

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Fifth Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

Course Code: EE305

Course Name: POWER ELECTRONICS

Max. Marks: 100

Duration: 3 Hours

(Graph sheets may be supplied on demand)

PART A*Answer all questions, each carries 5 marks.*

Marks

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|---|--|-----|
| 1 | With circuit diagram, explain the need of snubber circuit for SCR. | (5) |
| 2 | Explain the operation of R triggering circuit for SCR with the help of circuit diagram and waveform | (5) |
| 3 | With circuit diagram, explain the 3-phase dual converter operating in circulating current mode. | (5) |
| 4 | Draw the circuit diagram for single phase full bridge voltage source inverter using IGBT with RL load. Also draw the waveforms for output voltage, output current and input current. Show the device conduction in the waveform. | (5) |
| 5 | Explain the elimination of n^{th} order harmonics from the inverter output voltage using single pulse width modulation with suitable waveforms | (5) |
| 6 | With circuit diagram and waveforms, explain the two stage sequence control of AC voltage controller with R load | (5) |
| 7 | In a step-down chopper, voltage across the controlled switch is given in Fig.1. Determine the average output voltage. | (5) |

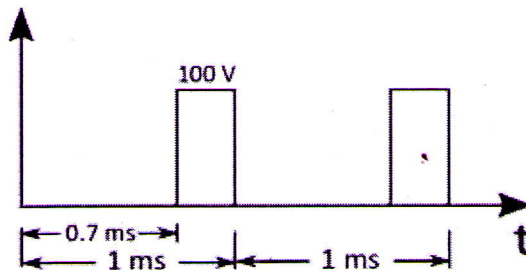


Fig.1

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|---|---|-----|
| 8 | Explain the PWM control and current limit control for the output control in chopper circuits. | (5) |
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PART B

Answer any two full questions, each carries 10 marks.

- 9 a) Explain the problems associated with the series operation of SCRs and the method to solve the issues. (5)
- b) Explain the structure and operation of enhancement type MOSFET. (5)
- 10 a) Sketch the variation of voltage across thyristor and current through it during the turn-on process. Indicate the turn on time subdivisions and explain the nature of these curves (5)
- b) A single-phase semi-converter delivers power to RLE load with $R = 5 \Omega$, $L = 10 \text{ mH}$ and $E = 80 \text{ V}$. The ac source voltage is 230 V , 50 Hz . For a continuous conduction, find the average value of output current for a firing angle delay of 50° . Sketch the input current and output voltage waveforms. (5)
- 11 Describe the working of a single phase full-converter in the inverter mode with RLE load. Draw the circuit diagram and illustrate your answer with waveforms for load voltage and current, source current, current through and voltage across one SCR. Assume constant load current. Obtain the expression for average output voltage (10)

PART C

Answer any two full questions, each carries 10 marks.

- 12 With circuit diagram and waveforms, explain six pulse and three pulse operating modes of 3-phase semiconverter. Assuming continuous conduction of load current, show that average output voltage is the same for both the operating modes. (10)
- 13 a) A 3-phase full converter is used for charging a battery with an emf of 110 V and an internal resistance of 0.2Ω . For a constant charging current of 10 A , compute the firing angle delay for ac line voltage of 220 V . Find also the supply power factor. (5)
- b) Draw the circuit diagram for 3-phase voltage source inverter with star connected resistive load on the assumption that each IGBT conducts for 120° . Also draw the waveforms for current through any one IGBT, phase voltages and line voltages. (5)
- 14 A star connected load of 15Ω / phase is fed from 420 V dc source through a 3- (10)

phase bridge inverter. For both (a) 180° mode and (b) 120° mode, determine rms value of load current, rms value of switch current and output power.

PART D

Answer any two full questions, each carries 10 marks.

- 15 With circuit diagram and waveforms, explain the single phase AC voltage controller with RL load. Derive the rms value of output voltage. Assume discontinuous conduction of load current. (10)
- 16 a) Explain sinusoidal pulse width modulation for the output voltage control of inverters with relevant waveforms. Mention its advantages. (5)
- b) Derive the expression for filter inductance and capacitance for Boost converter (5)
- 17 In a buck converter, let the output voltage be held constant at 5 V by controlling the switch duty ratio. Calculate minimum inductance required to keep the converter operation in a continuous conduction mode under the following condition: (10)
- (i) Input voltage is varied from 10 V to 40 V, and
 - (ii) Output power is kept at 5 W, and
 - (iii) Switching frequency is selected as 50 kHz.
