Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec– 2017**

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| **Code :** | **14EE3048** | **Duration :** | **3hrs** |
| **Sub. Name :** | **GRID CONVERTERS FOR WIND POWER SYSTEMS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | Sketch the basic power conversion in a wind turbine system. Present the scenario of power conversion structures along with the topologies for variable speed wind turbine systems. | CO2 | 20 |
| (OR) | | | | |
| 2. | a. | Illustrate the grid requirement of frequency and voltage deviation under normal operation. | CO1 | 10 |
| b. | Discuss on harmonization of grid codes and future trends in grid code evolution. | CO1 | 10 |
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| 3. | a. | The general message of the grid code is that the wind power plants should behave as much of possible in the same way as conventional power plants. Write a short note on grid code evolution in any two countries of your choice. | CO1 | 10 |
|  | b. | Outline the grid requirement of active and reactive power control in normal operation. | CO1 | 10 |
| (OR) | | | | |
| 4. |  | One of the most important aspects to consider in the control of power converters connected to electrical grids is the proper synchronization with the three-phase utility voltages. Discuss in detail about the two advanced grid synchronization systems. Compare and contrast them. | CO3 | 20 |
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| 5. | a. | Write a short note highlighting the significance of the SRF-PLL. | CO3 | 10 |
|  | b. | The direct power control has been developed in analogy to the well-known direct torque control used for drives. Illustrate the implementation of direct power control in the grid converters of a wind turbine system. | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | Explain the operation of cascaded control of the DC voltage through the AC current in a wind turbine system. | CO2 | 10 |
|  | b. | Derive the mathematical model of the L-filter inverter and LCL-filter inverter. | CO2 | 10 |
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| 7. |  | Power control under unbalanced grid conditions requires the design of specific strategies for calculating the current that should be injected into the grid by the power converter. Discuss the five different strategies for determining the reference current vector to deliver given active and reactive power set-points, P and Q, under unbalanced grid voltage conditions. | CO3 | 20 |
| (OR) | | | | |
| 8. | a. | Wind turbine systems can be autonomous, isolated or form micro-grid. Discuss with neat diagrams the stand-alone, micro-grid, droop control and grid supporting operation of a WTS. | CO2 | 10 |
|  | b. | The structure of the current controller is a key issue in the design of grid-connected power converters. Outline with neat diagrams the different control structures used for unbalanced current injection in WTS. | CO2 | 10 |
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|  | | **Compulsory:** |  |  |
| 9. | a. | The most widely used open-loop pulse-width modulation methods are carrier-based. Review the current control modulation techniques used in grid converters. | CO2 | 10 |
|  | b. | Summarize the design considerations of the grid filters. | CO3 | 10 |

ALL THE BEST