CBCS Scheme

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USN			15EE53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Power Electronics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- a. With the help of circuit diagram, input and output waveforms explain working of different types of power electronic converters. (08 Marks)
 - b. The reverse recovery time of a diode is 5μs and rate of fall of diode current is 80A/μs.
 Calculate: i) the storage charge Q_{RR} ii) Peak reverse current I_{RR}.
 (04 Marks)
 - c. List the parameters on which the performance of rectifier is evaluated.

OR

2 a. Briefly explain different types of power diodes.

(06 Marks)

(04 Marks)

b. Explain the peripheral effects of power electronic equipments.

(06 Marks)

- c. The bridge rectifier has an AC source with $V_m=100\mathrm{V}$ at 60Hz and a series load (RL) with $R=10\Omega$ and L=10mH. Calculate :
 - i) Average current in the load
 - ii) Average currents in the diodes.

(04 Marks)

Module-2

3 a. Explain the switching characteristics of MOSFET.

(05 Marks)

b. Explain the anti-saturation control of BJT.

(05 Marks)

c. The β of bipolar transistor varies from 12 to 75. The load resistance is 1.5 Ω . The supply voltage $V_{CC} = 40V$ and base input voltage is 6V. If $V_{CE(sat)} = 1.2V$, $V_{BE(sat)} = 1.6V$ and $R_B = 0.7\Omega$, calculate: i) ODF ii) Forced β iii) total power loss in transistor. (06 Marks)

OR

4 a. List and explain the switching limits of power BJT.

(98 Marks)

b. The base drive circuit of anti-saturation control has supply voltage 400V, collector resistance 4Ω , $V_{d1}=3.6V$, $V_{d2}=0.9V$, $V_{BE(sat)}=0.7V$. The voltage to the base circuit is 15V. $R_B=1.1\Omega$ and $\beta=12$. Find: i) Collector current without clamping ii) collector clamping voltage V_{CE} and ii) Collector current with clamping.

Module-3

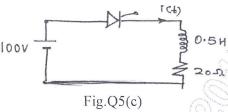
- 5 a. Explain the V-I characteristics of SCR. Also define: i) holding current and ii) Latching current.

 (06 Marks)
 - b. Explain different methods of turning on of thyristor.

(06 Marks)

c. For the SCR shown in Fig.Q5(c), has a latching current of 20mA and is fired by a pulse width of 50µs. Determine whether the SCR turns on as not and comment on the result obtained.

(04 Marks)



OR

- 6 a. With the help of two transistor model, derive an expression for anode current of a thyristor and explain why gate looses its control over the device once thyristor is turned on. (08 Marks)
 - b. A string of SCRs are connected in series to withstand a DC voltage of 15KV. The maximum leakage current and recovery charge difference of thyristor are 10mA and 150 μC respectively. A derating factor of 20% is applied for steady state and transient state voltage sharing's of thyristors. If the maximum steady state voltage sharing is 1000V. Calculate:

 i) steady state voltage sharing resistance R for each thyristor ii) transient voltage capacitance C₁ and iii) string efficiency.

 (08 Marks)

Module-4

- 7 a. With the help of circuit diagram and waveforms, explain the working of single phase full converter with R-L load. (08 Marks)
 - b. A single –phase full wave AC voltage controller has an input voltage of 150V (rms) and a load of 8Ω. The firing angle of thrystor is 60°. Find: i) average output voltage ii) rms output voltage iii) output power and iv) input P.F.

OR

- 8 a. Explain the working of single phase full wave AC voltage controller with resistive load. Draw relevant circuit, waveforms. Derive an expression for rms output voltage. (08 Marks)
 - b. A single phase circulating current dual converter is fed by 230V, 50Hz supply. The load is resistive. The peak current of converter 1 is 39.7A. The firing angles are 45° and 135° respectively. If peak circulating current is 11.5A, Find: i) inductance of current limiting reactor ii) load resistance.

Module-5

- 9 a. Explain the working of step-up chopper. Draw the relevant waveforms. Derive an expression for average output voltage. (06 Marks)
 - b. A step-down chopper has an input voltage of 200V and a load of 8Ω resistance. The voltage drop across thryristor is 2V and the chopping frequency is 800Hz. The duty cycle is 0.4. Find: i) average output voltage ii) rms output voltage iii) chopper efficiency. (06 Marks)
 - Briefly explain the factors that influence the performance of inverter.

(04 Marks)

- OR
- 10 a. Explain the voltage control of single –phase inverter using : i) multiple pulse width modulation ii) sinusoidal pulse width modulation. (08 Marks)
 - b. With the help of circuit diagram, explain the operation of different types of choppers.

(08 Marks)