Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

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A Constituent Institution of Manipal University

I SEMESTER M.TECH (POWER ELECTRONICS AND DRIVES)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: POWER ELECTRONICS DEVICES & CONVERTER TOPOLOGIES [ELE 5121]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 29 November 2016** **MAX. MARKS: 50**

Instructions to Candidates:

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

1A. Explain the operating principle of GTO and draw the switching characteristics of power MOSFET. ***05***

1B. Derive the expression for switch transition energy losses in turn off snubber circuits for k > 1 (slow charging) case. ***03***

1C. A thyristor has a maximum average gate power dissipation limit of 0.4 watts. It is triggered with pulsed gate current at a pulse frequency of 15 KHz and duty ratio of 0.5. Assuming the gate cathode voltage drop to be 1.5 volt. Find out the allowable peak gate current magnitude. ***02***

2A. Explain the extinction angle control and pulse-width modulation control schemes for power factor improvement with neat waveforms. ***05***

2B. A 3ϕ fully controlled thyristor bridge is connected to a highly inductive load with a resistance of 50Ω. Determine the average load voltage, average load current, input PF for a trigger angle of 30^0. The supply voltage is 415V, 3ϕ. Assume the load current is ripple free. ***03***

2C. A 1ϕ full converter fed from 220V, 60Hz supply gives an output voltage of 200V at no load. When loaded with a constant output current of 15A, the overlap angle is found to be 8^0. Compute the value of source inductance. ***02***

3A. Draw the circuit diagram of the boost switching regulator and explain its operation with neat waveforms. ***05***

3B. The buck regulator has an input voltage of Vs=15V. The required average output voltage is Va=7V and the peak to peak output ripple voltage is 25mV. The switching frequency is 30KHz. If the peak to peak ripple current of inductor is limited to 0.9A. Determine a) duty cycle b) filter inductance c) filter capacitor. ***03***

3C. Draw the circuit diagram of Cuk regulator. ***02***

4A. Explain the principle of operation of single phase/single phase cycloconverter with a neat circuit diagram and waveforms. ***05***

4B. A single phase full wave ac voltage controller has a R load of R=20Ω and the input voltage Vs=120V(rms), 50Hz. The delay angles of thyristors T_1 & T_2 are equal: $\alpha_1=\alpha_2=\alpha=\pi/2$. Determine a) rms output voltage V_0 b) input PF c) average thyristor current. ***03***

4C. Draw the load voltage and current waveforms for a synchronous tap changer with RL load. ***02***

5A. Briefly explain the 180^0 conduction mode of three phase inverters. ***05***

5B. A single phase full bridge inverter has a R load of R = 2.8Ω and the dc input voltage is 52V. Determine a) rms output voltage at fundamental frequency V_1 b) output power c) average and peak currents of each transistor d) peak reverse blocking voltage of each transistor e) THD f) DF. ***03***

5C. What are the methods for voltage control in single phase inverters? ***02***