

Code No: 125AF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B.Tech III Year I Semester Examinations, May/June - 2019****POWER ELECTRONICS****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 75****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**(25 Marks)**

- 1.a) What is the use of snubber circuit? [2]
b) What do you understand by “dynamic latch up” of an IGBT? How can it be prevented? [3]
c) Is it possible to operate a single phase fully controlled half wave converter in the inverting mode? Explain. [2]
d) Which connection is required for signal transformer used to generate the carrier waves for firing pulse generation of a three phase fully controlled rectifier? [3]
e) Define duty ratio of dc-dc converter. [2]
f) Sketch the load voltage waveform of step up chopper. [3]
g) How to vary the rms value of output voltage of single phase ac voltage controller? [2]
h) Is there any need for free wheeling diode in AC voltage controllers? Why? [3]
i) List out the methods of reducing harmonic distortion in the output voltage of inverters. [2]
j) A single-phase full bridge inverter with square wave output voltage is connected to a dc input voltage of 600 volts. What maximum rms load voltage that can be obtained from bridge? [3]

PART - B**(50 Marks)**

- 2.a) Draw static V-I characteristics of Silicon Controlled Rectifier. How the device can be controlled as a switch? What are the conditions required for turn on?
b) A resonant commutation circuit supply voltage is 200 V. Load current is 10 A and the device turn off time is 20 μ s. The ratio of peak resonant current to load current is 1.5. Determine the value of L and C of the commutation circuit. [5+5]

OR

- 3.a) Draw the circuit required to turn on thyristor using UJT. What are significant points to be noted in designing UJT firing circuit? Explain.
b) A thyristor is connected in series with a source of 100 V (dc) and a load of 20 ohms resistance and 0.5 H inductance. The thyristor is fired with a gate pulse of 50 micro sec. Will the SCR turned on reliably? If not why? The latching current of SCR is 50mA. [5+5]

- 4.a) Derive an expression for average output voltage of single phase half controlled rectifier with common cathode.
- b) A three phase fully controlled rectifier is supplied at 150 V/phase, 50 Hz, the source inductance being 1.2 mH per phase. Assuming a thyristor voltage drop of 1.5 V and continuous load current of 30 A. determine average load voltage at firing angles
(i) 30 deg (ii) 60 deg [5+5]

OR

- 5.a) Derive an expression for source current of single phase fully controlled rectifier feeding power to R-L load. Assume load current to be continuous.
- b) A 3 phase fully controlled bridge rectifier is operating from a 400 V, 50 Hz supply. There is a FWD across the load. Find the average output voltage for a firing angle of
(i) 45 deg (ii) 60 deg (iii) 90 deg [5+5]

6. Draw the circuit of load commutated dc-dc converter. Explain its working. Sketch the output voltage waveform and voltage across thyristor for a typical duty ratio. [10]

OR

- 7.a) Two loads having 10 ohm resistance each are to be serviced from a dc supply. The supply voltage is 24 V. Design commutation circuit component when turn off time specification of thyristor(s) is 20 micro sec. The chopper operating frequency is 1 kHz. Choose the duty ratio as per requirement.
- b) Draw the circuit of Jone's chopper. Explain its operation highlighting method of commutation of thyristor. [5+5]

- 8.a) Explain the operation of single phase mid-point cyclo-converter. Derive an expression for rms value of output voltage.
- b) A resistance heating load is controlled from a single phase supply using a TRIAC in the phase angle control mode. Determine firing angle when the output power is at (i) 80 % of its maximum (ii) 30% of its maximum. [5+5]

OR

- 9.a) Explain how the output frequency can be controlled in single phase cyclo converters. What are measures adopted to reduce THD in output voltage?
- b) A single phase load of 9 ohms and 0.03 H inductance, is controlled by inverse-parallel connected thyristors using phase angle delay. The ac supply voltage is 230 V, 50 Hz. Determine the load current waveform and load power at delay angle of 30° . [5+5]

- 10.a) Explain the operation of 3-phase bridge inverter in 120 degrees conduction mode.
- b) A 400 Hz, single phase, center-tapped inverter is required to generate an output close to sine wave shape from 72 V dc source into 10 ohms load via 1/1 transformer. Determine the required values of capacitance and inductance. Neglect losses. [5+5]

OR

- 11.a) Describe how sine-pulse width modulation is implemented in inverters. How THD reduction can be accomplished with PWM? Explain
- b) A three-phase sine-PWM inverter operates from a dc link voltage of 600 volts. For modulation index = 1.0. Compute the rms value of line voltage of fundamental frequency. [5+5]

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