GURU NANAK INSTITUTE OF TECHNOLOGY

An Autonomous Institute under MAKAUT

2022

POWER QUALITY AND FACTS

EE704B

TIME ALLOTTED: 3Hours **FULL MARKS:70**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

		Marks	CO No
1. i)	Types of electrical transients that occur in power system. a. Impulsive transien b. Oscillatory transient c. Both d. None of these	1	CO3
ii)	The most common way to calculate voltage sag is from:- a. Apparent power b. Peak voltage c. RMS voltage d. Average Voltage	1	CO3
iii)	Two identical devices or pieces of equipment might react differently to the same power quality parameters due to a. Component tolerance b. Differences in their manufacturing c. Both d. None of these	1	CO3
iv)	The parameters that define the quality of electrical power. a. Voltage b. Current c. Frequency d. All of these	1	CO3
v)	Types of electrical transients that occur in power system. a. Impulsive transient b. Oscillatory transient c. Both d. None of these	1	CO3
vi)	Harmonics in the system can do a. Can cause increase in resonance b. Increase loss in capacitances, noises c. Make relays maloperate d. All of the above	1	CO4

vii) Cause of power interruption — 1 — CO3
   a. Power system faults
   b. Equipment failure
   c. Cascading failure
   d. All of the above

viii) Which one ensures that any fault current likely imposed on a metal part will be safely conducted to ground or other grid systems serving as ground — 1 — CO1
   a. Grounding
   b. Bonding
   c. Coupling
   d. Isolation

ix) DSTATCOM is a _____ connected device designed to regulate the _____ either by generating or absorbing the reactive power. — 1 — CO1
   a. series, voltage
   b. shunt, voltage
   c. series, current
   d. shunt, current

x) Static Var compensators can regulate the voltage by — 1 — CO2
   a. Supply reactive power
   b. consumes reactive power
   c. Both a or b
   d. none

xi) Which of the following are sag mitigation devices — 1 — CO4
   a. DVR
   b. SSTS
   c. Active series compensators
   d. All of the above

xii) When electrical transformer is energized, which of the following harmonic component is predominate — 1 — CO2
   a. Third Harmonic
   b. Seventh Harmonic
   c. Second Harmonic
   d. Fifth Harmonic

GROUP – B
(Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No
2.	Write classifications of FACTS controllers. Write applications of FACTS controllers in distribution systems.	5	CO1
3.	What is surge impedance loading (SIL)? What do you mean by flat voltage profile?	5	CO2
4.	Explain-"Why Compensation Techniques are used in power system?"	5	CO3
5.	Explain single-tuned filter for harmonic reduction.	5	CO1

6.	Explain in detail with necessary diagram the working principle and functioning of power quality analyzers	5	CO4

GROUP – C
(Long Answer Type Questions)

(Answer any *three* of the following) **3 x 15 = 45**

		Marks	CO No
7. a.	Explain the objectives and procedures for performing power quality monitoring.	6	CO2
b.	A series capacitor is connected at the midpoint of the line to double the power transmitted. What is the reactance? (Data: l=1 mH/km, c= 11.1×10^{-9} F/km.)	4	CO2
c.	Illustrate in brief, about harmonics in a Thyristor-Controlled Reactor.	5	CO2
8. a.	Explain the expression for voltage and power in SVC.	7	CO1
b.	A three phase, 400 kV, 50 Hz, 900 km long line is operating with $V_S = V_R = V = 1.0$ p.u. and $\delta = 60^0$. A SVC is planned to be connected at the midpoint of the line to increase power transfer capability. The limits on the control range correspond to $\delta = 30^0$ and $\delta = 90^0$. Find the limits of SVC susceptance if the slope (Xs) of the control characteristic is (i) 0.0 and (ii) 0.05 p.u.	8	CO1
9. a.	Explain working of TSC- TCR with neat circuit diagram and waveform.	5	CO3
b.	Write and explain sources of harmonics in power system.	5	CO3
c.	Find out the reasons for increased concern in power quality.	5	CO3
10. a.	Define sag, swell, and interruption, under voltage and over voltage for power quality analysis.	8	CO3
b.	Explain the schematic diagram and working principle of a STATCOM	3	CO3
c.	Define Total Harmonic Distortion. Explain the procedure for calculation the Total Harmonic Distortion(THD) due to disturbance in the power system.	4	CO3
11.	Write Short note: (Any three)	3x5=15	
a.	DSTATCOM	5	CO4, CO1
b.	What are the control objectives of UPQC?	5	CO4, CO1
c.	CBEMA curve	5	CO3,CO4
d.	UPQC	5	CO4, CO1
e.	IEEE and IEC standards for power quality analysis.	5	CO3