

Total No. of Questions : 8] [Total No. of Printed Pages : 2

Roll No .....

**MEPS-301(C)**  
**M.E./M.Tech., III Semester**

Examination, December 2017

**Power Controller**

(Elective-I)

Time : Three Hours

Maximum Marks: 70

- Note: i) Attempt any five questions.  
ii) All questions carry equal marks.

- Explain the parallel operation of IGBT. Also, highlight the problems faced while parallel operation. 7
  - Briefly discuss the gate drive design considerations of the power MOSFET. 7
- Justify the following statements: 14
  - IGBT uses a vertically oriented structure
  - IGBT combines the advantages of MOSFET and power BJT
  - Punch-through IGBT structures are more popular and are widely used
- Explain the operation of three-phase fully controlled bridge converter with resistive load. Describe in detail the following modes of operations with associated waveforms: 14
  - Discontinuous conduction mode
  - Continuous conduction mode
- Discuss the effect of source-impedance on the performance of a single-phase fully controlled converter, indicating clearly the conduction of devices during one cycle. 7

[2]

- A 3-phase fully -controlled converter charges a battery from a three-phase supply of 230V, 50Hz. The battery emf is 200V and its internal resistance is  $0.5\Omega$ . On account of inductance connected in series with the battery, charging current is constant at 20A. 7  
Calculate:  
i) Firing angle ii) Supply power factor
- Discuss the working of load commutated chopper with associated voltage and current waveforms. Derive the expression from which the value of commutating capacitor of this chopper can be calculated. 14
- With an appropriate circuit diagram, discuss the principle of working of a three-phase bridge inverter. Draw phase and line voltage waveforms on the assumption that each device conducts for  $120^\circ$  and the resistive load is STAR connected. Also prepare a table which shows the sequence of firing of devices. 14
- State the need for reduction of harmonics in inverters. Outline the various methods for reduction of harmonics. 7
  - A three-phase bridge inverter is fed from a 500V dc source. The inverter is operated in  $180^\circ$  conduction mode and it is supplying a purely resistive star connected load determine: 7
    - RMS value of the output line and phase voltages
    - RMS value of the fundamental component of the line and phase voltages
- Discuss why a three-phase to single-phase cycloconverter requires positive and negative group phase-controlled converters. Under what conditions the group work as inverters or rectifiers? How should the firing angles of the two converters be controlled. 14

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