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Total Number of Pages : 02

B.Tech.  
PEEL5403

8<sup>th</sup> Semester Regular / Back Examination 2017-18  
ELECTRICAL POWER QUALITY  
BRANCH : EEE, ELECTRICAL  
Time : 3 Hours  
Max Marks : 70  
Q.CODE : C558

Answer Question No.1 which is compulsory and any five from the rest.  
The figures in the right hand margin indicate marks.  
Answer all parts of a question at a place.

**Q1** Answer the following questions: **(2 x 10)**

- a) Name two parameters (attributes) each for describing steady-state and non-steady-state phenomena that are used for categorization of power system electromagnetic phenomena.
- b) Give two broad classification of transients in view of the distortions found in voltage and current wave shapes along with a brief note for each class.
- c) Explain the meaning and significance of '*minimum voltage sag ride-through capability*' of sensitive equipment.
- d) Give a clear picture of the concept followed in describing area of vulnerability illustrating the use of adjustable speed drives and motor contactors.
- e) Indicate two major issues related to power quality problem arising out of lightning stroke currents entering the ground system.
- f) Justify the statement that "When both the positive and negative half cycles of a given waveform have identical shapes, the Fourier series contains only odd harmonics".
- g) How do you represent the complex power relationship with its components (real power, reactive power, and distortion power)? Hence, explain the significance of distortion power.
- h) Briefly explain two important applications of ferroresonant transformers.
- i) Write two advantages of expressing flicker signals as a percent of the total change in voltage with respect to the average voltage, over a certain period of time.
- j) Indicate any two procedures followed by flicker meters during the process of flicker measurement.

**Q2** a) With the help of appropriate figures and waveforms, explain the phenomenon of transients in any electrical power system with a brief note on its classification. Which parameter helps in damping out the oscillatory transients in a transmission network? **(5)**

b) How is it possible to assess the magnitude of voltage unbalance in a three phase AC system? Also explain the principal factors which characterize waveform distortion, with a brief note of each item considered, **(5)**

**Q3** a) How does voltage sag occur due to starting of large size motors? Explain your answer with the help of a voltage sag characteristic plot. **(5)**

b) An induction motor is started on full value of nominal supply voltage of 1 pu. Hence calculate the sag voltage in per unit of nominal system voltage considering the short circuit KVA and locked rotor KVA ratings of the motor as 100 KVA and 90 KVA respectively. **(5)**

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**Q4 a)** Name and discuss the practices generally followed by the power system utilities to help reduce the number and severity of faults in their system. Hence compare the functionalities of fuses with that of reclosers used for over current limitation. **(5)**

210 210 **b)** Considering lightning as a major candidate for power quality disruption, indicate three possible means for protection of the system against lightning strike with a detail explanation of their functioning. **(5)** 210

**Q5 a)** Explain the mechanism of harmonic distortion with focus on the sources responsible for it and the effects of harmonic distortion on various equipment of a power system. **(5)**

210 210 **b)** Explain the term "Total Harmonic Distortion (THD)" with respect to voltage and current values of an AC system. In a particular single phase AC system, the total harmonic distortion indices for 3<sup>rd</sup>, 5<sup>th</sup>, and 7<sup>th</sup> harmonic components present are 0.3, 0.2, and 0.1 respectively. Calculate the net total harmonic distortion index for the system. **(5)** 210

**Q6 a)** Explain the key factors affecting equipment sensitivity in the event of voltage sag in a particular system. Also list the equipment which are sensitive only to the magnitude of voltage sag. **(5)**

210 210 **b)** Explain how interharmonics are created in a system and explain various effects of interharmonics. Also explain the principles followed in regulating utility voltage with distributed resources. **(5)** 210

**Q7** Discuss on the fundamental principles of protection and its importance for improvement of power quality through application of magnetic synthesizers and active series compensators. Also explain the merits of fault clearing technique in this context. **(10)**

210 210 210 210 210 210 210 **Q8 Write short answer on any TWO :** **(5 x 2)** 210

210 210 **a)** What are the effects of triplen harmonics present in a system? How can you suppress the effects of triplen harmonic? 210

**b)** What is the importance of power quality monitoring and what are the standards followed in practice for the same? 210

**c)** Discuss any two computer tools available for transient analysis and give a table of comparison between them. 210

210 210 **d)** How it is possible to improve voltage regulation through end user capacitor installation? Explain with a practical example. 210 210

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