# Electrical Engineering

| SEMESTER - I (Common for all B.Tech Courses) | | | | | | |
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| **S.No** | **C. Code** | **Course** | **L** | **T** | **P** | **C** |
| 1 | MA 101 | Calculus | 3 | 1 | 0 | 8 |
| 2 | EE 101 | Introduction to Electrical Systems and Electronics | 3 | 0 | 0 | 6 |
| 3 | CS 101 | Computer Programming | 3 | 0 | 2 | 8 |
| 4 | PH 101 | Quantum Physics and Applications | 2 | 1 | 0 | 6 |
| 5 | HS 106 | Design thinking and Creativity | | | | 0 |
| 6 | NO 105/107 | NSS/NSO/NCC/NCA | 0 | 0 | 2 | 2 |
| 7 | EE 104 | Formal Communications | 1 | 0 | 0 | 2 |
| | First Semester Total Credits | | | | | 32 |

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| 1 | **Title of the course** (L-T-P-C) | **Calculus** **(3-1-0-8)** |
| 2 | **Pre-requisite courses(s)** | - |
| 3 | **Course content** | Review of limits, continuity, differentiability. Mean value theorem, Taylors Theorem, Maxima and Minima. Riemann integrals, Fundamental theorem of Calculus, Improper integrals, applications to area, volume. Convergence of sequences and series, power series. Partial Derivatives, gradient and directional derivatives, chain rule, maxima and minima, Lagrange multipliers. Double and Triple integration, Jacobians and change of variables formula. Parametrization of curves and surfaces, vector fields, line and surface integrals. Divergence and curl, Theorems of Green, Gauss, and Stokes. |
| 4 | **Texts/References** | 1. B.V. Limaye and S. Ghorpade, A Course in Calculus and Real Analysis, Springer UTM (2004)<br>2. B.V. Limaye and S. Ghorpade, A Course in Multivariable Calculus and Analysis, Springer UTM (2010)<br>3. James Stewart, Calculus (5th Edition), Thomson (2003).<br>4. T. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern (1980).<br>5. Marsden and Tromba, Vector calculus (First Indian Edition), Springer (2012) |

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| 1 | **Title of the course (L-T-P-C)** | **Introduction to Electrical Systems and Electronics (3-0-1-6)** |
| 2 | **Pre-requisite courses(s)** | Exposure to Calculus |
| 3 | **Course content** | **From Physics to Electrical Engineering**<br>(a) Lumped matter discipline<br>(b) Batteries, resistors, current sources and basic laws<br>(c) I-V characteristics and modeling physical systems<br>**Basic Circuit Analysis Methods**<br>(a) KCL and KVL, voltage and current dividers<br>(b) Parallel and serial resistive circuits<br>(c) More complicated circuits<br>(d) Dependent sources, and the node method<br>(e) Superposition principle<br>(f) Thevenin and Norton method of solving linear circuits<br>(g) Circuits involving diode.<br>**Analysis of Non-linear Circuits**<br>(a) Toy example of non-linear circuit and its analysis<br>(b) Incremental analysis<br>(c) Introduction to MOSFET Amplifiers<br>(d) Large and small signal analysis of MOSFETs<br>(e) MOSFET as a switch<br>**Introduction to the Digital World**<br>(a) Voltage level and static discipline<br>(b) Boolean logic and combinational gates<br>(c) MOSFET devices and the S Model<br>(d) MOSFET as a switch; revisited<br>(e) The SR model of MOSFETs<br>(f) Non-linearities: A snapshot<br>**Capacitors and Inductors**<br>(a) Behavior of capacitors, inductors and its linearity<br>(b) Basic RC and RLC circuits<br>(c) Modeling MOSFET anomalies using capacitors<br>(d) RLC circuit and its analysis<br>(e) Sinusoidal steady state analysis<br>(f) Introduction to passive filters<br>**Operational Amplifier Abstraction**<br>(a) Introduction to Operational Amplifier<br>(b) Analysis of Operational amplifier circuits<br>(c) Op-Amp as active filters<br>(d) Introduction to active filter design<br>**Transformers and Motors**<br>(a) AC Power circuit analysis<br>(b) Polyphase circuits<br>(c) Introduction to transformers |

