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D Total Pages **2**

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SAINTGITS COLLEGE OF ENGINEERING
KOTTAYAM, KERALA

(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH. DEGREE EXAMINATION(R), MARCH 2021
(POWER SYSTEMS)

Course Code: 20EEPST107

Course Name: POWER ELECTRONIC CIRCUITS

Max. Marks: **60** **Duration:** **3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain the reverse recovery characteristics of power diodes.
2. The output of a 50Hz 1-phase full-wave bridge rectifier has a 50 Hz ripple. It this circuit working properly? Justify with necessary waveforms.
3. Explain the operation of the AC voltage controller feeding RL load when firing angle is less than and more than load impedance angle.
4. Derive the output voltage equation of boost converter considering the effect of inductor resistance. All other components are assumed ideal for a ripple free current and voltage operation.
5. Draw the schematic diagram of a full bridge transformer isolated buck converter and plot the voltage waveform across transformer primary and secondary.
6. Explain the basic operation of the fly back converter with the help of circuits schematic.
7. A single-phase single-pulse full bridge inverter with input dc source of 360V supplies power to resistive load with R=50ohm. If the pulse width of the inverter output voltage is 60-degree, compute (a) the rms value of output voltage (b) the power consumed by load.
8. Explain the concepts of multilevel inverter and discuss its merits and limitations.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. (a) Elaborate the architecture of MOSFET. (4)

   (b) Explain thyristor protection schemes. (2)

OR

10. (a) What is the principle of operation of IGBT. (4)

    (b) A constant voltage of 300V is switched on to a series combination of resistance and inductance with values R=200ohm and L=150mH. Compute the circuit current at t=2.5ms . (2)

MODULE II

11. A single-phase bridge-type full-wave controlled rectifier has an ac input of 120V rms at 50Hz and 20ohm load resistor . The delay angle is 45degree. Determine the average current in the load, the power absorbed by the load and source voltamperes. (6)

OR

12. A three-phase half wave-controlled rectifier is supplied from a three- phase 400V and 50Hz source. The converter is feeding a resistive load of value 200ohm. Determine the average load voltage for firing angle of 0°, 30° and 60°. Assume a thyristor voltage drop of 1.5V. (6)

MODULE III

13. Discuss the effect of source inductance on a single-phase full converter with necessary waveforms and equations. (6)

OR

14. Draw the schematic of three-phase voltage controller supplying power to star connected resistive load. Explain its operation and plot its output voltage waveform across any one phase and neutral. (6)

MODULE IV

15. Design a boost converter with the following specification. Switching frequency=50kHz, input voltage varies between 6-12V. Regulated output required is 15V. the load resistor connected across the output is 15 ohm. The maximum allowable inductor current ripple is 10% of the average inductor current and the output voltage ripple is 1% of output voltage. (6)

OR

16. A Cuk converter has an input of 12V and required to generate an output of -18V supplying a 45W load. Select the duty ratio, the switching frequency, the inductor sizes such that the change in inductor currents is no more than 10 percentage of average inductor current, the output voltage ripple should be less than 1 percent, and the ripple voltage across C1 is should be less than 5 percent. (6)

MODULE V

17. With the help of circuit schematic, explain the operation of forward converter at different switching states. Also plot various current and voltage waveforms of converter for one switching period. (6)

OR

18. Explain the operation of half-bridge transformer isolated dc-dc converter with the help of switching signal waveforms. Also derive the relationship between input and output voltages from necessary waveforms. (6)

MODULE VI

19. Outline the various methods of harmonic reduction in inverters. (6)

OR

20. Explain the working of single phase constant current source inverter and enumerate it's applications. (6)

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