Registration No :

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B.Tech
PEL5I101

5th Semester Regular / Back Examination 2018-19
POWER ELECTRONICS
BRANCH : EEE
Time : 3 Hours
Max Marks : 100
Q.CODE : E303

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Short Answer Type Questions (Answer All-10)** (2 x 10)
a) What are the conditions of successful switching (turned-off) of an thyristor ?
b) What are the design considerations of snubber circuit ?
c) What do you mean by safe operating area (SOA) of a power BJT switch ?
d) D Define displacement factor, input power factor, harmonic factor.
e) Why variable frequency operation is not desirable for changing the duty cycle of the DC to DC chopping voltage.
f) What is modulation index for a PWM control ?
g) What is zero crossing detector and why is it utilized in a triggering circuit?
h) Differentiate between the CSI and VSI.
i) A step-up DC Chopper has input voltage of 220V and output voltage of 660V. If the non-conducting time of the thyristor is 100 μsec, Compute the pulse width of output voltage.
j) What are the advantages and disadvantages of cycloconverter ?

Part- II

Q2 **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)
a) Is a thyristor phase-controlled converter a soft-switched converter? Justify.
b) Define $\frac{di}{dt}$ and $\frac{dv}{dt}$ ratings of SCR. Write down the protection schemes of SCR against these.
c) Draw the static V~I characteristic of an SCR and explain.
d) Discuss the unequal current distributions and other operating problems during parallel operation of SCRs. How to overcome it.
e) Enumerate the merits of controlling the heater power by a TRIAC using integral cycle control over the phase-angle control.
f) Explain the operation of two quadrant chopper with relevant circuit diagram.
g) Describe the problem in single phase unidirectional ac voltage controller that will be overcome by bidirectional ac voltage controller. Find the output rms voltage of bidirectional single phase ac voltage regulator for a resistive load for a resistive load with voltage waveform.
h) Explain Boost converter operation with circuit diagram and waveforms.
i) Describe the operation of Single phase midpoint type step up Cyclo-converter for discontinuous load current .
j) With all the waveforms, explain the circuit operation of type-C chopper.
k) Draw the possible configurations of a single-phase voltage controller ? Also, list some of industrial applications of the ac voltage controllers.
l) Discuss on switching characteristics of GTO during turn-on and turn-off processes.

Part-III

Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Derive the output voltage of the single phase full wave converter with source inductance connected with R-L load. Draw the relevant output voltage and current waveform. **(10)**

b) The boost regulator has an input voltage of V_s =6V. The average output voltage is V_a= 15V and the average load current is 0.5 A. The switching frequency is 20 kHz. If L=250 μ H and C=440 μ F, determine (a) the duty cycle (b) the ripple current of the inductor (c) the peak current of the inductor (d) the ripple voltage of the filter capacitor (d) the critical value of L and C. **(6)**

Q4 **a)** What are different types of SCR triggering? Explain detail the operation of UJT triggering with neat circuit diagram and show how it is differs from others triggering. **(10)**

b) A string of thyristors is connected in series to withstand a dc voltage of V_s=15 kV. The maximum leakage current and recovery charge differences of thyristors are 10 mA and 150 μ C respectively. A derating factor of 20% is applied for the steady state and transient voltage strings of thyristors. If the maximum steady-state voltage sharing is 1000V, determine (a) the steady-state voltage-sharing resistance R for each thyristor, and (b) the transient voltage capacitance for each thyristor. **(6)**

Q5 **a)** Explain the operation of 3-phase bridge inverter for 180 degree mode of operation with aid of relevant phase and line voltage waveforms. **(10)**

b) The single phase half bridge inverter has a resistive load of R = 2.4 ohm and the dc input voltage is V_s = 48 V. Determine (i) the rms output voltage at the fundamental frequency (ii) the output power (iii) the total harmonic distortion (THD) **(6)**

Q6 **a)** What are the different control strategies of AC voltage controller? Explain briefly with circuit diagram and waveforms. **(10)**

b) An R-L load, energized from single phase, 230V, 50Hz source through a single thyristor, has R=20 ohm and L=0.08 henry. If it is triggered in every positive half cycle at α=75^0, find current expression as function of time. **(6)**