Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

SEVENTH SEMESTER B.TECH (INSTRUMENTATION&CONTROL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

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.	Discuss the two transistor analogy of SCR with necessary diagram and equations.	**4**
1B.	What is meant by Thyristor protection? Describe how snubber circuits can be used to protect SCR.	**3**
1C.	Define String efficiency. 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.	**3**
2A.	Explain the switching characteristics of Gate turn off thyristor (GTO) with the help of neat waveforms. Write any two advantages of GTO over the conventional SCR.	**4**
2B.	What is UJT and draw its symbolic representation. Explain the I-V characteristics of an UJT.	**4**
2C.	Write any two difference between IGBT and BJT.	**2**
3A.	What is the need of commutation for SCR's? Discuss the load commutation technique with appropriate circuit and waveforms.	**4**
3B.	A single phase full wave converter with supply of 230V, 50 Hz feeds power to a RLE load with R= 6 Ω, L= 6mḤ and E=60 V. Find average value of load voltage and load current for a trigger angle of 75°. In case one of the 4 SCR's in the circuit is short circuited due to a fault, find the new value of load voltage and load current.	**3**
3C.	What are Dual Converters? Give the principle of operation of single phase Dual converter with respect to non-circulating current.	**3**
4A.	A single phase half wave converter feeds an RL load with a free-wheeling diode. Discuss how the free-wheeling diode comes into play in the circuit during the input	**4**

voltage cross-over. Illustrate the answer with the waveforms of supply voltage, load voltage and load current.

4B. A 3 phase full converter charges a battery from a 3 phase supply of 230 V, 50 Hz. The battery EMF is 120 volts and its internal resistance is 4Ω. On account of the inductance connected in series with battery, the charging current is constant at 20A. Compute the firing angle delay and supply power factor. In case it is desired that power flows from DC source to AC source, find the new firing angle for same current. **4**

4C. A single phase 230 volts, 1 KW heater is connected across a single phase supply through an SCR for a resistive load. The peak value of the input supply is 250 volts. For a firing angle of 45°, calculate the power absorbed in the heater. **2**

5A. With the help of neat diagram, explain the working of a 3 phase half wave controlled rectifier feeding a resistive load. **4**

5B. Describe the working of a Morgan's chopper with appropriate circuit and waveforms. **4**

5C. In a step up chopper, input voltage is 230 V and output voltage is 920 V. If the output pulse width time of the chopper is 80μs, compute the conducting time of the chopper. In case the output pulse width is made one-fourth of the initial value, for a constant frequency operation, calculate the average value of new output voltage. **2**

6A. Describe the working of a series inverter with appropriate circuit and waveforms. What is the drawback of this configuration? **4**

6B. With the help of neat circuit diagram explain the working of a single phase to single phase mid-point step down cycloconverter. **3**

6C. Brief the principle of phase control for a single-phase half wave ac to ac voltage-controller. **3**