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| | | (d) Introduction to motors |
| **4** | **Texts/References** | **1.** Anant Agarwal and Jefferey H. Lang, "Foundations of Analog and Digital Electronics Circuits," Morgan Kaufmann publishers, 2005<br>**2.** Wlilliam H. Hayt, Jr., Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis," Tata McGraw-Hill<br>**3.** Theodore Wildi, "Electrical Machines, Drives and Power Systems," Pearson, 6-th edition.<br>**4.** V. Del. Toro, "Electrical Engineering Fundamentals," Pearson publications, 2nd edition. |

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| 1 | **Title of the course** (L-T-P-C) | **Quantum Physics and Applications** **(2-1-0-6)** |
| 2 | **Pre-requisite courses(s)** | Nil |
| 3 | **Course content** | • Quantum nature of light: Photoelectric Effect and Compton Effect.<br>• Stability of atoms and Bohr`s rules.<br>• Wave particle duality: De Broglie wavelength, Group and Phase velocity, Uncertainty Principle, Double Slit Experiment.<br>• Schrödinger Equation.<br>• Physical interpretation of Wave Function, Elementary Idea of Operators, Eigen-value Problem.<br>• Solution of Schrödinger equation for simple boundary value problems.<br>• Reflection and Transmission Coefficients. Tunneling.<br>• Particle in a three dimensional box, Degenerate states.<br>• Exposure to Harmonic Oscillator and Hydrogen Atom without deriving the general solution.<br>• Quantum Statistics: Maxwell Boltzmann, Bose Einstein and Fermi Dirac Statistics by detailed balance arguments.<br>• Density of states.<br>• Applications of B-E statistics: Lasers. Bose-Einstein Condensation.<br>• Applications of F-D statistics: Free electron model of electrons in metals. Concept of Fermi Energy.<br>• Elementary Ideas of Band Theory of Solids.<br>• Exposure to Semiconductors, Superconductors, Quantum Communication and Quantum Computing. |
| 4 | **Texts/References** | 1. Quantum Physics: R. Eisberg and R. Resnick, John Wiley 2002, 2nd Edition.<br>2. Introduction to Modern Physics: F. K. Richtmyer, E. H. Kennard and J.N. Cooper, Tata Mac Graw Hill 1976, 6th Edition.<br>3. Modern Physics: K. S. Krane, John Wiley 1998, 2nd Edition.<br>4. Introduction to Modern Physics: Mani and Mehta, East-West Press Pvt. Ltd. New Delhi 2000.<br>5. Elements of Modern Physics: S. H. Patil, Tata McGraw Hill, 1984.<br>6. Concepts of Modern Physics, A Beiser, Tata McGraw Hill, 2009. |

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| 1 | **Title of the course** (L-T-P-C) | **Design thinking and Creativity** **(1-0-0-0)** |
| 2 | **Pre-requisite courses(s)** | **Nill** |
| 3 | **Course content** | **1.** Problem Exploration- Students move around and find problems that need solutions.<br>**2.** They analyse the problem (not solution) and evolve a problem space. The problem space is converted into a story boar and presented in a poster session.<br>**3.** Feedback at the poster session is used to refine the problem definition(s).<br>**4.** Solution Exploration: Creative solutions (solution space) are now explored and presented using story boards.<br>**5.** The solutions are converted into "embodiments". |
| 4 | **Texts/References** | **1.** "Stuff Matters" Prof. Mark Miodownik, Penguin<br>**2.** "Design and Technology by James Garratt, Cambridge University Press.<br>**3.** How it works in the home: Walt Disney:9780894340482- Amazon.com.<br>**4.** How it works in the city (Walt Disney available on Amazon.com)<br>**5.** Change by design – Tim Brown<br>There are some additional books in this "How it Works" series. |