# Electrical Engineering

| Semester - II | | | | | | |
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| **S. No** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 1 | MA 102 | Linear Algebra | 3 | 1 | 0 | 4 |
| 2 | MA 103 | Differential Equations -I | 3 | 1 | 0 | 4 |
| 3 | EE 204 | Digital Systems | 2 | 1 | 0 | 6 |
| 4 | EE 214 | Digital Circuits Laboratory | 0 | 0 | 3 | 3 |
| 5 | EE 205 | Network Theory | 2 | 1 | 0 | 6 |
| 6 | EE 229 | Electronic Devices | 3 | 0 | 0 | 3 |
| 7 | ME 111 | Engineering Graphics Lab | 1 | 0 | 3 | 5 |
| 8 | ME 113 | Hands on Engineering Lab | 0 | 0 | 3 | 3 |
| 9 | NO 105/107 | NSS/NSO/NCC/NCA | 0 | 0 | 2 | 2 |
| | | Total Credits | | | | |

# Electrical Engineering

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| 1 | **Title of the course** (L-T-P-C) | **Linear Algebra (3-1-0-4)** |
| 2 | **Pre-requisite courses(s)** | -- |
| 3 | **Course content** | Vectors in $R^n$, notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of $R^n$, basis of a vector subspace. Systems of linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, application to-quadratic-forms. |
| 4 | **Texts/References** | **1.** H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley (1995).<br>**2.** G. Strang, Linear algebra and its applications (4th Edition), Thomson (2006)<br>**3.** S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India (2000)<br>**4.** E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999) |

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| 1 | **Title of the course** (L-T-P-C) | **Differential Equations -I (3-1-0-4)** |
| 2 | **Pre-requisite courses(s)** | Nill |
| 3 | **Course content** | Exact equations, integrating factors and Bernoulli equations. Orthogonal trajectories. Lipschitz condition, Picard's theorem, examples on non-uniqueness. Linear differential equations generalities. Linear dependence and Wronskians. Dimensionality of space of solutions, Abel-Liouville formula. Linear ODEs with constant coefficients, the characteristic equations. Cauchy-Euler equations. Method of undetermined coefficients. Method of variation of parameters.<br>Laplace transforms generalities. Shifting theorems. Convolution theorem. |
| 4 | **Texts/References** | **1.** E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999)<br>**2.** W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005) |

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| 1 | **Title of the course** (L-T-P-C) | **Digital Systems** **(2-1-0-6)** |
| 2 | **Pre-requisite courses(s)** | None |
| 3 | **Course content** | • Introduction to Digital Systems<br>• Number systems and Logic: Number Systems, Different Codes, Boolean logic, basic gates, truth tables<br>• Introduction to Logic families: TTL, CMOS etc.<br>• Boolean Algebra: Laws of Boolean Algebra, logic minimization using K maps<br>• Combinational Logic Circuits: Adders, Subtractors, Multipliers, MSI components like Comparators, Decoders, Encoders, MUXs, DEMUXs<br>• Sequential circuits: Latches, Flipflops, Analysis of clocked sequential circuits, Registers and Counters (Synchronous and Asynchronous), State Machines<br>• Introduction to Hardware Description Languages<br>• Array based logic elements: Memory, PLA, PLD, FPGA<br>Special Topics: Asynchronous State machines, Testing and Verification of Digital Systems |
| 4 | **Texts/References** | 1. J. F. Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005<br>2. M. Moris Mano; Digital Design, 4th Edition, Pearson,2009<br>3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009<br>4. H.Taub and D. Schilling; Digital Integrated Electronics, McGraw Hill, 1977.<br>5. Charles H Roth; Digital Systems Design using VHDL, Thomson Learning, 1998. |

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| 1 | **Title of the course** (L-T-P-C) | **Digital Circuits Laboratory** **(0-0-3-3)** |
| 2 | **Pre-requisite courses(s)** | Digital Systems Theory (EE224) |
| 3 | **Course content** | This purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab:<br>Experiments with discrete ICs<br>1. Introduction of digital ICs<br>2. Realizing Boolean expressions<br>3. Adder/Subtractor<br>4. Shift registers<br>5. Synchronous Counters<br>6. Asynchronous Counters + 7- segment display<br>7. Finite State Machines (2 weeks) Experiments with CPLD<br>8. Arithmetic and Logic Unit<br>9. LCD, Buzzer Interfacing Pipelining |
| 4 | **Texts/References** | 1. M. Moris Mano; Digital Design, 5th Edition, Pearson, 2009<br>2. J.F.Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005.<br>3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009 |

