

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), May 2016

B. Tech in Electrical Engg. and Electronics & Communication Engg., Semester VI

Roll No.....

EE603: Industrial 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 Short answer/objective type questions (10 questions @ 1 mark) 10
- i. An IGBT has three terminals called
 - (a) collector, emitter and base
 - (b) drain, source and base
 - (c) drain, source and gate
 - (d) collector, emitter and gate
 - ii. Which of the following devices should be used as a switch in a low power switched-mode power supplies.
 - (a) GTO
 - (b) TRIAC
 - (c) SCR
 - (d) MOSFET
 - iii. A single-pulse diode rectifier is feeding an RL load with freewheeling diode across the load. For conduction angle β , the main diode and freewheeling diode would, respectively, conduct for
 - (a) $\pi, \beta - \pi$
 - (b) $\pi, \pi - \beta$
 - (c) π, β
 - (d) $\beta - \pi, \pi$
 - iv. A single-phase full-wave diode bridge rectifier delivers a load current of 10A, which is ripple free. Average and RMS values of diode currents are respectively
 - (a) 5A, 7.07A
 - (b) 10A, 7.07A
 - (c) 5A, 10A
 - (d) 7.07A, 5A
 - v. When a SCR is reverse biased, the number of blocked p-n junction is
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 - vi. In a SCR, anode current is made up of
 - (a) electrons only
 - (b) electrons and holes
 - (c) holes only
 - (d) electrons or holes
 - vii. In a 3-phase semiconverter, the three SCRs are triggered at an interval of
 - (a) 60°
 - (b) 90°
 - (c) 120°
 - (d) 180°
 - viii. In a 3-phase full converter, 3 SCRs pertaining to one group, are fired at an interval of
 - (a) 60°
 - (b) 90°
 - (c) 120°
 - (d) 180°
 - ix. In dc choppers, if T_{on} is the on-period and f is the chopping frequency, then output voltage in terms of input voltage V_s is given by



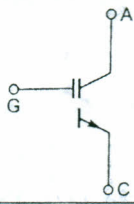
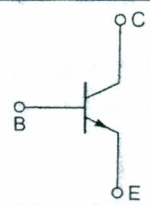
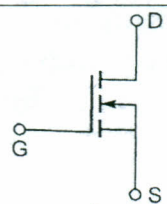
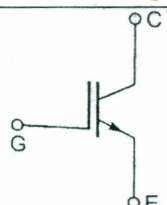
- (a) $V_s \cdot T_{on} / f$ (b) $V_s \cdot f / T_{on}$
 (c) $V_s / f \cdot T_{on}$ (d) $V_s \cdot f \cdot T_{on}$

x. If, for a single-phase half-bridge inverter, the amplitude of output voltage is V_s and the output power is P , then their corresponding values for a single-phase full-bridge inverters are

- (a) V_s, P (b) $2V_s, P$
 (c) $2V_s, 2P$ (d) $2V_s, 4P$

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

i.	(A) BJT	(1) 
	(B) MOSFET	(2) 
	(C) IGBT	(3) 
	(D) MCT	(4) 

Match the devices on the left hand side with the circuit symbols on the right hand side and give the correct answers for the codes given below.

Codes:

A B C D

(a) 2 3 4 1

(c) 3 2 1 4

A B C D

(b) 2 3 1 4

(d) 3 2 4 1

- ii. By making a block diagram, explain the meaning of power electronic systems.
 iii. What is the meaning of p^+n^- junction?
 iv. Make the relevant waveforms for a closed circuit containing a dc source, a switch, a diode and a resistive load. All are connected in series.

Q.3A Discuss advantages and disadvantages of power electronics converters. 2+3

Q.3B A single-phase full bridge diode rectifier is supplied from 230 V, 50 Hz source. The load consists of $R = 10\Omega$ and a large inductance so as to render the load current constant. Determine: 05

- (a) average values of output voltage and output current
 (b) average and rms values of diode currents

(c) rms values of input and output currents, and supply power factor.

- Q.4A Explain L-filter. Also give a brief comparison between C-filter and L-filter. 3+2
- Q.4B Thyristor ratings can be given in many ways. Out of these, explain about different current rating. 05
- Q.5A What are the basic requirements to commutate the SCR? Name different commutation methods. Explain external-pulse commutation. 1+1
+3
- Q.5B Mention the use of firing angle in phase controlled rectifiers. 2+3
A single-phase 230V, 1kW heater is connected across 1-phase, 230V, 50Hz supply through an SCR. For firing delays of 45° and 90° , calculate the power absorbed in the heater element.
- Q.6A A 3-phase M-3 converter is operated from 3-phase, 230V, 50Hz supply with load resistance $R = 10\Omega$. An average output voltage of 50% of the maximum output voltage is required. Determine 1+2
+2
(a) the firing angle
(b) average and rms values of load current
(c) rectification efficiency.
- Q.6B How a semiconverter differ from a full converter? Explain the working of semiconverter by making clear waveforms if the firing angle is 60° . 05
- OR
- Q.6B How a semiconverter differ from a full converter? Explain the working of full converter by making clear waveforms if the firing angle is 60° . 05
- Q.7A Chopper-What do you mean by this word? Explain ac and dc chopper. Also provide the applications. 1+2
+2
- Q.7B Can one chopper circuit be used for the purpose of step-up as well as step-down the voltage? If yes, then explain how. If no, then why not? 1+4
- OR
- Q.7B A step-up/step-down chopper has input dc voltage of 220V and output voltage of 660V. If the conduction time of thyristor chopper is $120\mu s$, compute the pulse width of load voltage. 05
In case pulse width of load voltage is increased to three times its previous width, for constant frequency operation, calculate the new value of average output voltage.
- Q.8A Define 'inverter'. Explain 3-phase 180 degree mode voltage source inverter with the help of neat diagram and waveforms. Also formulate the equations for output phase and line voltages. 1+7
+2
- Q.9A Briefly point out the difference between the two controlling methods of AC voltage controllers. 5+5
A single-phase voltage controller has input voltage of 230V, 50Hz and a load of $R = 15\Omega$. For 6 cycles on and 4 cycles off, determine
(a) rms output voltage,
(b) input pf and



(c) average and rms thyristor currents.

Q.9B List out different applications of Cycloconverters. Explain the principle of cycloconverter operation with the help of single-phase to single-phase step-up Bridge-type cycloconverter. 1+9

OR

Q.9B List out different applications of Cycloconverters. Explain the principle of cycloconverter operation with the help of single-phase to single-phase step-down Mid-point cycloconverter. 1+9