

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), November 2018

B. Tech. 3rd Year, Semester-VI

Roll No.....

ECE629-Power Electronics

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

- Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10
- i. Which of the following conditions is necessary for triggering system for thyristors:
(a) It should be synchronized with the main supply (b) It must use separate power supply
(b) It should provide a train of pulses (d) None of these
 - ii. The SCR is turned-off when the anode current falls below:
(a) Forward current rating (b) breakover voltage (c) holding current (d) latching current
 - iii. Turn-off time of a thyristor effects its:
(a) operating voltage (b) operating frequency (c) overload capacity (d) thermal behavior
 - iv. A single phase full wave mid point thyristor converter uses a 230/200 V transformer with centre tap on the secondary side. The Peak inverse voltage per thyristor is:
(a) 100 V (b) 141.4 V (c) 200 V (d) 282.8 V
 - v. In a semi-converter with RLE load during the freewheeling period, the energy is:
(a) fed back to the source (b) fed to the inductor(L) and absorbed by E
(c) absorbed by the L & E and dissipated at R (d) fed to the L & E and dissipated at R
 - vi. In case of a constant frequency system, $T_{on} = (1/4)T$. If the chopping frequency 2 kHz, find the value of T_{off} : (a) 1/8 ms (b) 3/8 ms (c) 1/8 μ s (d) 3/8 μ s
 - vii. The load commutated chopper circuit consists of: (a) two thyristors and one commutating capacitor (b) four thyristors and one commutating capacitor (c) two thyristors and two commutating capacitors (d) four thyristors and two commutating capacitors
 - viii. In AC voltage controllers the: (a) variable ac with fixed frequency is obtained (b) variable ac with variable frequency is obtained (c) variable dc with fixed frequency is obtained (d) variable dc with variable frequency is obtained
 - ix. Voltage source inverters using GTOs are turned off by: (a) load commutation (b) line commutation (c) applying a negative gate pulse (d) removing the base signal
 - x. External control of dc input voltage can be obtained by the use of a:
(a) transformer (b) chopper (c) inverter (d) converter
- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10
- i. How can a thyristor turned off?
 - ii. What are the advantages of single phase bridge converter over single phase mid-point converter?
 - iii. What is meant by step-up and step-down chopper?
 - iv. Why thyristors are not preferred for inverters?
- Q.3A Draw and explain the forward characteristics of SCR using two transistor model of SCR. 05
- Q.3B Explain the different type of over current & over voltage protection in SCR. 05
- Q.4A Explain the working of single phase dual converter with circuit diagram and waveforms. 05
- Q.4B Derive the expressions for average output voltage and rms output voltage of 1- ϕ semi-converter. 05
- Q.5A Describe the principle of working of single phase to single phase cyclo-converter for both 05

continuous and discontinuous conduction for a bridge type cyclo-converter.

Q.5B What is a freewheeling diode? Draw the circuit diagram of an SCR full wave rectifier with RL load. For with and without freewheeling diode and explain the operation with necessary output waveforms. 05

Q.6A A single phase half wave controlled converter is operated from a 120 V, 50 Hz supply. Load resistance 10 Ohm. If the average output voltage is 25% of the maximum possible average output voltage, determine: (a) firing angle (b) rms and average output currents (c) average and rms SCR currents. 05

Q.6B Explain the operation of step up chopper and derive an expression for its output voltage. 05

OR

Q.6B What is a dc chopper? Describe various types of chopper configurations. 05

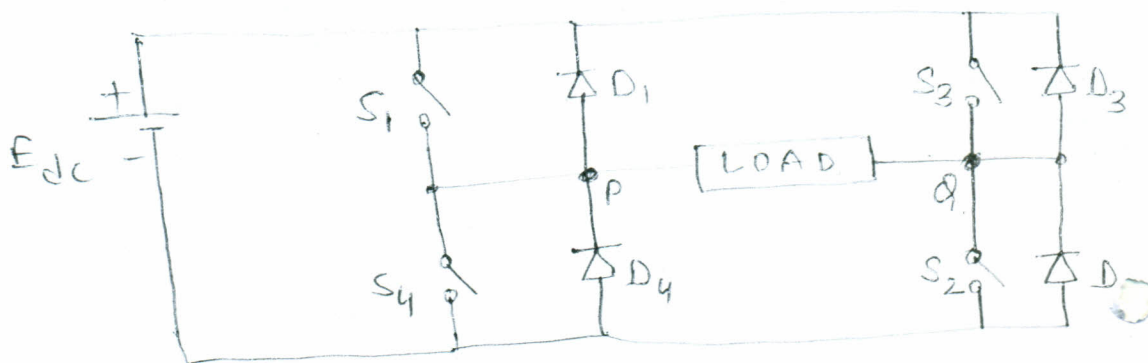
Q.7A A single phase fully controlled bridge converter supplies an inductive load. Assuming that the output current is virtually constant, and is equal to I_d , determine the following performance measures, if the supply voltage is 230 V and if the firing angle is maintained at $(\pi/6)$ radians. (i) average output voltage (ii) supply rms current (iii) supply fundamental rms current (iv) fundamental power factor (v) supply power factor 05

Q.7B Explain the operation of single phase full bridge voltage source inverter and the help of voltage and current waveforms? 05

OR

Q.7B Explain the operation of 3- ϕ PWM inverter of 180 degree Conduction of output voltage with resistive load. 05

Q.8 The full bridge inverter has a source voltage $E_{dc}=220$ V. the inverter supplies an RLC load with $R=10$ ohm, $L=10$ mH and $C=52$ μ F. the inverter frequency is 400 Hz. Determine: (i) the rms load current at fundamental frequency (ii) the rms value of load current (iii) the power output (iv) the average supply current. 10



Q.9A A simple dc chopper is operating at a frequency of 2 kHz from a 96 V dc source to supply a load resistance of 8 ohm. The load time constant is 6 ms. If the average load voltage is 57.6 V, find the T_{on} period of the chopper, the average load current, the magnitude of the ripple current and its RMS value. 10

Q.9B Explain the working of current commutated chopper with aid of circuit diagram and necessary waveforms. Derive an expression for its output voltage. 10

OR

Q.9B Explain the effect of source inductance in the operation of three-phase fully controlled converter, indicating clearly the conduction of various thyristors during one cycle with relevant waveforms. 10