Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

II SEMESTER M.TECH (ESM/PED) END SEMESTER EXAMINATIONS APRIL - MAY 2017

SUBJECT: POWER QUALITY ISSUES & MITIGATION [ELE 5238]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 25, April 2017** **Max. Marks: 50**

Instructions to Candidates:

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

1A. How the power quality problems are classified? ***(03)***

1B. What are factors that decide the rating of lossless passive shunt compensators? ***(02)***

1C. For a quasi-square wave of voltage with 120° pulse width with an amplitude of 50V, calculate distortion factor and total harmonic distortion. ***(05)***

2A. Explain with a neat block diagram of control algorithm for elimination of voltage harmonics of the series active power filter. ***(03)***

2B. How the passive shunt compensators are classified based on supply/load systems. ***(02)***

2C. A three phase three-wire 415 V, 50 Hz AC supply has a single phase 25 kW resistive load connected between two lines. If it is required to provide load balancing 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)***

3A. Derive the conditions for the passive shunt compensator for load balancing and p.f. correction (UPF) of a three phase four-wire delta connected unbalanced load. ***(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 are the power quality problems that a hybrid power filters can mitigate? ***(02)***

4B. How the passive power filters are classified based on the connection used with neat sketches. ***(02)***

4C. A three phase three-wire 415 V, 50 Hz AC supply feeds power to three-phase delta connected 25kW, 0.8 p.f (lag) synchronous motor. If a PWM based DSTATCOM is used to provide reactive power compensation for UPF operation of motor, determine

(i) DC bus voltage
(ii) DSTATCOM current
(iii) Supply current
(iv) The value of interfacing inductance if the switching frequency is 2.5kHz and ripple current is 10%
(v) kVA rating of the DSTATCOM ***(06)***

5A. What are the effects of power quality problems on users? ***(03)***

5B. Explain the principle of operation of UPQC-P for voltage sag and voltage swell compensation with phasor diagram. Why time domain control algorithms are preferred for real time control of UPQCs as compared to the frequency domain control algorithms. ***(04)***

5C. A shunt active power filter is used for harmonic current compensation at UPF for a single phase 230V, 50Hz, AC source supplying load through fully controlled thyristor bridge converter with 25A constant DC current operating at a firing angle of 60°. Determine the current and VA rating of shunt active power filter. ***(03)***