

**Elective - II : Power Quality**

P. Pages : 2

Time : Three Hours



**TKN/KS/16/7658**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Questions 1 OR Questions No.2.
  3. Solve Questions 3 OR Questions No.4.
  4. Solve Questions 5 OR Questions No.6.
  5. Solve Questions 7 OR Questions No.8.
  6. Solve Questions 9 OR Questions No.10.
  7. Solve Questions 11 OR Questions No.12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Use of non programmable calculator is permitted.

1. a) Define power quality. Why we are more concern about power quality? **7**
- b) Define following power quality terms: **6**
- |                   |                        |
|-------------------|------------------------|
| i) Under voltage, | ii) Swells             |
| iii) Flickers     | iv) Voltage unbalance, |
| v) Noise          | vi) Interharmonics.    |
- OR**
2. a) What are the common problems associated with grounding? **7**
- b) What are the solutions for grounding problems. Discuss any four. **6**
3. a) What are the main sources of flickers? **7**
- b) What are the various means to reduce flickers. Explain any one in details. **7**
- OR**
4. a) Distinguish between impulsive and oscillatory transients. **5**
- b) Write short note on:
- |                                  |          |
|----------------------------------|----------|
| i) On-line UPS. & Hybrid UPS.    | <b>4</b> |
| ii) Motor-generator set.         | <b>2</b> |
| iii) Ferro resonant transformer. | <b>3</b> |
5. a) Derive an expression for voltage sag using voltage divider model. For 33kv, overhead line with fault level 750 MVA, source is purely reactive with  $Z_S = j 0.161\Omega$  impedance of line is  $(0.117 + j 0.315)$  Ohm/meter ( $\Omega$ /km). Calculate voltage sag experienced if the fault occurs at 10 km from PCC. Also calculate voltage sag when source impedance  $Z_S = j 0.32\Omega$  & fault is at 10 km. **8**
- b) Explain equipment sensitivity to voltage sag. **6**
- OR**
6. a) What are the major causes of voltage sag? **6**

- b) Explain in detail solutions for voltage sag at utility level & end-user level. **8**
7. a) What are voltage and current harmonics? **3**
- b) What are harmonics & transients? **3**
- c) The measurement of supply current of 440V, 106A, 60 Hz SMPS based drive has given following results.  
 $I_1 = 60A$ ,  $I_3 = 39A$ ,  $I_5 = 21A$ ,  $I_7 = 5A$ .  
 Find i) THD, ii) TDD, iii) RMS value of the current. **7**
- OR**
8. a) Discuss evaluation of active power, reactive power & apparent power under non-sinusoidal condition. **7**
- b) Write note on active and passive filters. **6**
9. a) What are the various power quality monitoring objectives? **6**
- b) Draw block diagram & explain working & IEC flicker meter. **7**
- OR**
10. a) What are the various power quality monitoring instruments? **8**
- b) How do the sources of harmonics in power system located? **5**
11. a) Write a brief note on on-line power quality assessment & off -line power quality assessment. **7**
- b) What are FACTS devices used for mitigation of power quality problems? **6**
- OR**
12. a) What is power quality state estimation (PQSM)? **6**
- b) Write short note on: **2**
- i) Digital fault recorders.
- ii) Wiring & grounding test equipments. **3**
- iii) Spectrum and harmonic analyzers. **2**

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