Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER M.TECH (EMAL / PESC) END SEMESTER EXAMINATION, MAY 2016

APPLICATION OF POWER ELECTRONICS IN POWER SYSTEMS [ELE540]

(PROGRAM ELECTIVE- II)

REVISED CREDIT SYSTEM

Time: 3 Hours 14 MAY 2016 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A. What are the factors which affect loadability of an AC transmission line? Discuss the methods to increase loadability of the line. ***03***

1B. Derive the expressions for midpoint voltage, current and power of a symmetrical long line with a series capacitor connected at the midpoint of the line. A 500kV, 50Hz, 600km long symmetrical line is operated at the rated voltage. Inductance of the line= 1 mH/km and capacitance=11 nF/km. Angular difference δ=50°.

i) What is the maximum power carried by the line and the midpoint voltage corresponding to this condition?

ii) Compute the power transfer through the line when a series capacitor of reactance 150Ω is connected at midpoint of the line. ***07***

2A. With a neat block diagram, explain SVC controller used for stability studies. Bring out the differences between susceptance regulator and supplementary modulating controller. ***05***

2B. Explain the basic working principle of STATCOM. Write the differential equations governing a 3 phase, 6 pulse STATCOM. ***05***

3A. With relevant circuit diagram and waveforms, explain the capacitive vernier mode of operation of TCSC. ***04***

3B. Compare the performance of STATCOM and SSSC with respect to transient stability, voltage regulation and power enhancement. ***03***

3C. Define power quality. Write the following for voltage sag and harmonics i) cause, ii) effect and iii) remedial measure. ***03***

4A. Consider the current waveform:

$i(t)$ = 2 + 100 sin(wt) + 30 sin(3wt) + 17 sin(5wt) + 8 sin(7wt) A. Compute the following i) total rms current and ii) THD of the current ***03***

4B. What is a static transfer switch (STS)? Explain the working of STS under normal and faulty condition. ***03***

4C. Consider a distribution system with feeder impedance 0.01+j0.2 pu and load impedance 0.75+j0.3 pu connected in series with a supply voltage 220V, 50Hz. Compute the DVR voltage if the load voltage is to be brought to 220V using minimum energy compensation. ***04***

5A. A 1 phase, 3 branch shunt passive single tuned filter (tuned for 3rd, 5th and 7th harmonic frequency) is employed to reduce the THD of supply current and to improve the displacement power factor to unity for a 1 phase, 240V, 50Hz fed diode bridge converter which draws an ac current of $i(t)= 50\sin(wt-30°)+16\sin(3wt)+10\sin(5wt)+7\sin(7wt)$. Compute the following

i) Fundamental active and reactive power drawn by the load

ii) Values of filter elements if the quality factor is 50.

iii) THD of source current if the source reactance at fundamental frequency is j0.5 Ω. ***07***

5B. With a neat block diagram, explain any one method of generating reference current waveform in distortion identifier of shunt active filter. ***03***

6A. Evaluate a HVDC transmission system with respect to transmission cost and performance. ***04***

6B. A 3 phase 48 pulse bridge rectifier is fed from transformer with turns ratio 0.45 and primary voltage 240 kV. Determine (i) the output voltage of rectifier when firing angle is 18° and commutation angle 18° (ii) fundamental component of ac line current, power factor, active and reactive power at HT bus if the dc current is 2 kA. ***06***