

POWER QUALITY

Full Marks: 70

Time: 3 hours

Answer SIX questions including Q No. 1 which is compulsory.
The figures in the right hand margin indicate marks. Symbols carry usual meaning.

- 1) Answer all questions 2x10
- a) Classify voltage magnitude events on magnitude and time scale basis.
b) List-out the types of instruments used for PQ measurement.
c) What are the draw backs of commercial power quality monitors?
d) List out the various sources of harmonics in a distribution system.
e) What are harmonic filters? Classify them .
f) How the performance of voltage sag is estimated?
g) Discuss about equipment sensitivity to voltage sags.
h) Listout the principles of over voltage protection.
i) Differentiate between voltage flicker and voltage unbalance.
j) What are the power quality problems that may arise due to end-user capacitors? Discuss
- 2) a) What are the basis to select the locations for power quality monitoring? Discuss the same with the case of distribution sub-station. 5
b) What are the other options that would be suggested with permanent PQ monitoring equipment? 5
- 3) a) What is power quality? Is it a problem or solution? Define various power quality events. 5
b) Classify various power quality events defined as per IEEE and IEC standards. 5
- 4) a) i) Differentiate between voltage and current distortion. 5
ii) Explain various harmonic indices and their methods of determination. 5
b) Describe methods to locate harmonic sources. 5
- 5) Explain the harmonic sources from commercial loads with their characteristic waveforms. 10
- 6) a) What are the basic principles of protection against sags? Categorize the solutions at the end user level. 5
b) Discuss about motor starting sags. Estimate sag severity during full voltage starting. 5
- 7) a) Describe the various sources of over voltage phenomenon in systems. 5
b) Describe about the devices used for over voltage protection. 5
- 8) a) Explain the effects and mitigation techniques for voltage unbalance. 5
b) Describe the operation of the devices used for utility voltage regulation. 5

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