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

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. **(04 Marks)**

OR

2   a. Briefly explain different types of power diodes. **(06 Marks)**
    b. Explain the peripheral effects of power electronic equipments. **(06 Marks)**
    c. The bridge rectifier has an AC source with $V_m = 100V$ 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 1.5Ω. 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. **(08 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 β = 12. Find : i) Collector current without clamping ii) collector clamping voltage V_{CE} and ii) Collector current with clamping. **(08 Marks)**

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)
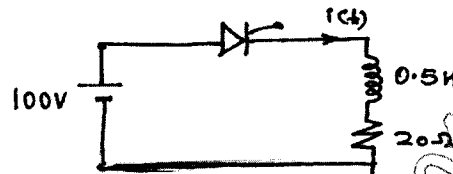

Fig.Q5(c)

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 C_1 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 thyristor is 60°. Find : i) average output voltage ii) rms output voltage iii) output power and iv) input P.F. (08 Marks)

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 i 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. (08 Marks)

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 voltag drop across thryristor is 2V and the chopping frequency is 800Hz.The duty cycle is 0.- Find : i) average output voltage ii) rms output voltage iii) chopper efficiency. (06 Marks)

   c. 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 widt modulation ii) sinusoidal pulse width modulation. (08 Mark)

    b. With the help of circuit diagram, explain the operation of different types of choppers. (08 Mark)

* * * 2 of 2 * * *