Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATIONS, DEC 2016/JAN 2017

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. With a two transistor model, obtain an expression for the anode current of a SCR. **4**

1B. An AC circuit using a SCR has a dv/dt rating of 25 volts/ μs, source inductance of 0.2 mH and RMS value of supply voltage is 230 V. With a damping factor 0.65, find the values of resistance & capacitance of the snubber circuit. **3**

1C. With neat circuit diagram and relevant waveforms, describe the working of a UJT trigger circuit for an SCR. **3**

2A. What is the need of a commutation circuit? With the help of relevant circuit, waveforms and mathematical equations, explain the working of class-D commutation circuit. **5**

2B. With circuit diagram and waveforms, discuss the working of class A commutation circuit. **3**

2C. SCRs with ratings of 1100 Volts and 250 Amperes are available to be used in a string to handle a load 6kV and 1 kA. Calculate the number of series and parallel units required in the string for a de-rating factor of (a) 0.2 (b) 0.4. **2**

3A. An AC source voltage of 230 V, 50 Hz is connected to R = 8Ω and a DC battery E = 150 V through a single SCR. On the assumption that the SCR is fired continuously, find **5**

a) Average value of charging current.

b) RMS value of the charging current.

Derive the expressions used.

3B. With the help of circuit diagram and waveforms, describe the working of a single phase semi converter. **3**

3C. List any four comparison between BJT and IGBT. **2**

4A. A 230 V, 50 Hz single phase supply is connected to a single phase half wave converter with the following load configurations : **5**

a) R Load

b) RL Load

Assuming a 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. Describe the working of three phase full converter with a neat circuit diagram. Show the conduction range of the SCR's for firing angle of 0° and 30° with respect to input pulse. **5**

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

5B. How can the duty cycle be varied to control the operation of a step up chopper? Derive the expression used. **3**

5C. What are dual converters? Describe the working of a dual converter with 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 120° mode of operation. **6**

6B. Discuss the operation of a single phase AC to AC voltage control with respect to phase control and ON-OFF control. **4**

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