

**Government College of Engineering, Amravati**  
(An Autonomous Institute of Government of Maharashtra)

**V Semester B. Tech. (Electronics & Telecom.)**

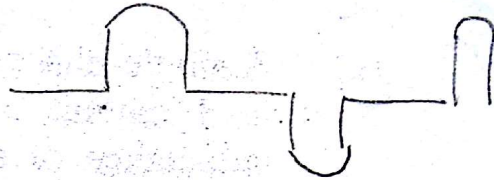
**Winter - 2015**

**Course Code: ETU 503**

**Course Name: Power Electronics**

**Time: 2 hr.30min.**

**Max. Marks: 60**



**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Each sub-question (a,b,c) carries equal (6) marks.

1. (a) Draw dynamic characteristics of SCR during the processes of turn-on and turn off. Define the various time intervals in them.

(b) Draw circuit diagram and with the help of necessary waveforms, explain the single phase ac power control using TRIAC.

2. Attempt any TWO.

(a) A thyristor in a particular circuit is to be protected against :  
i) Short circuit of the load side,  
ii) Sustained over-load.

Draw suitable protection schemes and explain

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their working in brief.

- (b) State the advantages of half controlled converter over fully controlled converter. Draw average output voltage versus firing angle characteristic for H.C.C. and show its operating quadrant on  $V_o-I_o$  plane.

- (c) A single-phase, full bridge converter feeds an R-L load having a resistance of 5.5 ohms and an inductance of a very large value causing perfect smoothing. The converter is fed from a 400 V, 50 Hz single-phase supply. For a converter firing angle of  $75^\circ$  determine :
- the average value of output voltage
  - the average and rms values of output current
  - the average and rms values of thyristor current
  - the power factor of the ac source

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**Attempt any TWO.**

- (a) For a dc chopper, explain precisely the following principles: i) Time ratio control, and ii) Current limit control
- (b) Explain with waveforms, the working of a single-phase to single-phase cycloconverter.
- (c) Calculate the values of the commutating capacitor and the range of commutating inductor for a chopper circuit with following details :
- Input battery voltage = 50 V,  
Max. load current = 50 A,  
Turn off time of main  $SCR_1 = 30 \mu s$   
Chopper frequency = 500 Hz.

The load voltage required is 10% to 100% and for reliable commutation, assume 50% tolerance

on turn-off time of the main  $SCR_1$ .

4. (a) A single-phase full bridge inverter is supplying R+L series load.
- Draw circuit diagram
  - Sketch the gating pulses to all thyristors
  - Draw output voltage and output current waveforms.
- (b) Explain how single-phase fully controlled converter can work as a rectifier as well as inverter.

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**Attempt any TWO.**

- (a) Explain the digital firing scheme for three-phase converter.
- (b) With neat circuit diagram, explain any power electronic method for speed control of three-phase induction motor.
- (c) A thyristor is triggered by a pulse train of 5 kHz. The duty ratio of the pulse train is 0.5. If allowable average gate power is 100 watts, calculate the maximum allowable gate drive power.

$$\begin{array}{r} 12 \\ 6 \\ 6 \\ \hline 24 \end{array}$$

$$6 + 12 + 6$$

$$24$$

$$f = 5 \text{ kHz}$$

$$\alpha = 0.5$$

$$P_{gaw} = \frac{V_{gk} I_g}{f_r}$$

$$P_{gmax} =$$

$$V_{gk} I_g =$$



**Government College of Engineering, Amravati**  
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**Fifth Semester B. Tech.**  
**(Electronics and Telecommunication)**

**Winter – 2016**

**Course Code: ETU503**

**Course Name: Power Electronics**

**Time: 2 hr. 30min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) **Each sub-question (a,b,c) carries equal (6) marks.**

1. (a) Explain briefly, the processes of turn ON and turn OFF for the following solid state switches :  
i) GTO ii) IGBT
- (b) Two SCRs of forward current ratings 200 A and 300 A are to be operated in parallel. Their on-state voltage drops are 1.5 V and 1.2 V respectively. If they have to share total load of 500 A, to ensure proper current sharing by them,  
i) Whether the same resistance in series with each SCR can be used or two different resistances will be required ? Give reason.  
ii) Calculate the value/s of resistance / resistances.

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2. **Attempt any TWO.**

- (a) With reference to the SCR and its two-transistor model, answer the following:  
i) When the SCR is turned ON, why it remains ON even after removing the gate signal ?  
ii) Why a negative voltage to the gate can not turn-OFF the conducting SCR ?
- (b) Differentiate between continuous and discontinuous modes of operation of a single-phase fully controlled converter. State the factors which determine these modes of operation for the converter.
- (c) For a particular SCR; the forward break-over voltage is 150 V, when a gate current of 2 mA flows in its gate circuit. If a sinusoidal voltage of 400 V at 50 Hz. is applied to it, find the average value of the output voltage across a purely resistive load of 50 ohms.

3. **Attempt any TWO.**

- (a) Draw the schematic configurations of the basic step-down and step-up dc choppers. Derive the expressions for their average output voltage, in terms of duty cycle and the input dc voltage.
- (b) Draw output voltage waveforms and differentiate precisely between dual-converter and cyclo-converter.
- (c) What is the average value of a chopped voltage waveform whose ON and OFF periods are 20  $\mu$ s and 10  $\mu$ s respectively, and peak value is 10 V ? Also find the frequency and duty cycle of this chopper.

4. (a) What is series inverter ? Explain how its performance can be improved.

- (b) Explain with necessary waveforms, working of three-phase bridge inverter.

5. **Attempt any TWO.**

- (a) With neat circuit diagram, explain the working of solid-state fan regulator.

- (b) With neat circuit diagram, explain any power electronic method for speed control of d c motor.

- (c) Explain the principle of operation and any circuit configuration of switched mode power supply.