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**P.E.S. College of Engineering, Mandya - 571 401**  
*(An Autonomous Institution affiliated to VTU, Belgaum)*  
**Fifth Semester, B.E. - Electrical and Electronics Engineering**  
**Semester End Examination; Dec. - 2015**  
**Power Electronics**

*Time: 3 hrs*

*Max. Marks: 100*

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

**UNIT - I**

- 1 a. Explain briefly the different types of thyristor power converter and mention two applications. 10
- b. With a neat circuit and waveforms of control signal and output voltage, explain the control characteristic of IGBT and SCR. 6
- c. Make the comparisons between BJT and MOSFET. 4
- 2 a. Sketch the structure of n-channel enhancement type MOSFET and explain its working principle. Also draw its transfer characteristics. 8
- b. Sketch and explain the switching characteristics of power BJT. The sketch should have the waveform; 6
- i)  $V_{BE}$       ii)  $I_B$       iii)  $I_C$ .
- c. Draw and explain the switching characteristics of IGBT. 6

**UNIT - II**

- 3 a. With a neat circuit, explain turn on and turn off base drive control for transistor. 6
- b. With neat circuit explain the necessary of isolation. Explain the two isolation schemes for power electronics devices. 6
- c. Explain the significance of over current and over voltage and their protection for BJT's. 8
- 4 a. Using two transistor analogy, derive an expression for anode current of SCR and also explain the V-I characteristics of SCR. 10
- b. What is the need of series and parallel operation of a thyristor and explain them with relevant diagram. 8
- c. State the conditions to be satisfied for proper turn-off of SCR. 2

**UNIT - III**

- 5 a. With the help of circuit diagram and waveforms explain the operation of self commutation. 8
- b. In the Fig. Q5 (b) the source voltage  $V = 100V$  and current through  $R_1$  and  $R_2$  is 25 A. The turn-off time of both the SCRS is 40 seconds. Find the value of capacitor for successful commutation and hence show that circuit turn off time is  $0.693 RC$ . 4

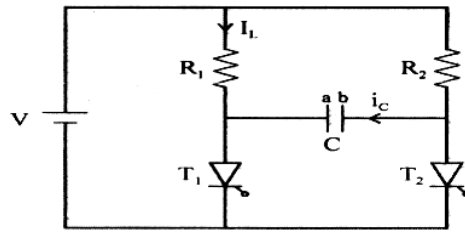


Fig.Q.5(B)

- c. Distinguish between line commutation and forced commutation. 8
- 6 a. Distinguish between on-off control and phase control of AC voltage controller. 4
- b. Explain the operation of single phase bidirectional AC voltage controller for resistive load. 8
- c. An AC voltage controller has a resistive load of  $R = 10$  and rms input voltage is  $V_s = 120$  V, 60 Hz. The thyristors switch is ON for  $n = 25$  cycles and OFF for  $m = 75$  cycles. Determine; 8
- i) The RMS output voltage                      ii) Input power factor.

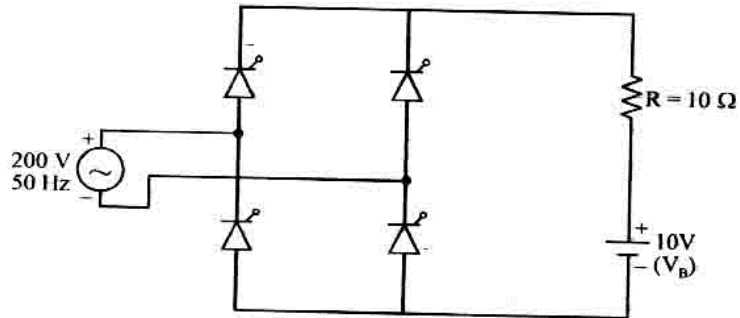
#### UNIT - IV

- 7 a. What is a chopper? How are choppers classified? Explain the operation of class C chopper. 8
- b. With the help of a circuit schematic describe principle of step-up chopper. Obtain the expression for average output voltage in terms of duty ratio. 8
- c. Input to the step up chopper is 200 V. The output required is 600 V. If the conducting time of thyristor is  $200 \mu\text{s}$  Compute; 4
- i) Chopping frequency
- ii) If the pulse width is halved for constant frequency of operation, and the new output voltage.
- 8 a. Explain the principle of operation of a single phase full bridge inverter with suitable circuit diagram and waveform. 10
- b. With the help of neat diagram and waveform and explain the operation of 180 mode of  $3\phi$  inverter with star connected R - load. 10

#### UNIT - V

- 9 a. With neat circuit and waveform derive an expression for the RMS value of output voltage of phase semi converter with R.L. load. (Assume discontinuous load current). 8
- b. A single neat half wave controlled rectifier is used to supply power to 10 load from 230 V, 50 Hz supply at a firing angle of  $30^\circ$ . Calculate; 6
- i) Average output voltage    ii) Effective output voltage    iii) Average load current.
- c. With relevant circuit and waveform explain the operation of a dual converter. 6

- 10 a. With neat circuit and waveforms explain the working principle of 3-half wave controlled rectifier with R load. 6
- b. In the circuit down shown find the charging current if the trigger angle  $\alpha = 90^\circ$  8



- c. A single phase full wave controlled rectifier is used to supply a resistive load of  $10 \Omega$  from a 230 V, 50 Hz, supply and firing angle of  $90^\circ$ . What is its mean load voltage? If a large inductance is added in series with the load resistance, what will be the new output load voltage? 6

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