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Question Paper Code : 51017

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024

Fifth/Sixth Semester

Electrical and Electronics Engineering

EE 3591 – POWER ELECTRONICS

(Common to : Mechanical and Automation Engineering /
Mechatronics Engineering / Robotics and Automation)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the purpose of using driver circuit?
2. What is switching power loss?
3. Draw the equivalent circuit for IGBT.
4. Define Space Vector Modulation.
5. What is Bridge Rectifier?
6. Define Distortion Factor.
7. Write the necessity for thermal protection in converters.
8. Define harmonic factor.
9. Draw the VI characteristics of TRIAC.
10. What is positive gate pulse triggering?

PART B — (5 × 13 = 65 marks)

11. (a) Describe the following characteristics of MOSFET.
 - (i) Steady – state characteristics. (7)
 - (ii) Switching characteristics. (6)
- Or
- (b) Explain with neat diagram the classifications of resonant converters. (13)

12. (a) Discuss with neat diagram the behaviour of IGBT. (7)

(i) Static behaviour (7)

(ii) Dynamic behaviour (6)

Or

(b) Discuss in detail with neat diagram about the programmed harmonic elimination switching technique. (13)

13. (a) With sketches and derivations, compare the output performance of single-phase half-wave rectifier with single-phase full-wave rectifier. (13)

Or

(b) Discuss in detail with neat diagram the effect of current commutation in three-phase full bridge rectifier and the principle of operation of voltage doubler circuit. (13)

14. (a) Explain in detail about the following

(i) The operation of two transistor analogy of the SCR. (7)

(ii) Turn ON losses and the thermal protection of SCR. (6)

Or

(b) Describe the effect of source inductance on

(i) Single phase converter. (7)

(ii) Three phase converter. (6)

15. (a) With sketches explain the structure and operation of TRIAC. Also discuss about the VI characteristics of TRIAC. (13)

Or

(b) Explain in detail of the following single-phase AC voltage controller.

(i) Unidirectional controller. (7)

(ii) Bidirectional controller. (6)

PART C — (1 × 15 = 15 marks)

16. (a) The single-phase half-bridge inverter as shown in Figure.16 (a) has a resistive load of $R = 2.4\Omega$ and the DC input voltage is $V_s = 48\text{ V}$. Determine (i) The rms output voltage at the fundamental frequency V_{O1} , (ii) The output power P_o (iii) The average and peak currents of each transistor (iv) the peak reverse blocking voltage V_{BR} of each transistor (v) the THD.

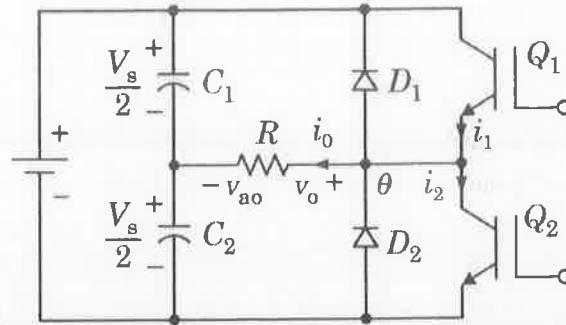


Figure 16(a)

Or

- (b) The single-phase full converter as shown in Figure 16(b) is operated with symmetric angle control. The load current with an average value of I_a is continuous, where the ripple content is negligible. (i) Express the input current of converter in Fourier series, and determine the HF of input current, DF, and input PF. (ii) If the conduction angle is $\beta = \pi/3$ and the peak input voltage is $V_m = 169.83\text{ V}$, Calculate V_{DC} , V_{rms} . HF, DF and PF.

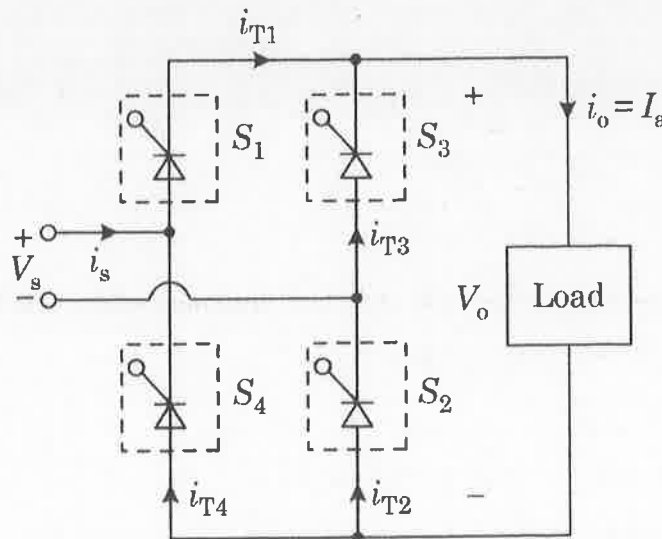


Figure 16(b)