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| 1 | **Title of the course** (L-T-P-C) | **Network Theory** **(2-1-0-6)** |
| 2 | **Pre-requisite courses(s)** | -- |
| 3 | **Course content** | **Graphs of networks:** current and voltage spaces of graphs and their representations: incidence, cutset and circuit matrices; Tellegen's Theorem.<br>Formal study of methods of analysis such as nodal, modified nodal, cutset, loop analysis for linear networks.<br>Multiport representation for networks with particular emphasis on 2-ports.<br>Time domain analysis of R, L, M, C, controlled sources, networks using state space methods.<br>Introduction to s-domain methods. |
| 4 | **Texts/References** | 1. Jerome P. Levine, Omar Wing, Classical Circuit Theory, Springer, 2009.<br>2. S. Ghosh, Network Theory: Analysis and Synthesis, Prentice Hall of India, 2005.<br>3. N Balabanian and T.A. Bickart, Linear Network Theory: Analysis, Properties, Design and Synthesis, Matrix Publishers, Inc. 1981.<br>4. L.O. Chua, C.A. Desoer, E.S. Kuh, Linear and Nonlinear Circuits, McGraw - Hill International Edition 1987. |

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| 1 | **Title of the course** (L-T-P-C) | **Electronic Devices** **(3-0-0-3)** |
| 2 | **Pre-requisite courses(s)** | EE 102 |
| 3 | **Course content** | • Introduction of Semiconductor Equations: Fermi-Dirac Distribution, Boltzmann's approximation<br>• Semiconductor Diodes: Barrier formation in metal- semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes.<br>• Field Effect Devices: JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models.<br>• Bipolar transistors: IV characteristics and Elers-Moll model; small signal models; Charge storage and transient response |
| 4 | **Texts/References** | 1. D. A. Neamen, Semiconductor Physics and Devices, 4e Edition, McgrawHill, 13th reprint, 2016.<br>2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.<br>3. B.G. Streetman, Solid State Electronic Devices, 7th Edition, Pearson, 2016.<br>4. J. Millman and A. Grabel, Microelectronics, II edition 34th reprint McGraw Hill, International, 2017.<br>5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.<br>6. R.T. Howe and C.G. Sodini, Microelectronics : An integrated Approach, Prentice Hall International, 1997. |

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| 1 | **Title of the course** (L-T-P-C) | **Engineering Graphics Lab (1-0-3-5)** |
| 2 | **Pre-requisite courses(s)** | -- |
| 3 | **Course content** | Engineering Graphics with mini drafter: Around half a semester and bit more with following topics to be covered.<br>• Introduction to Engineering Graphics<br>• Curves<br>• Projections of Points<br>• Projection of Lines<br>• Projection of Planes<br>• Projections on Auxiliary Planes<br>• Projections of Solids<br>• Sections of Solids<br>• Intersections of Solids<br>Engineering Graphics with 2D Drafting Software: 5 weekly computer laboratory sessions covering above using AutoCAD® as a drafting software, 5th session on Isometric Projections. |
| 4 | **Texts/References** | **1.** N. D. Bhatt, revised and enlarged by V. M. Panchal and P. R. Ingle, Engineering Drawing, 53rd Edition, 2014, Charotar Publishers, Anand.<br>**2.** Warren J. Luzadder and Jon M. Duff, Fundamentals of Engineering Drawing, Prentice-Hall of India.<br>**3.** Gopalakrishna K. R., Engineering Drawing Vol. I & II Combined., Subhas Stores, 25th Edition, 2017.<br>**4.** Narayana. K. L., and Kannaiah, P. E., Textbook on Engineering Drawing, 2nd Edition, 2013, Scitech Publications, Chennai.<br>**5.** Venugopal K. and Prabhu Raja V., Engineering Drawing + AutoCAD, New Age International Publishers, 5th Edition, 2011. |

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| 1 | **Title of the course** (L-T-P-C) | **Hands on Engineering Lab** **(0-0-3-3)** |
| 2 | **Pre-requisite courses(s)** | -- |
| 3 | **Course content** | **List of Experiments (Mechanical Workshop)**<br>• To make a Square-fit from the given mid steel pieces (Fitting)<br>• To make a V-fit from the given mid steel pieces (Fitting)<br>• To make a rectangular tray as per required dimensions (Sheet Metal)<br>• To build a transition piece (Sheet Metal)<br>• To make a Butt joint using the given two M.S pieces (Arc welding)<br>• To make a lap joint using the given two M.S pieces (Arc welding)<br>• To build a pipeline using fittings for given flow circuit (Plumbing)<br>**List of Experiments (Electrical Workshop)**<br>• To control one lamp by a one switch with provision for plug socket with switch control (Electrical wiring)<br>• To do stair case wiring (i.e. control of one lamp by two switches fixed at two different places) (Electrical wiring)<br>• Measurement of hot and cold resistance of filament<br>• Improvement of Power Factor<br>• Calibration of Energy meter<br>• Measurement of Power using three ammeter/voltmeter method<br>**List of Experiments (Electronics)**<br>• Understanding breadboard, One-way traffic<br>• Introduction to Arduino and Buzzer<br>• Using Arduino speed measurement of motor/ glowing of LED<br>• Control of water level using Arduino<br>Line follower using Arduino |
| 4 | **Texts/References** | Elements of Workshop Technology Vol. 1 (2015), S. K. Hajra Choudhary, A. K. Hajra Choudhary and Nirjhar Roy, Media Promoters and Publishers Pvt. Ltd.<br>W. A. J. Chapman, Workshop Technology, Vol. 1 (2006), Vol 2 (2007), and (1995), CBS Publishers. |