

**GANPAT UNIVERSITY**  
**B.TECH SEM-V (ELECTRICAL)**  
**REGULAR EXAMINATION NOV-DEC-2015**  
**2EE503:- POWER ELECTRONICS DEVICES & CIRCUITS**

Time: 3 Hours

Total Marks:-70

- Instructions:** - 1. Attempt all questions.  
2. Make suitable assumptions wherever necessary.  
3. Answer to two sections must be written in separate answer books.  
4. Figures to the right indicate full marks.

**SECTION-I**

- Que.-1** (A) Define: AC voltage regulator. Explain the working of an AC voltage regulator with Integral Cycle Control. [06]  
(B) What is mid-point cycloconverter? Explain its working with input and output waveforms. [06]

**OR**

- Que.-1** (A) Draw the various possible configuration for single phase AC voltage regulator. [06]  
(B) The resistance of a heating element of a 230 V, 5 kW resistance furnace is 12  $\Omega$ . Find: (1) The duty ratio, for 50% input power using Integral Cycle Control [06]  
(2) The duty ratio, for 50% of the rated voltage using Integral Cycle Control  
(3) Power factor for condition (2).

- Que.-2** (A) What are the methods for controlling the output voltage of an inverter? Discuss series inverter control. [05]  
(B) Draw the gate pulses, line to line voltage and phase voltage waveforms regarding to 120° conduction mode. [06]

**OR**

- Que.-2** (A) Explain SPWM technique of inverter voltage control. [06]  
(B) A three-phase bridge inverter is fed from a 450 V DC source. The inverter is operated in 180° conduction mode and is supplying a purely resistive star connected load. Determine: a) RMS value of the output line & phase voltages. [05]  
b) RMS value of load current and power delivered to the load if the load resistance is 20  $\Omega$ /phase.

- Que.-3** **Attempt any three:** [12]

- (A) Draw and explain any one type of SMPS with neat sketch.  
(B) What are the types of UPS? Draw line diagram of any two methods of it.  
(C) Compare: Thyristor and Transistor.  
(D) Calculate the number of SCRs, Each with rating of 500 V, 75A required in each branch of a series and parallel combination for a circuit with the total voltage and current rating of 7.5 KV and 1000A. Assume derating factor of 14%



## SECTION-II

- Que.-4 (A) With proper graphical representation, explain characteristic of Thyristor. [06]  
(B) What is forced commutation? Explain operational modes of class C and class D commutation circuit in detail. [06]

OR

- Que.-4 (A) Why series and parallel connection of SCR is required? Explain equalization techniques for series and parallel connection. [06]  
(B) Describe following protection scheme with proper circuit diagram: [06]  
1.  $di/dt$  protection  
2.  $dv/dt$  protection  
3. Gate protection

- Que.-5 (A) Derive average output voltage equation for single phase half wave fully controlled rectifier for RL load and draw waveform for output voltage  $V_o$ , output current  $I_o$  and voltage across Thyristor. [06]  
(B) With the help of circuit diagram and waveforms explain three phase half wave fully controlled rectifier. [05]

OR

- Que.-5 (A) What is effect of source impedance on the performance of the single phase full wave fully controlled rectifier? Explain with circuit diagram and waveform also derive average output current equation for this case. [06]  
(B) A delayed full wave rectified current for resistive load has an average value equal to half of its maximum value. Find the delay angle  $\alpha$ . Also draw circuit diagram and waveform. [05]

Que.-6 **Attempt any three:** [12]

- (A) Explain basic operation of step up chopper and derive equation for output voltage  $E_o$ .  
(B) Classify chopper on the basis of direction of  $E_o$  and  $I_o$  also describe its operational modes of class C chopper.  
(C) Draw circuit diagram of multiphase chopper and explain its operation with the help of waveforms.  
(D) 1. A step up chopper is used to deliver load voltage of 500 v from a 220 v dc source. If the blocking period of the Thyristor is 80  $\mu$ s, compute the required pulse width.  
2. A DC copper operates on 230 V dc and frequency of 400 Hz, feeds an RL load. Determine the ON time of the chopper for output of 150 V.

END OF PAPER