

JK LAKSHMIPAT UNIVERSITY, JAIPUR
INSTITUTE OF ENGINEERING AND TECHNOLOGY
EndTerm Examination (Regular/Backlog), April-May2018
B. Tech. 3rd Year, Semester-VI

EE 603- Industrial Electronics
ECE629-Power Electronics

Roll No.....
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. The SCR ratings, di/dt in A/ μ Sec and dv/dt in V/ μ Sec, may vary, respectively, between:
(a) 20 to 500, 10 to 100 (b) both 20 to 500 (c) both 10 to 100 (d) 50 to 300, 20 to 500
 - ii. When the emitter terminal of a UJT is open, the resistance between the base terminal is generally: (a) High (b) Low (c) Extremely low (d) None of the above
 - iii. Each diode of a 3-phase, 6-pulse bridge diode rectifier conducts for:
(a) 60° (b) 120° (c) 180° (d) 90°
 - iv. In a 3-phase full converter, the output voltage pulsates at a frequency equal to:
(a) supply frequency, f (b) $2f$ (c) $3f$ (d) $6f$
 - v. In a two-quadrant dc to dc chopper, the load voltage is varied from positive maximum to negative maximum by varying the time ratio of the chopper from: (a) zero to unity
(b) unity to zero (c) zero to 0.5 (d) 0.5 to zero
 - vi. In dc choppers, the waveforms for input and output voltages are respectively:
(a) discontinuous, continuous (b) both continuous (c) both discontinuous
(d) continuous, discontinuous
 - vii. A single phase voltage controller feeds power to a resistance of 10 ohm. The source voltage is $200 \sin 314 t$ volts. For firing angle of 90° , the average thyristor current in amperes is:
(a) 10 (b) $10/\pi$ (c) $5\sqrt{2}/\pi$ (d) $5\sqrt{2}$
 - viii. In single-pulse modulation of PWM inverters, fifth harmonic can be eliminated if pulse width is equal to: (a) 30° (b) 72° (c) 36° (d) 108°
 - ix. A single phase full bridge inverter can operate in load commutation mode in case load consists of: (a) RL (b) RLC underdamped (c) RLC overdamped (d) RLC critically damped
 - x. How many switches are used to construct a three phase to three phase cycloconverter?
(a) 3 (b) 6 (c) 12 (d) 18
- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10**
- i. Define latching current and holding current.
 - ii. What is the function of freewheeling diodes in controlled rectifier?
 - iii. What are the control strategies for chopper?
 - iv. What are the different classifications of inverters?
- Q.3A Explain the different type of over current & over voltage protection in SCR. 05**
- Q.3B Explain the effect of source inductance in the operation of single phase fully controlled converter, indicating clearly the conduction of various thyristors during one cycle. 05**

- Q.4A Explain the working principle of multiphase chopper. 05
- Q.4B Describe the operation of single phase full wave AC voltage controller with the help of voltage and current waveform. Also derive the expression for average value of output voltage. 05
- Q.5A A single phase transistorized bridge inverter has a resistive load of $R=3\ \Omega$ and the dc input voltage of $E_{dc} = 48$ volts. Determine: (i) transistor rating (ii) THD (iii) distortion factor. 05
- Q.5B Explain the principle of working of single phase to single phase step up cycloconverter. List the factors that affect the performance of cycloconverters. 05
- Q.6A What is snubber circuit? Why is it needed? Draw such circuit for a SCR and give guidelines for selecting its components. 05
- Q.6B For type-A chopper, dc source voltage = 230 V, load resistance = 10 Ω . Take a voltage drop of 2V across chopper when it is on. For a duty cycle of 0.4 calculate (a) average and rms values of output voltage and (b) chopper efficiency. 05
- OR
- Q.6B Draw and explain the forward characteristics of SCR using two transistor model of SCR. 05
- Q.7A Explain the operation of single phase VSI Half and Full bridge with R Load. 05
- Q.7B A single phase full converter feeds power to RLE load with $R=6\ \Omega$, $L=6\text{mH}$ and $E=60\text{V}$. the ac source voltage is 230V, 50 Hz. For continuous conduction, find the average value of load current for a firing angle delay of 50° . 05
- In case one of the four SCRs gets open circuited due to a fault, find the new value of average load current taking the output current as continuous.
- OR
- Q.7B Explain the continuous conduction mode and non-continuous conduction mode of Class A chopper. 05
- Q.8A A single phase ac regulator feeds power to a resistive load of 4 Ω from 230V, 50 Hz source. Determine: (i) the peak values of average and rms thyristor currents for α firing angle. 10
- (ii) the minimum circuit turn off time for firing angle α .
- (iii) the ratio of third harmonic voltage to fundamental voltage for $\alpha = \pi/3$.
- (iv) the maximum value of di/dt occurring in the SCRs
- Q.9A A three phase bridge inverter is operated in 120° conduction mode. Determine: (i) Fourier series for the line voltage (ii) the nth harmonic component (iii) the fundamental component (iv) the rms value (v) distortion and harmonic factor (vi) first four harmonics 10
- Q.9B Draw the circuit of 3 phase fully controlled rectifier with R-L-E load and explain the working for $\alpha=60^\circ$ with necessary waveforms. Derive the expression for output voltage. 10
- OR
- Q.9B A six pulse, blocked group cycloconverter is fed from a three phase 600V (line), 50 Hz supply. The supply has an inductance of 1.146 mH/phase. If the cycloconverter is supplying a variable resistive load with a current of 28 Amp, estimate the peak and rms value of load voltage for firing angles of (i) 0° (ii) 30° (iii) 60° 10