

M.E. First Semester (Electrical & Elect.) (New-CGS)
13282 : Advanced Power Electronics : 1 EEEME 2

P. Pages : 2

Time : Three Hours



AU - 3397

Max. Marks : 80

- Notes :
1. All question carry equal marks.
 2. Answer **three** question from Section A and **three** question from Section B.
 3. Assume suitable data wherever necessary.
 4. Illustrate your answer necessary with the help of neat sketches.
 5. Use of slide rule logarithmic tables, Steam tables, Moller's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.
 6. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) What are power MOSFETS ? Explain in detail working of enhancement MOSFET and also comment on V_{GS} . 7
- b) Explain voltage current characteristics of IGBT and describe the symmetric & Asymmetric IGBTs. 7

OR

2. a) Describe the switching performance of GTO. 7
- b) Explain basic structure of MCT in detail. Also comment on "how the faster turn-ON & turn-OFF times are benefitted". 7
3. a) What do you understand by switching mode Regulators ? Briefly explain BUCK Regulators & hence comment on condition for continuous inductor current and capacitor voltage. 6
- b) With neat circuit diagram and waveforms, explain Cuk regulators. 7

OR

4. a) Give detail working operation of flyback converter with circuit diagram & necessary waveforms. Comment on continuous versus discontinuous mode of operation. 6
- b) Give detail working of forward converter with all necessary waveforms & circuit diagram. Also comment on flyback versus forward converters. 7
5. a) Design 60 Hz power transformer of the following specifications, 7
Primary voltage $V_i = 120V$, 60 Hz (Sq. wave)
Secondary voltage $V_o = 40V$ Secondary output current $I_o = 6.5A$
Assume transformer efficiency $\eta = 95\%$ Window factor $k_u = 0.4$ USE E-Core.
- b) Explain the terms, 6
 - i) Hysteresis loss
 - ii) Eddy current loss
 - iii) Skin effect for design the magnetic component.

OR

6. a) Design a dc inductor of $L = 450 \mu\text{H}$. The dc current is $I_L = 7.2 \text{ A}$ with a ripple of $\Delta I = 1 \text{ A}$. Assume window factor $k_u = 0.4$. Use power core with a graded air gap. 7
- b) Explain the single pass transformer design procedure by using its flowchart. 6

SECTION - B

7. a) Explain 180 degree conduction mode of operation for a three phase inverters. 7
- b) What do you understand by space vector PWM with necessary equations. 6

OR

8. a) Explain the effect of harmonics present in inverter system. Enlist various methods in inverter for reduction of Harmonics. Explain any one of them in detail. 7
- b) Explain circuit analysis of current source inverter with resistive load. 6
9. a) What do you understand by isolation in driver circuits? Explain in detail the importance of it. Also give brief description on some commonly available driver chips. 7
- b) Describe the significance of blanking circuit in inverters. Hence give details on blanking times for bridge circuits. 6

OR

10. a) Explain with neat diagram power device protection in drive circuits. 7
- b) Describe cascade connected drive circuits in detail. 6
11. a) What is the use of cyclo converters? Explain in detail with necessary circuit diagram & waveform the operation of three phase cyclo converters. 7
- b) Explain the working operation of three phase bidirectional Delta-connected controllers with resistive load. Also draw neat circuit diagram & relevant waveforms for $\alpha = 120^\circ$. 7

OR

12. a) Give comparison between non-circulating and circulating current operation of cycloconverters. 7
- b) The input voltage to the cyclo converter is 120V (rms), 60 Hz. The load resistance is 5Ω & load inductance is $L = 40 \text{ mH}$. The frequency of output voltage is 20 Hz. If the converters are operated as semi converters such that, $0 \leq \alpha \leq \pi$ and the delay angle is $\alpha_p = 2\pi/3$, determine, 7
- i) The rms value of output voltage (V_o)
- ii) The rms current of each thyristor (I_R)
- iii) Input PF.
