

**R16**

Code No: 136DJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, May - 2019

**POWER ELECTRONICS**  
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

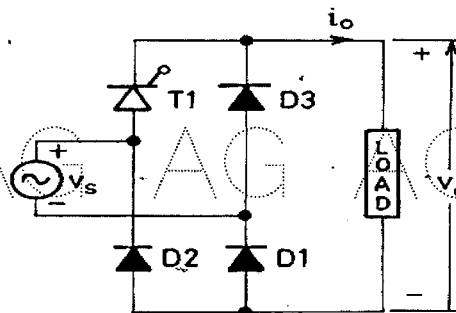
Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A**

(25 Marks)

- 1.a) Name any four power semiconductor devices. [2]
- b) Draw the firing circuit for SCR using UJT and write the necessary design equations. [3]
- c) Which converter will act as three pulse as well as six pulse converter? [2]
- d) Draw the firing pulse, output voltage and load current for the circuit shown in Figure. Assume the load is highly inductive. [3]



- e) Mention the applications of AC voltage controllers. [2]
- f) In an AC voltage controller, six cycles of input voltage are made on and four cycles are made off simultaneously across the load. Find the circuit power factor. [3]
- g) Compare time ratio control and current limit control. [2]
- h) Find the effective resistance and average thyristor current in a basic DC-DC chopper in terms of duty cycle. [3]
- i) What are the advantages of modified series inverter? [2]
- j) Define harmonic factor, THD and Distortion factor. [3]

**PART - B**

(50 Marks)

- 2.a) Explain the working of SCR.
- b) SCRs with a rating of 1000 V and 200 A are available to be used in a string to handle 6 kV and 1 kA. Calculate the number of series and parallel units required. Assume the derating factor is 0.1. [5+5]

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OR

- 3.a) Explain the working of MOSFET.  
b) Explain resonant pulse commutation with necessary circuit and waveforms. [5+5]

- 4.a) A single phase transformer, with secondary voltage of 230 V, 50 Hz delivers power to load 10 ohms through a half wave controlled rectifier circuit. For a firing angle delay of 60 degrees, determine rectification efficiency.  
b) SCRs with peak forward voltage rating of 1000 V and average on-state current rating of 40 A are used in single phase mid-point converter and single phase bridge converter. Find the power that these two converters can handle. Use a factor of safety of 2.5. [5+5]

OR

- 5.a) A single phase full converter bridge is connected to RLE load. The supply voltage is 230 V, 50 Hz. The average load current of 10 A is constant over the working range. For  $R = 0.4 \text{ Ohms}$  and  $L = 2 \text{ mH}$ , compute the firing angle delay for  $E = 120 \text{ V}$ .  
b) Explain the working of three phase full converter for a firing delay angle of 45 degree. [5+5]

6. A single phase half wave ac voltage controller feeds a load of  $R = 20 \text{ ohms}$  with an input voltage of 230 V, 50 Hz. Firing angle of thyristor is 45 degrees. Determine  
a) rms voltage and power delivered to the load.  
b) Average input current and input power factor. [5+5]

OR

7. A single phase full wave ac voltage controller feeds a load of  $R = 20 \text{ ohms}$  with an input voltage of 230 V, 50 Hz. Firing angle for both the thyristors is 45 degrees. Calculate  
a) rms value of output voltage and load power  
b) Input power factor, average and rms current of thyristors. [5+5]

8. The speed of a separately excited dc motor is controlled using type A chopper. The supply voltage is 220 V DC. The armature resistance is 0.5 ohms and armature inductance is 10 mH. The motor constant is 0.1 V/ rpm. The motor drives a constant torque load requiring an average armature current of 30 A. On the assumption of continuous armature current, calculate,  
a) The range of speed control  
b) The range of duty cycle. [5+5]

OR

- 9.a) Explain the working of Morgans chopper.  
b) Explain the working of Jones chopper. [5+5]

10. For a single phase full bridge inverter, input voltage = 230 V DC,  $T = 1 \text{ ms}$ . The load consists of  $R = 1 \text{ Ohm}$ , Inductive reactance = 6 Ohms and capacitive reactance of 7 Ohms.  
a) Sketch the waveforms for load voltage, fundamental component of load current, source current and voltage across thyristor 1. Indicate the devices under conduction during different intervals of one cycle.  
b) Check whether forced commutation is required or not. Take thyristor turn off time as 100 micro seconds. [7+3]

OR

11. Explain the following:  
a) Internal voltage control of inverter  
b) External voltage control of inverter. [5+5]