Code No: 115AF JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD B. Tech III Year I Semester Examinations, November/December - 2018 **POWER ELECTRONICS** (Electrical and Electronics Engineering)

Time: 3 hours

Note: This question paper contains two parts A and B. Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

1.a) Differentiate latching current with holding current of an SCR. [2] Define different components of turn on time and turn off times of a thyristor. b) [3] What is the effect of source resistance on the average output voltage of a single phase c) semi-converter? [2] How four quadrant of operation is possible with single phase fully controlled d) converters? [3] What are the advantages and disadvantages of chopper? [2] e) What is the Current limit control of dc-dc converter? Explain briefly. f) [3] List out two difference between TRIAC and thyristor? [2] **g**) What are the three main limitations of a cycloconverter compared ac voltage controller. h) [3] What is the difference between series inverter and parallel inverter? [2] i) Draw the circuit diagram for parallel inverter. i) [3]

PART - B

Discuss the switching characteristics of SCR by mentioning its salient features.

2.a) What are "dv/dt" and "di/dt" ratings of SCRs? What happens if these ratings are b) exceeded? [5+5]

OR

- Draw and explain the transfer and output characteristics of *n*-channel enhancement type 3.a) MOSFET's.
 - b) Mention the importance of snubber circuit which is connected across SCRs. [5+5]
- Trace the input and output load voltage waveform of 1- Phase half controlled bridge 4.a) converter having highly inductive load with firing delay angle of 60° . Justify your comments about the power flow.
 - Derive an expression for i) average load voltage ii) average load current iii) RMS load b) voltage of 1-phase half-controlled converter with inductive load. [5+5]

OR

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(50 Marks)

(25 Marks)



Max. Marks: 75

- 5.a) Explain the operation of 3-phase fully controlled Converter with R load for inverter operation
 - b) The dc voltage from a 1- phase fully controlled bridge converter with RL load is 110 V. The ac source voltage is 220 V rms. The load resistance, R = 0.5 Ω, and load inductance, L is large enough to cause the load current to be essentially constant.
 i) Determine the delay angle α ii) Estimate the power delivered to the load. [5+5]
- 6.a) Explain the operation of step-up chopper with a neat circuit diagram and necessary output waveforms and also derive expression for output voltage.
 - b) The step-down dc chopper has a resistive load, $R = 20 \Omega$ and input voltage, $V_s = 220 v$. When the chopper remains on, its voltage drop, $V_{ch} = 1.5 V$ and chopping frequency, f = 10 kHz. If the duty cycle is 80 %, Estimate the: (i) average output voltage (ii) rms output voltage, and (iii) Chopper efficiency. [5+5]

OR

- 7.a) Explain the operation of ac chopper with neat circuit diagram and waveforms.
- b) A chopper circuit is operating on TRC principle at a frequency of 2KHz on 220v dc supply. If the load voltage is 170v, compute the conduction and blocking periods of thyristor chopper in each cycle. [5+5]
- 8.a) Discuss the methods of voltage control employed in ac voltage controllers with necessary waveforms
- b) A single phase bidirectional controller supplies a resistance load of $R = 10 \Omega$. Determine the output voltage and power consumed by the load for following cases: (i) $\alpha = 30^{0}$ (ii) $\alpha = 75^{0}$ (iii) $\alpha = 120^{0}$. [5+5]

OR

- 9.a) Illustrate the principle of working of a 1-phase to 1-phase bridge type step down cycloconverter feeding an R load.
 - b) A 1 phase a.c.regulator feed power to a resistive load of 4 Ω from 230 V, 50 Hz a.c.source. Determine i) the peak value of average and rms thyristor currents for any firing angle α . ii) the minimum circuit turn-off time for any firing angle α . [5+5]
- 10.a) A 3-phase bridge inverter is operated in 180° conduction mode. Derive output line voltage and phase voltage expression.
 - b) 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 $R = 5 \Omega$ 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). [5+5]

OR

- 11.a) Describe sinusoidal PWM control of single phase VSI with the help of suitable waveform.
 - b) A square-wave inverter has a dc source of 125 V, an output frequency of 60 Hz, and an RL series load with $R = 20 \Omega$, and L = 25 mH. Determine (i) an expression for load current, (ii) rms load current, and (iii) average source current. [5+5]