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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17EE3037** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SMART GRID TECHNOLOGIES** | **Max. marks :** | **100** |

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

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | The smart grid (SG) concept has experienced major hype in the past few years.Discuss the evolution, definition and need for SG and differentiate between the conventional grid and smart grid. | CO2 | 10 |
| b. | Outline the development and international policies in SG. | CO1 | 10 |
| (OR) | | | | |
| 2. | a. | “Never before has the electric utility industry experienced a technology revolution as transformative as the smart grid.” Substantiate this statement highlighting the concept of resilient and self-healing grid. | CO1 | 10 |
| b. | Review the converging factors that drive the energy industry to modernize the electric grid and highlight on the global SG initiatives. | CO1 | 10 |
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| 3. | a. | Illustrate the technology advances and functionalities of smart substations. | CO2 | 10 |
| b. | Transmission systems are the bulk power delivery systems of electric utilities. Assess the advances in energy management systems for the smart grid. | CO6 | 10 |
| (OR) | | | | |
| 4. | a. | Elaborate on the distribution management systems in a SG network highlighting on distribution SCADA control and Volt/Var control. | CO6 | 10 |
| b. | Focussing on the reliability needs in a smarter grid, discuss about fault detection, isolation and service restoration. | CO2 | 10 |
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| 5. | a. | Communication is the core of SG applications. Point out why communication networks have become a key enabler of the SG. Detail the communication requirements to support SG operations. | CO3 | 10 |
| b. | Write a note on the communication standards and protocols that find application in SG networks. | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | Bring out the role of cloud computing technologies in making the grid smarter. Mention its advantages and challenges. | CO5 | 10 |
| b. | The topic of threats to the smart grid has been the subject of much research and documentation. Write a note on the SG cyber security strategy and requirements as laid down by NIST. | CO5 | 10 |
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| 7. | a. | Many industry experts consider smart meters as the foundation for smart grid. Track the evolution of the electric meter and meter reading. | CO2 | 10 |
| b. | Discuss on the protocols, security requirements and other needs of the advanced metering infrastructure in the SG. | CO5 | 10 |
| (OR) | | | | |
| 8. |  | Discuss in detail about phasor measurement units and intelligent electronic devices. Write a note on their role in wide area monitoring, protection and control. | CO6 | 20 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | State the need for fault current limiters (FCL) in distribution networks. Draw the different static FCL designs. | CO4 | 6 |
| b. | Consider the D-STATCOM shown in figure. Assume that a six pulse VSC operating on sinusoidal PWM is employed for the D-STATCOM. Calculate the modulation index required: i) generate 5 Mvar or reactive power; and ii) to absorb 5 Mvar of reactive power.  Data: For a six-pulse VSC operating on sinusoidal PWM *VLL*= 0*.*612 × *ma*×*VDC* where *VLL* is the line to line voltage at D-STATCOM terminals, *ma* is the modulation index and *VDC* is the DC capacitor voltage. | CO4 | 4 |
| c. | Discuss the significance of power quality conditioners for smarter grids and write a note on anti-islanding. | CO4 | 10 |