*Regulation* R17 *Subject code: 1P6BB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

## B.Tech III Year II Semester Supplementary Examinations, June 2022

# POWER ELECTRONICS

*(EEE)*

***Maximum Marks: 70*** Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

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

1 What losses occur in a thyristor during working conditions.
2 What are the factors that affect the turn off time of SCRs?
3 What is commutation angle or overlap angle?
4 What is meant by input power factor in controlled rectifier?
5 What are the two types of cyclo-converters?
6 What is an AC voltage controller?
7 What is meant by voltage commutation?
8 What is meant by frequency modulation control in a dc chopper?
9 Why thyristors are preferred for inverter circuit
10 What are the main classifications of inverter

Part-B

Answer All the following questions. (5X10M=50Marks)

11 a) Explain the construction of SCR with neat diagram. Draw its V-I characteristics. 7
b) What are the applications of power MOSFET? 3

OR

12 Explain the operation of IGBT with VI and switching characteristics. 10

13 A single-phase semi converter delivers to RLE load with R=5Ω, L =10mH and E =80V. The source voltage is 230V, 50Hz. For continuous conduction, Find the average value of output current for firing angle α=50. 10

OR

14 Discuss the operation of single-phase semi converter and derive the output voltage expression. 10

15 a) Explain the operation of single-phase step-up cycloconverter with RL load. 5
b) A single-phase half wave AC voltage controller, using one SCR in antiparallel with a diode. Feeds 1kW,230V heater. Find the load power for a firing angle of (i) $0^0$ (ii)$180^0$ (iii) $70^0$. 5

OR

| | | |
|---|---|---|
| 16 | a) Distinguish between an ac voltage controller and a cyclo-converter with respect to operation and control aspects. | 5 |
| | b) Derive an expression for rms value of output voltage of single-phase ac voltage controller. | 5 |
| 17 | Explain working principle of AC chopper with necessary diagrams | 10 |
| | OR | |
| 18 | a) Derive expressions for minimum and maximum values of load current in a step down chopper with R-L-E load. | 5 |
| | b) A step-up chopper has a source of 250 V (dc) in series with inductance of 0.1 H. If the semiconductor switch is operated with different values of duty ratio, plot output voltage vs duty ratio | 5 |
| 19 | A 3-phase bridge inverter is operated in $180^0$ conduction mode. Derive output line voltage and phase voltage expression. | 10 |
| | OR | |
| 20 | A six-step three-phase inverter has an adjustable dc input. The load is a balanced Y connection with a series RL combination in each phase, with R = 5 Ω and L = 50 mH. The output frequency is to be varied between 30 and 60 Hz. Determine the range of the dc input voltage required to maintain the fundamental-frequency component of current at 10 A (rms). | 10 |