Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER M.TECH (EMAL / PESC) MAKE UP EXAMINATIONS,

JAN 2016

SUBJECT: ADVANCED POWER ELECTRONIC CONVERTERS [ELE 528]

(PROGRAM ELECTIVE- III)

REVISED CREDIT SYSTEM

Time: 3 Hours 15 January 2016 MAX. MARKS: 50

Instructions to Candidates:

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

1A. Assuming ideal circuit elements, discuss the working of a buck converter operating with continuous mode of operation. Support your answer with relevant circuit diagram and waveforms. Compare the output voltage expression when the circuit works in discontinuous mode of operation. (05)

1B. A buck converter has an input which varies between 10V and 30V and an output voltage of 5V. The output current is 10A. The switching frequency is 40 kHz. Current ripple has to be limited to 20% of its average value and voltage ripple should not exceed 1%. Determine the duty ratio, value of inductor and capacitor so as to comply with the ripple condition for the variation in input voltage. (05)

2A. Discuss, the performance of a flyback DC-DC converter, and hence draw suitable waveforms to develop expressions for calculating average load voltage, the necessary filter circuit to be used. (05)

2B. Acuk converter has an input of 12 V and is to have an output of -18 V supplying a 40 W load. Select the duty ratio, inductor sizes such that the change in inductor currents is no more than 10% of the average inductor current, the output ripple voltage is no more than 1%, and the ripple voltage across C_1 is no more than 5%. Take f_s = 50kHz. (05)

3A. With suitable circuit diagram and waveforms, explain the working principle of a Push-Pull dc-dc converter. Hence deduce an expression for the output voltage. (05)

3B A Push-Pull converter has the following parameters: V_s = 30 V, N_P/N_S =2, D=0.3, L_x = 0.5mH, R= 6Ω, C= 50 µF and f_s = 10 kHz. Determine average output voltage, maximum and minimum values of inductor current and the output voltage ripple. Assume all components to be ideal. (05)

4A. The Zero Current Switch resonant converter has following parameters, V_s=100V, I_o=1.5A, L_r=10µH, C_r=0.01µF and f_s=50kHz. Determine the Output voltage of converter. Hence estimate the ratings necessary for the switch. Draw the waveforms of inductor current and capacitor voltage for the operation. (06)

4B. Explain the continuous-conduction mode operation of SLR dc-dc converter working in $\omega_s<\omega_{O;}$ using suitable circuit diagram and waveforms. (04)

5A. A parallel resonant dc-dc converter supplying a resistive load of 10Ω from a source voltage of 100V. The switching frequency is 20% excess of the resonant frequency of 100 KHz, and characteristic impedance Z_o = 5 Ω. Select suitable values of L_r and C_r for the converter and hence determine the output voltage. (04)

5B. Discuss the steps involved in developing the state space averaged model for a dc-dc converter and hence obtain the generalized expression for the small signal transfer function. (06)

6A. Explain the different types of power line disturbances. (04)

6B. Explain the term current mode control with reference to dc-dc converters. Also discuss slope compensation technique. (06)