

Code No: 5843AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**M.Tech I Semester Examinations, March - 2023****ADVANCED POWER ELECTRONIC CONVERTERS-I****(Power Electronics)****Time: 3 Hours****Max. Marks: 60**

Note: This question paper contains two parts A and B. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART - A**(10 Marks)**

- 1.a) What is the full form of IGBT? [1]
- b) What is the circuit symbol of MTO? [1]
- c) What is extinction angle? [1]
- d) What is harmonic factor? [1]
- e) What an inverter does? [1]
- f) What is delta modulation? [1]
- g) Why space vector modulation is used? [1]
- h) What is 60 degree PWM? [1]
- i) What is a DC link capacitor? [1]
- j) What is multilevel concept? [1]

PART - B**(50 Marks)**

- 2.a) Describe the structure of IGBT in detail.
 - b) Compare the features of MTO and ETO in detail. [5+5]
- OR**
- 3.a) Describe the structure of Integrated Gate-commutated thyristor in detail.
 - b) Explain the principle of working of MOSFET with neat waveforms. [5+5]
- 4.a) Derive the expression for the input power factor of a single phase fully controlled converter with resistive load.
 - b) A three-phase half controlled converter is operated from a three-phase Y-connected 230-V, 50-Hz supply and the load resistance is $R = 20 \Omega$. If it is required to obtain an average output voltage of 60% of the maximum possible output voltage, calculate the delay angle and the rms output current. [5+5]
- OR**
- 5.a) What is a twelve pulse converter? Explain its working with neat sketch.
 - b) The single-phase fully controlled converter has an RL load of $L = 5\text{mH}$ and $R = 2 \Omega$. The input voltage is 100V (rms) at 50 Hz. Determine the average and rms thyristor currents for the firing angle of 30° . [5+5]

- 6.a) How the voltage of single phase inverters is controlled? Explain.
b) The single-phase half-bridge inverter has an RL load of $R = 5 \Omega$ and $L = 10 \text{ mH}$. The dc input voltage is 100V. Determine the average, rms, and peak currents of each transistor [5+5]

OR

- 7.a) Compare different PWM techniques in detail.
b) The full-bridge inverter has an RLC load with $R = 5 \Omega$, $L = 10 \text{ mH}$, and $C = 20 \mu\text{F}$. The inverter frequency, $f_o = 400\text{Hz}$, and the dc input voltage, $V = 200\text{V}$. Express the instantaneous load current in a Fourier series and calculate the rms load current at the fundamental frequency. [5+5]
- 8.a) What is a three phase inverter? Explain its working for 180° conduction.
b) The three-phase full-bridge inverter has a Y-connected load and each phase consists of $R = 4 \Omega$ and $L = 10\text{mH}$. The inverter frequency is $f_o = 100\text{Hz}$ and the dc input voltage $V = 200\text{V}$. Determine the rms, average, and peak currents of the transistors. [5+5]

OR

- 9.a) Give the detailed analysis of 120° degree conduction of three phase inverters.
b) The three-phase inverter has a delta-connected load of $R = 5 \Omega$ and $L = 10 \text{ mH}$. The inverter frequency is $f_o = 50\text{Hz}$ and the dc input voltage is $V = 120\text{V}$. Determine the rms line voltage at the fundamental frequency and the load power. [5+5]
- 10.a) Draw the circuit diagram of flying capacitor multi level inverter and explain its working.
b) A single-phase cascaded multi-level inverter has $m = 5$. Find the switching angles to eliminate the 5th, 7th, 11th, and 13th harmonics. [5+5]

OR

- 11.a) Explain in detail about the working of back to back intertie system.
b) A single-phase diode-clamped inverter has $m = 5$. Find the generalized Fourier series and THD of the phase voltage. [5+5]

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