Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

II SEMESTER M. TECH (ESM/PED) END SEMESTER EXAMINATIONS APRIL - 2018

SUBJECT: POWER QUALITY ISSUES & MITIGATION [ELE 5238]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 23 April 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. How power quality problems are classified? ***(02)***

1B. What are the different types of passive shunt compensators used in the distribution network based on supply/load systems. ***(02)***

1C. 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. ***(06)***

2A. What are factors that decide the rating of lossless passive shunt compensators? ***(02)***

2B. How series active power filters are classified based on types of converter used and which type is generally preferred and why? ***(02)***

2C. 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. ***(06)***

3A. A three-phase four-wire unbalanced non-isolated star connected load having Za =(9.0+j3.0) pu, Zb=(3.0+ j1.5) pu, and Zc =(7.5+ j1.5) pu is fed from an AC supply with an input line voltage of 415V at 50 Hz and a base impedance of 9.15Ω per phase. It is to be realized as a balanced unity power factor load on the three-phase supply system using a four-leg PWM-based DSTATCOM. Calculate (a) the DSTATCOM line currents (b) its neutral current (c) its kVA rating. ***(05)***

3B. Explain with a neat block diagram of synchronous reference frame theory based control algorithm of three-leg VSC based three-phase 3-wire self-supported DVR. ***(05)***

4A. What is power quality monitoring? Mention different types of instruments used for PQ Monitoring. ***(03)***

4B. What are the effects of power quality problems on users? ***(03)***

4C. A single-phase AC voltage controller is used to control the heating of packing element in a food vending machine at a power of 200W at 20V fed from a single-phase AC mains of 230V at 50 Hz. Feeder conductors have the resistance of 0.25Ω each. Calculate (a) AC source rms current and (b) losses in the distribution system. If an ideal shunt compensator is used to compensate power factor to unity, then calculate (c) AC source rms current (d) losses in the distribution system and (e) ratio of losses in the distribution system without and with a compensator. ***(04)***

5A. Determine percentage current unbalance in a 3-phase 3-wire system with three phase unbalanced load currents I_a=(0.9+j0) pu, I_b=(-0.55-j0.9526) pu and I_a=(-0.475+j0.8227) pu. ***(03)***

5B. Explain with a neat block diagram of right shunt and left shunt UPQC used for mitigating multiple PQ problems of voltages and currents. ***(03)***

5C. With the relevant phasor diagram explain the operation of three phase three wire capacitor supported DVR to protect the sensitive loads from voltage sag. ***(04)***