R20 Regulation *Subject code: 3E6BC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech VI Semester Regular Examinations, June/July 2023

LINE-COMMUTATED AND ACTIVE RECTIFIERS

(Electrical and Electronics Engineering)

Maximum Marks: 70 Date:03.07.2023 Duration: 3 hours

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 What is the importance of freewheeling diode?
2 What are the factors that affect the output ripple of the capacitor-filter rectifier?
3 What do you understand by continuous current operation of thyristor converter?
4 Define the term voltage ripple factor and current ripple factor.
5 What are the advantages of using 12-pulse converter?
6 What is the reason of commutation overlap?
7 What are the advantages of using an isolated flyback converter?
8 What is the main difference between non-isolated DC-DC boost converters and single-switch AC-DC boost converters?
9 Give the advantages of a three-phase inverter over a single-phase inverter.
10 List the applications of a bidirectional boost converter.

Part-B

Answer All the following questions. (10MX 5=50Marks)

11 A. In an aerospace application, a single-phase full-wave uncontrolled rectifier is supplied at 115 V, 400 Hz with source reactance of 0.15 Ω. Assuming continuous ripple free load current of 5 A, compute the average load power. (5M)
B. What is the effect of commutation overlap? How to avoid this? (5M)

OR

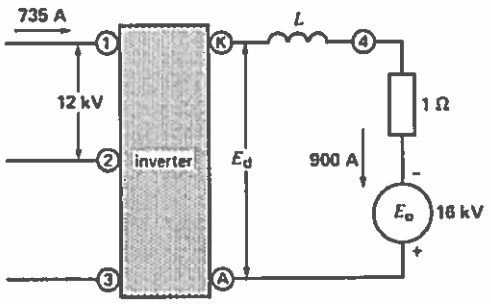
12 Draw and explain the working principle of 3-phase diode rectifier with C filter. (10M)

13 A single phase fully controlled bridge converter operates in the continuous conduction mode from a 230 V, 50 Hz single phase supply with a firing angle $\alpha = 30°$. The load resistance and inductances are 10 Ω and 50 mH respectively. Find out the 6^{th} harmonic load current as a percentage of the average load current. (10M)

OR

14 Draw the schematic and voltage waveform of a 3-phase thyristor rectifier with LC filter. (10M)

15 A 16 kV dc source having an internal resistance of 1 Ω supplies 900 A to a 12 kV, 3-phase, 6-pulse, 60 Hz inverter (see figure) (10M)



Calculate the following

a. The dc current carried by each SCR.
b. The dc voltage generated by the inverter.
c. The required firing angle α.
d. The effective value of the ac line currents.
e. The reactive power absorbed by the inverter.

OR

16 Describe with neat circuit diagram and associated waveforms, operation of 12-pulse converters. (10M)

17 Explain the operation and working principle of a single-phase AC-DC single-switch boost converter. (10M)

OR

18 A. Discuss the concept of isolation in power converters. (4M)
B. Explain the operation and working principle of an isolated single-phase AC-DC flyback converter. (6M)

19 A. Describe the control structure and working principle of a three-phase inverter used in motor drive applications. (7M)
B. List the merits of isolated bidirectional AC-DC converter. (3M)

OR

20 Explain the control structure of a bidirectional closed-loop converter and discuss their advantages in terms of power flow control. (10M)