# P.E.S. College of Engineering, Mandya - 571 401
### *(An Autonomous Institution affiliated to VTU, Belagavi)*
## Fourth Semester, B.E. - Electronics and Communication Engineering
### Semester End Examination; May/June - 2018
## Power Electronics

*Time: 3 hrs*                                          *Max. Marks: 100*

*Note*: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

## UNIT - I

1 a. With a neat sketch, explain the control characteristics of power switching devices.  8

b. With the help of a neat block diagram, explain generalized power converter system.  6

c. List the advantages and disadvantages of MOSFET over BJT.  6

2 a. With the help of a neat transient model and waveforms, explain the transient model of BJT.  8

b. Explain the need for base drive control with necessary equations, explain Turn on control.  6

c. The Bipolar transistor shown in the Fig. Q2(c) is specified to have β in the range of 8 to 40. The load resistance $R_c$ = 11 Ω. The DC supply voltage $V_{CC}$ = 200 V and the input voltage to the base circuit is $V_B$ 10 V. If $V_{CE(Sat)}$ = 1 V and $V_{BE(Sat)}$ =1.5 V. Find;

   i) The value of $R_B$ that results in saturation with an overdrive factor of 5

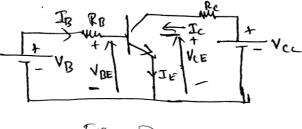   ii) The forced $β_f$          iii) The power loss $P_T$ in the Transistor

   6



Figure Q2(c)

## UNIT - II

3 a. With the help of a two transistor model for a thyristor, explain Regenerative action.  8

b. Explain the different way of turning ON a thyristor.  10

c. Differentiate between Phase-Control thyristor and Fast-Switching thyristor.  2

4 a. With the help of a neat diagram and waveforms, explain turn off characteristics of thyristors for a line commutated thyristor.  8

b. Ten Thyristors are used in a string to withstand a DC voltage of $V_s$ = 15 kV. The maximum leakage current and recovery change differences of thyristors are 10 mA and 150 µC respectively. Each thyristor has a voltage sharing resistance of R = 56 kΩ and capacitance of G = 0.5 µF. Determine;

   i) Maximum steady-state voltage sharing $V_{DS(Max)}$        ii) The steady state voltage derating factor

   iii) The maximum transient voltage sharing $V_{DT(max)}$      iv) The transient voltage derating factor

   8

c. Explain UJT triggering circuit for full wave rectifier.  4

**UNIT - III**

5 a. With the help of a neat diagram and waveforms, explain the principle of ON-OFF AC-Voltage controller.                                                              8

b. Single phase half-wave controller is having a pure resistance load of R = 10 Ω and supply voltage is 230 V, 50 Hz. If the delay angle of thyristor T is $\alpha = \pi/2$ rad. Compute;

i) The rms value of output voltages and output current     ii) The input power factor

iii) The rms and average thyristor current                                              6

c. With the help of a neat diagram and waveforms, explain the operation of a single-phase full wave AC voltage controller.                                               6

6 a. With the help of neat diagram and waveforms, explain the operation of single phase controlled HWR with R load.                                                        6

b. A single phase full converter operating from a single phase 230 V, 50 Hz supply has a resistive load of R = 15 Ω. If the average load current is 11.78 A. Find;

i) Delay angle $\alpha$                                    ii) rms values of output voltage and current

iii) Average rms value of thyristor current                                          6

c. With neat diagram and wave forms, explain the operation of dual converter. List the advantages and disadvantages of circulating current.                           8

**UNIT - IV**

7 a. Explain the operation of step down chopper with RL load.                         8

b. A chopper is feeding an RL load with $V_s$ = 220 V, R = 5 Ω, L = 7.5 mH, f = 1 kHz, K = 0.5, E = 0 V. Calculate;

i) Maximum instantaneous load current $I_1$

ii) Peak instantaneous load current $I_2$                                            6

iii) Maximum peak to peak load ripple current

c. Explain the principle operation of step-up chopper.                               6

8 a. Explain the performance parameter of choppers.                                  6

b. List the application of chopper.                                                  4

c. Explain the clarification of choppers based on the polarity of average output voltages and currents.  10

**UNIT - V**

9 a. Explain the principle of operation of single phase half bridge inverter with R load.    10

b. With the help of a neat diagram and waveforms explain :

i) Single PWM                    ii) Sinusoidal PWM used in the voltage control of Invertor   10

10 a. With the help of a necessary circuit diagrams, explain any two configuration for switched mode DC power supplies.                                                          10

b. Explain the following with respect to UPS configurations :

i) Load normally connected to ac main supply                                        10

ii) Load normally connected to inverter.

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