MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

II SEMESTER M.TECH (ESM/PED) MAKE UP EXAMINATIONS JUNE 2017

SUBJECT: POWER QUALITY ISSUES & MITIGATION [ELE 5238]
REVISED CREDIT SYSTEM

Time: 3 Hours   **Date: 17 June 2017**   **Max. Marks: 50**

Instructions to Candidates:
   ❖ Answer **ALL** the questions.
   ❖ Missing data may be suitably assumed.

1A.	What are the power quality problems that the hybrid power filters can mitigate?	*(02)*
1B.	How the power quality problems are classified?	*(03)*
1C.	Explain with a neat block diagram of unit template based control algorithm of three-leg VSC based three-phase 3-wire DSTATCOM for ZVR mode of operation	*(05)*
2A.	How the passive shunt compensators are classified based on supply/load systems.	*(03)*
2B.	Why an indirect current control method is superior when compared to the direct current control scheme of a DSTATCOM.	*(02)*
2C.	A single phase 230V, 50Hz, AC mains with feeder impedance of $0.5+j3\Omega$ supplies power to the load having $Z_L=16+j12\Omega$. Determine the voltage across the load. If a PWM based SSSC is used to regulate the load voltage to 230V with minimum rating, determine the VA rating of the compensator.	*(05)*
3A.	How the passive power filters are classified based on the connection used with neat sketches.	*(03)*
3B.	A single-phase shunt active power filter is used for harmonic current compensation at UPF for a single-phase 230V, 50Hz, AC source supplying load through diode bridge converter with 22A constant DC current. Determine the current and VA rating of shunt active power filter.	*(03)*
3C.	A single phase AC mains with source impedance supplies power to a single phase lagging p.f. load. Derive the expression for the susepctance of the shunt compensator to get unity p.f. at the substation.	*(04)*
4A.	Explain with a neat block diagram of synchronous reference frame theory based control algorithm for a three-phase four-wire VSC based UPQC for the operation of the DSTATCOM and DVR.	*(07)*
4B.	Determine percentage current unbalance in a 3-phase 3-wire system with three phase unbalanced load currents $I_a=9\angle 0^0 A$, $I_a=11\angle 240^0 A$ and $I_c=9.5\angle 120^0 A$.	*(03)*
5A.	A three phase four-wire 415 V, 50 Hz AC supply has a single phase 10 kW resistive load connected across line (say R-phase) and neutral terminal. If it is required to eliminate the neutral current using a shunt compensator. Determine	
	(i) Supply line currents	
	(ii) The values of compensator elements (L or C)	
	(iii) kVA rating of the compensator	*(05)*
5B.	Derive the expressions for the susepctances of the passive shunt compensator for load balancing and p.f. correction (UPF) of a three phase three-wire delta connected unbalanced load.	*(05)*