



# Bhartiya Skill Development University

## Syllabus for Ph.D. Entrance Test

### Electrical

#### A.C & D.C Converters

Characteristics of semiconductor devices, Protections and cooling of power semiconductor devices, Single phase rectifiers, three phase rectifiers and Filter controlled rectifiers Triggering circuits for phase controlled rectifiers.

Single-Phase and Three-Phase AC to DC converters- half controlled configurations- operating domains of three phase full converters and semi-converters – Reactive power considerations.

Analysis and design of DC to DC converters- Control of DC-DC converters, Buck converters, Boost converters, Buck-Boost converters, Cuk converters.

Single phase and three phase inverters, Voltage source and Current source inverters, Voltage control and harmonic minimization in inverters.

AC to AC power conversion using voltage regulators, choppers and cyclo-converters, consideration of harmonics. Role of power electronics in industrial applications.

#### References:

1. Ned Mohan, Undeland and Robbin, "Power Electronics: converters, Application and design", John Wiley and sons.Inc, Newyork, 1995.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, New Delhi, 1995.
3. P.C Sen., "Modern Power Electronics", Wheeler publishing Co, First Edition, New Delhi, 1998.
4. S.N. Singh, " A Text Book of Power Electronics" Dhanpat Rai & Co, 2000.
5. R.W. Erickson, Dragan Maksimovic, "Fundamentals of Power Electronics", Springer, 2005.

#### Renewable Energy Sources

Introduction to Renewable Energy Systems: Wind power, Hydropower, Solar energy-Biomass, Bio-fuel, Geothermal Heat energy, Solar-thermal plants, Applications.

Introduction to PV-Cells, Array, Solar power extraction using PV-Cells, I-V Characteristics, Maximum power point tracking-Methods, PV-Inverters with D.C. to D.C. converters-on low frequency side and high frequency side with isolation, without isolation.

Wind Energy Sources and potentials, Evaluation of Wind Intensity, Topography, General Classification of Wind Turbines-Rotor Turbines, Multiple-Blade Turbines, Generators and speed control used in wind power energy, Wind Power Control: Fixed speed with capacitor bank, Rotor



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resistance control, Synchronous Generator-external magnetized, Synchronous Generator-permanent magnets.

Fuel Cells: Fuel cells, Commercial Technologies for Generation of Electricity, Constructional Features of Solid Oxide Fuel Cells, Constructional Features of Proton Exchange Membrane Fuel Cells, Load Curve Peak Sharing with Fuel Cells, Advantages and Disadvantages of Fuel Cells

### References:

1. Troy A. Rule, "Solar wind and land: Conflicts in renewable energy development, 2014.
2. N.K. Bansal and M.K. Kleeman, "Renewable Sources of Energy and Conversion Systems".
3. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and applications, PHI learning Pvt. Ltd.
4. Kreith and Kreider, Solar Energy Handbook, McGraw Hill.
5. G.L. Johnson, Wind Energy Systems, Prentice Hall, 1985
6. J.F. Manwell, J.G. McGowan and A.L. Rogers, Wind Energy Explained John Wiley & Sons Ltd.

### Smart Grid

Introduction to smart grid and emerging technologies, Operating principles and models of smart grid components, Key technologies for generation, networks, loads and their control capabilities; decision-making tools.

Grid Integration: Standalone systems, Concept of Micro-Grid and its components, Hybrid systems – hybrid with diesel, with fuel cell, solar-wind, wind –hydro systems, Hybrid system economics, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling. Effect on power quality, harmonic distortion, voltage transients and sags, voltage flickers, dynamic reactive power support.



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#### **References:**

1. James Momoh, "Smart grid: Fundamentals of design and analysis, WILEY-IEEE press, 2015.
2. Lora T. Berger and Krzysztof Iniewski, "Smart grid applications, communications and security, WILEY, 2015.
3. Strzelecki Benysek, "Power Electronics in Smart Electrical Energy Networks", Springer, 2008.  
Clark W Gellings, "The Smart Grid: Enabling Energy Efficient and Demand Side Response", CRC Press, 2009.