Ministers and Minister of State and their powers and functions
State Executives – Appointment of Governors, Powers and Functions of the Governor, Powers and Functions of Chief Minister, Functions of State Cabinet, Functions of State Legislature.
Election Commission: Composition, Selection of Chief Election Commissioner, Powers and Functioning of Election commission. | |

| Unit – 3: The Judiciary and Legal System | 8 Hours |
|---|---|
| Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok Ayuktas Act 2013. The Legal System: Sources of Law and the Court Structure: Enacted Law-Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India: District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court.
Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace. | |

| Unit – 4: Intellectual Property Laws and E-Governance | 6 Hours |
|---|---|
| Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement.
Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act. E-Governance and role of engineers in E-Governance, need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary. | |

| Total Contact Time: 28 Hours | |

| Books and references: |
|---|
| 1. The Constitution of India, 1950 (Bare Act), Government Publication |
| 2. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi. |
| 3. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015. |
| 4. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014. |

5. Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.

6. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.

7. Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.

8. Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.

9. Subhash C. Kashyap: Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT, 2018.

10. Madhav Khosla: The Indian Constitution, Oxford University Press.

11. V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)

12. Suresh T. Viswanathan: The Indian Cyber Laws, Bharat Law House, New Delhi-8

13. P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi

14. Prabudh Ganguli: Gearing up for Patents: The Indian Scenario, Orient Longman.

15. BL Wadehra: Patents, Trademarks, Designs and Geological Indications Universal Law Publishing - LexisNexis.

16. Intellectual Property Rights: Law and Practice, Module III by ICSI (only relevant sections)

17. Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/e-Governance_Project_Lifecycle_Participant__Handbook-5Day_CourseV1_20412.pdf

18. Information Technology Act, 2000 with latest amendments RTI Act 2005 with latest amendments.

19. Information Technology Rules, 2000

20. Cyber Regulation Appellate Tribunal Rules, 2000

21. NPTEL lectures on IPR and patent rights