Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

SEVENTH SEMESTER B.TECH. (INSTRUMENTATION & CONTROL ENGG.)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: POWER ELECTRONICS [ICE 405]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. What is the need for static and dynamic equalization circuits for series connected SCR's? Draw the equalization circuits and hence explain how they achieve equalization. **4**

1B. With neat circuit diagram and waveforms, describe the working of a line synchronized UJT circuit capable of producing trigger pulses in each half cycle of the AC waveform. **3**

1C. A SCR is used as a semi-conductor switch to connect a load of 5Ω and 0.05H to a 240 Volts, 50 Hz supply. Find the expression for current and triggering angle to ensure that no current transient occurs. **3**

2A. What are the purposes of commutation circuits? With relevant circuit, waveforms and mathematical model, discuss the working of a class-B commutation circuit. **5**

2B. For a LC circuit (L = 10μH and C=50μF), supplied with a DC voltage of 220 volts, the SCR is turned on at time t=0. Determine the conducting time of the SCR and voltage across the capacitor at the instant of turnoff if the initial current of the inductor is 0 when the capacitor is uncharged. **3**

2C. The V_g-I_g characteristics of a SCR is given by $V_g = 1 + (9*I_g)$. The gate pulses are rectangular with an amplitude of 12 V and duration of 60 μs with a duty cycle of 0.3. Find series resistance R_g in the gate circuit to limit peak power loss to 6 Watts and the average gate power loss. **2**

3A. Explain the effect of source inductance on the performance of line commutated converters. Derive an expression for output DC voltage of a single phase fully controlled converter taking into account of source inductance. **4**

3B. For a half controlled AC DC converter configuration fed by a 230 Volts, 50 Hz supply, an inductance of L = 0.2H is connected in series with a battery of E = 50 V to limit the **4**

charging current. The SCR is gated at w_t = 60°. Find

I. Expression of charging current.

II. Current extinction angle and SCR conduction angle.

3C. Write any four points of comparison between a P-MOSFET and IGBT. **2**

4A. A 230 V, 50 Hz single phase supply is connected to single phase bridge converter of the following configurations : **6**

I. Half controlled bridge rectifier

II. Fully controlled bridge rectifier

Assuming firing angle delay of 30°, draw the load voltage and load current waveforms with respect to supply voltage. Also calculate average DC output voltage for each circuit configurations.

4B. With a neat circuit diagram, describe the working of a three phase full converter. Show the conduction range of the SCR's for firing angle of 0° with respect to the input pulse. **4**

5A. With the help of neat diagram and waveforms, explain the working of Morgan's chopper. **4**

5B. Discuss the time ratio control method of choppers with relative advantages and disadvantages. **3**

5C. What are dual converters? Describe the working of a dual converter with non-circulating current mode of operation. **3**

6A. What are inverters? Explain the working of three phase bridge inverter with firing sequence and output waveforms for phase and line voltage for 180° mode of operation. **6**

6B. What are cyclo-converters? With the help of neat circuit diagram discuss the working of a single phase mid-point step down cyclo-converter. **4**

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