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



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **14EE2033** | **Duration :** | **3hrs** |
| **Sub. Name :** | **HARMONICS AND POWER QUALITY** | **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. | Write the various IEEE and IEC power quality standards. | CO3 | 05 |
| b. | Explain the following event based disturbances:  (i) Dip (ii) Swell (iii) Transients. | CO1 | 15 |
| **(OR)** | | | | |
| 2. |  | Explain the following steady state disturbances.  (i) Magnitude (ii) Unbalance (iii) Harmonics  (iv) Flicker (v) Voltage swells. | CO1 | 20 |
|  |  |  |  |  |
| 3. |  | What are the different voltage sag mitigation techniques? Explain each technique. | CO1 | 20 |
| **(OR)** | | | | |
| 4. | a. | In a 3-phase AC main, there is voltage sag at PCC of 10, 20 and 30% of ABC phase for 5, 10 and 20 cycles. Calculate:   1. Detroit Edison Sag Score (SS). 2. Voltage sag Energy. 3. Voltage sag lost energy index (VSLEI). | CO1 | 05 |
| b. | Explicate the following causes of sags.   1. Voltage sag due to motor sag. 2. Voltage sag due to single line to ground fault. 3. Voltage sag due to transformer energizing. | CO1 | 15 |
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| 5. | a. | What is the need for protection against over voltages? What are the basic principles of over voltages protection of load equipments? | CO2 | 10 |
| b. | Draw the standardized waveform of the lightning induced voltage. Discuss about the wave shape of the lightning current. | CO2 | 10 |
| **(OR)** | | | | |
| 6. | a. | Illustrate the surge arrestors and surge suppressors used in transmission and distribution system. | CO2 | 10 |
| b. | Describe the underground cable system protection. | CO2 | 10 |
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| 7. | a. | What are the various causes of harmonics in distribution power system? | CO1 | 10 |
| b. | List the various effects of equipments due to harmonics. Explain it briefly. | CO2 | 10 |
| **(OR)** | | | | |
| 8. |  | Define the following terms related to IEEE standards.  (i) SCR (ii) Load current (iii) Short circuit current  (iv) Total harmonic distortion (v) Total demand distortion | CO3 | 20 |
|  | | **Compulsory**: |  |  |
| 9. | a. | What are the various devices used for controlling harmonic distortion? Also illustrate the operation of DVR and UPFC devices which controls the distortion. | CO2 | 15 |
| b. | Describe the principle of operation of shunt active power filter with neat schematic. | CO2 | 05 |