**Department of Electrical Engineering, SVNIT, Surat**

**Syllabus Comprehensive Test for Ph. D. Students**

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| Sr. No. | **(Common for all students)** |
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| 1. | **Research Writing:**  Organization of Research Paper and Report, Reading and Analyzing Research Papers and Reports, Text Structure. Common Writing Mistakes, Ethical Issues, Writing Composition, Technical Writing |
| 2. | **Fundamentals of Electrical Engineering:**  Electrical Circuits Analysis, Magnetic Circuits and Electromagnetism, Signals and Systems |
| 3. | **Mathematics:**  Vector Calculus, Probability and Statistics, Fourier Transform, Numerical Methods. Curve Fitting and Regression Analysis, Algebraic Methods, Matrix and Determinants |

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| **Sl No.** | **(Part A – Power Systems)** |
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| 1. | **Power Systems:** Load Flow Analysis, Short Circuit Studies, Load Frequency Control, Optimal Power flow |
| 2. | **Power System Protection:** Symmetrical Component. Protection of Generator, Motor, Transformer, Transmission line and Bus-Bar, Relay Co-Ordination. Numerical Relaying |
| 3. | **Power System Dynamics and Control:** Madeline of Synchronous Machine, Excitation System, Dynamics of a Synchronous generator Connected to Infinite Bus, Multi-Machine System, Transient and Voltage Stability |
| 4. | **High Voltage Engineering:** Non-destructive Testing of Dielectric Materials, Measurement Dielectric Constant and Loss Factor, Parallel Discharge Measurement, Rl Measurement, Condition Monitoring of Electrical Apparatus. |
| 5. | **Applications of Power Electronics in Power Systems:** Long transmission lines, issues and their compensation, active-reactive power and voltage control through Converters, HVDC transmission systems |
| 6. | **Solar and wind power conversion:** Fundamentals of solar and wind power and their control using converters |

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| **Sl No.** | **(Part B – Power Electronics and Electrical Drives)** |
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| 1. | **Power electronics:**  Power Semiconductor Devices, gate pulse generation using logic circuits and digital control, design consideration: snubber circuit, magnetic components, DC-DC Converters, Inverters, Line Commutated Converters, Unity Power Factor Conversion |
| 2. | **Modelling of Electrical Machines:**  Reference-Frame Theory, Voltage and Torque Equations, Analysis of Steady State and Dynamic Operation |
| 3. | **AC and DC Drives:**  Fundamentals of Electric Drives, Close Loop Control of De Drive, Induction Motor Drives, Synchronous Motor Drives |
| 4. | **Applications of Power Electronics to Power Systems:**  Reactive power control and compensation, solar and wind power integration with grid |

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| **Sl No.** | **(Part C – Instrumentation and Control)** |
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| 1. | **Vector spaces and matrices**  Definition of linear spaces, operators, matrix representation of the operators, similarity transformations, Eigen vectors, characteristic Polynomials, transfers matrices, diagonalizable matrices. |
| 2. | **Linear feedback system**  Transfer functions, state space representation convolution integrals, solution to LTI systems, computation of matrix exponentials, control system components, comparison between the transfer function and state space models, PID controllers and their tuning, analog vs digital controllers. |
| 3. | **Modern control systems**  State space based control systems design, Lyapunov matrix equations, Riccati equations, Stability analysis of linear and non-linear systems, linearization techniques, and observers. |
| 4. | **Control system instrumentation**  Sensors, transducers and actuators, sample and Hold circuits, V/f and f/V Converters, A/D and D/A Converters, Data Acquisition system, industrial automation, general PLC programming, distributed control system |