

Department of Electrical Engineering, SVNIT, Surat

Syllabus for PhD Comprehensive Examination

Important Notes: (i) The question paper is in two sections, the section-I is of 40 marks and the section-II is of 110 marks. (ii) Each PhD candidate has to attempt 100 marks out of 150. (iii) Each candidate has to score at least 60% marks in the comprehensive examination followed by viva based on the syllabus.

Section: I (Common for all students)

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 Circuit 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

BOOKS RECOMMENDED:

1. Steven D. Krause, The Process of Research Writing, Eastern Michigan University-USA, 2007.
2. Harry Cotton, Principles of Electrical Technology, Pitman, 1967.
3. V. N. Mittle and Arvind Mittal, Basic electrical engineering, , Tata McGraw-Hill Education, 2nd Ed. 2005.
4. Van Valkenburg M.E., Network Analysis, Prentice Hall, India, 3rd Ed. 2002.
5. John Bird, Higher Engineering Mathematics, Elsevier Publishers Ltd., 5th Ed. 2006.
6. E Kreyszing, Advanced Engineering Mathematics, John Wiley, Int. Student Ed. 1995.
7. S S Shastri , Introductory Methods of Numerical Analysis, Prentice Hall Ltd., 5th ED. 2012.
8. <http://nm.mathforcollege.com/> a web-course published by Prof. Kaw Autar, University of South Florida USA.

Section: II (Opt any one of part A/B/C)

Part A: Power Systems

1. Power System Analysis :

Load Flow Analysis, Short Circuit Studies, Load Frequency Control, Optimal Power Flow

2. Power System Protection:

Symmetrical Components, Protection of Generator, Motor, Transformer, Transmission Line And Bus-Bar. Relay Co-Ordination. Numerical Relaying

3. Power System Dynamics and Control:

Modeling 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, Partial Discharge Measurement, RI 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

BOOKS RECOMMENDED:

1. Hadi Saadat, Power System Analysis, Mc-GrawHill, USA, 1st ED. 2002.
2. John J. Grainger, William D. Stevenson, JR. Power System Analysis, McGraw Hill, 1994.
3. N G Hingorani and L Gyugyi, Understanding FACTS, IEEE Press, N Y USA, 1st Ed. 2001.
4. K R Padiyar , Power System Dynamics Stability and Control, B S Publication, 2nd Ed.2008.
5. Elgerd ollel, Electric Energy Sytems Theory- an Introduction, Tata Mc Graw Hill, 2nd Ed. 1995.
6. Padiyar. K. R., HVDC Power Transmission Systems, Wiley Eastern Limited, New Delhi, 2000.
7. Bhuvanesh Oza, N C Nair, R P Mehta, V H Makwana, Power System Protection and Switchgear, Tata Mc Graw Hill, 2010.
8. M S Naidu, V Kamaraju, High voltage Engineering, Tata McGraw Hill, New Delhi, 4th Ed. 2008.
9. Thomas Ackermann, Wind Power in Power System, John Willey & Sons, 2005.
10. C. S. Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning Pvt. Limited, New Delhi, 3rd Ed. 2015.

Part B: Power Electronics and Electrical Drives

1. Power Electronics:

(i) Power Semiconductor Devices, gate pulse generation using logic circuits and digital control, design consideration: snubber circuit, magnetic components.

(ii) Dc-Dc Converters, Inverters, Line Commutated Converters, Unity Power Factor Conversion,

2. Modeling 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 Dc 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

BOOKS RECOMMENDED:

1. M H Rashid, Power Electronics Circuits, Devices, and Applications, Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition, 1999.
2. Ned Mohan, Tore M. Undeland and William P. Robbins, Power Electronics Converters, Applications, and Design, John Willey & Sons, Inc., 2nd Edition, 1995.

3. J P Agrawal, Power electronic systems: Theory and design, Addison Wesley Longman (Singapore) Pte. Ltd. New Delhi, 2001.
4. Erickson Robert W., Maksimovic Dragan, Fundamentals of Power Electronics, Kluwer Academic Publishers Group (Netherlands), 2001.
5. A Pressman, Switching Power Supply Design, McGraw-Hill, 1998.
6. N G Hingorani and L Gyugyi, Understanding FACTS, IEEE Press, N Y USA, 1st Ed. 2001.
7. Padiyar. K. R., HVDC Power Transmission Systems, Wiley Eastern Limited, New Delhi, 2000.
8. P C Krause, Oleg Wasynczuk, Scott D. Sudhoff, Analysis of Electric Machinery and drive systems , IEEE Press, 2002.
9. Thomas Ackermann, Wind Power in Power System, John Willey & Sons, 2005.
10. C. S. Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning Pvt. Limited, New Delhi, 3rd Ed. 2015.

Part C: Instrumentation and Control

1. Vector spaces and matrices

Definition of linear spaces, operators, matrix representation of the operators, similarity transformations, eigen vectors, characteristic polynomials, transfer matrices, diagonalizable matrices,

2. Linear feedback systems

Transfer functions, state space representations, 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 instrumentations

Sensors, transducers and actuators, Sample and Hold Circuits, V/f And f/V Converters, A/D And D/A Converters, Data Acquisition Systems, industrial automation, general PLC programming, distributed control systems

BOOKS RECOMMENDED:

1. K. Hoffman and Ray Kunze, Linear Algebra, 2nd Edition, Prentice-Hall, Inc., New Jersey.
2. B. C.Kuo, Automatic Control Systems, 7th Edition, Prentice-Hall, Inc., New Jersey.
3. G. C. Goodwin, S. F. Graebe and M. E. Salgado, Control Systems Design, Prentice Hall, 2001.
4. M. Vidyasagar, Nonlinear Systems Analysis, 2nd Edition, Prentice-Hall, Inc., 2002.
5. D. E. Seborg, T. F. Edgar, D. A. Mellichamp, F. J. Doyle, Process Dynamics and Control, 4th Edition, Wiley, 2016.