

III B. Tech I Semester Supplementary Examinations, August - 2021**POWER ELECTRONICS**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. Answer **ALL** the question in **Part-A**3. Answer any **FOUR** Questions from **Part-B**

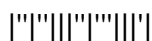
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**PART -A****(14 Marks)**

1. a) Draw the switching characteristics of Power MOSFETs. [2M]
- b) List any two advantages of freewheeling diode in phase controlled rectifiers. [2M]
- c) What are the important features of three phase semi converters? [2M]
- d) Explain the principle of current limit control in case of choppers. [3M]
- e) List the differences between  $120^\circ$  and  $180^\circ$  conduction modes of operation. [3M]
- f) List any two applications of AC Voltage Controllers. [2M]

**PART -B****(56 Marks)**

2. a) Describe the different modes of operation of a thyristor with the help of its static I-V Characteristics. [7M]
- b) Write a brief note on requirements of Gating circuits of SCR. [7M]
3. a) Draw the power circuit for a single-phase half-controlled converter with RL load and explain its operation with relevant waveforms. [7M]
- b) A single-phase full converter feeding RLE load has the following data:  $V_s = 230$  V, 50 Hz;  $R=2.5$   $\Omega$ ,  $E=80$  V and firing angle  $\alpha=30^\circ$ . If the load inductance is large enough to make the load current constant:
  - i) Compute the average value of load voltage and load current
  - ii) Find the input power factor.
4. a) A three phase full converter is connected to a resistive load. Explain the working and sketch the output voltage wave forms for the firing angles of  $30^\circ$  and  $90^\circ$  and also derive the average output voltage expression for both cases. [10M]
- b) A three phase fully controlled bridge converter is supplying dc load of 400 V, 60 A from a three phase 660 V (line), 50 Hz AC Supply. If the thyristors have a voltage drop of 1.2V when conducting, neglecting overlap, compute:
  - i) firing angle of thyristors
  - ii) RMS value of thyristors currents. [4M]



5. a) Explain the working of buck-boost converter with relevant waveforms in CCM mode and also derive the expressions for critical values of L and C. [7M]
- b) A step up chopper has input voltage of 220 V and output voltage of 660 V. If the conducting time of thyristor chopper is 100  $\mu$ s, compute the pulse width of output voltage. In case output voltage pulse width is halved for constant frequency operation, find the average value of new output voltage. [7M]
6. a) Explain the working of three phase voltage source inverter with relevant waveforms in 180 degree mode of operation. [7M]
- b) Explain the principle of sinusoidal pulse width modulation. [7M]
7. a) Describe the principle of phase control in single phase half wave ac voltage regulator. Derive the expressions for rms value of output voltage for this control. [7M]
- b) A single phase voltage controller has the following data: [7M]  
Source voltage: 230 V at 50 Hz, load =  $j4 \Omega$ , Calculate:  
i) The control range of firing angle  
ii) The max. value of RMS load current  
iii) The max. value of RMS thyristor current.

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