USN | | | | | | | | | | |

10EC73

Seventh Semester B.E. Degree Examination, May 2017
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. With neat circuit diagram and waveforms, explain the control characteristics of GTO and MOSFET. **(04 Marks)**

b. What is power electronics? Briefly explain the relationship of power electronics to power, electronics and control. Mention any four power electronics applications. **(08 Marks)**

c. Explain with relevant circuit and waveforms, the dc-ac converter and dc-dc converter. Mention two applications of each. **(08 Marks)**

2 a. With circuit diagram, explain the proportional base control. Mention few important points to be consider while designing the base drive of BJT. **(08 Marks)**

b. For the transistor switch of Fig.Q2(b), calculate:
i) β_f of transistor
ii) The minimum ODF for β range 8 to 40
iii) Obtain the power losses of the transistor

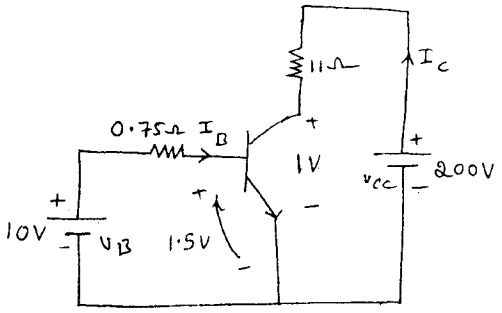

Fig.Q2(b) **(08 Marks)**

c. Compare BJT and MOSFET at least four. **(04 Marks)**

3 a. Briefly explain the regenerative effect of thyristor by using two transistor model. Derive the anode current of thyristor I_A. **(08 Marks)**

b. The thyristor is gated with a pulse width of 40 μsec. the latching current of thyrister is 36 mA and V_s = 220 V for a load of 60 Ω and 2H. Will the thyristor get turned on? If not how it can be overcome for the given load? **(04 Marks)**

c. With neat circuit diagram and waveforms, explain UJT triggering circuit. **(08 Marks)**

4 a. Explain with circuit diagram and waveforms, the single phase semi-converter with RL load for mode '1' operation ($0 \le \omega t \le \alpha$) when diode D_m conducts. Derive the load current. **(10 Marks)**

b. Explain in brief the principle of operation of a controlled rectifier. **(04 Marks)**

c. A single phase half wave converter is operated from a 120 V, 50 Hz supply and the load resistance is 10 Ω if the output voltage is 25% of the maximum possible average output voltage. Calculate: i) delay angle, ii) the rms and average output current. **(06 Marks)**

PART – B

5 a. Compare natural and forced commutation. **(04 Marks)**

b. With circuit diagram and waveforms, explain the complementary commutation. Derive circuit turn-off time $t_{off} = 0.693$ RC. **(10 Marks)**

c. In the resonant pulse commutation circuit of Fig.Q5(c) the supply voltage $V_s = 200$ V, load current $I_0 = 150$ A, capacitance C = 20 μF, inductance L = 04 mH. Determine the peak resonant reversing current of thyristor T_3 and turn off time t_{off}. Assume $V_0 = V_s$.

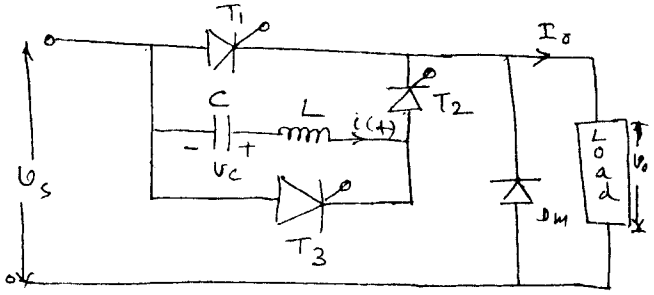

Fig.Q5(c) **(06 Marks)**

6 a. With a necessary circuit and waveforms, explain the operation of single phase full wave controller with resistive load. Derive the expression for rms output voltage. **(10 Marks)**

b. What is an ac voltage controller? Explain with circuit and waveforms the principle of phase control. Derive an expression for the rms output voltage. **(10 Marks)**

7 a. Explain with suitable circuit and waveforms, the principle of operation of step-up chopper. Derive an expression for average output voltage of step up chopper. **(10 Marks)**

b. A dc chopper has a resistive load of 10 Ω and the input voltage is 200 V. when the chopper switch is ON, its voltage drop is 2V and the chopping frequency is 1 kHz, if the duty cycle is 50%, determine: i) average output voltage, ii) RMS output voltage, iii) the chopper efficiency. **(06 Marks)**

c. Mention four applications of chopper. **(04 Marks)**

8 a. Briefly explain with circuit and waveforms, the principle of operation of single phase half bridge inverter with resistive load. **(08 Marks)**

b. Discuss the voltage control of single pulse width modulation. **(06 Marks)**

c. Write a brief note on single phase current source inverter. **(06 Marks)**

* * * * *