CBCS SCHEME

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18EE53

Fifth Semester B.E. Degree Examination, July/August 2021
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Mention the types of power electronic circuits indicating input and output waveforms and two applications of each type. **(10 Marks)**

b. With a neat circuit diagram and waveforms explain the operation of full wave bridge diode rectifier with purely resistive load. Derive the expression for average and RMS value of output voltage, rectification efficiency. **(10 Marks)**

2 a. With a neat circuit diagram and waveforms explain diode switched RL load with necessary equations. **(08 Marks)**

b. With a block diagram explain peripheral effects of power electronic circuits. What are the remedies for them? **(06 Marks)**

c. Briefly explain different types of power diodes. **(06 Marks)**

3 a. For the transistor switching circuit shown in Fig.Q3(a) Determine :
i) The over drive factor ODF
ii) Forced β
iii) Power loss in transistor.
$V_{CE(sat)} = 1.2V$; $V_{BE(sat)} = 1.6V$, $\beta_{min} = 12$.

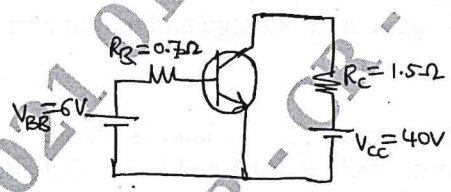

Fig.Q3(a) **(08 Marks)**

b. Draw the switching waveforms of a power MOSFET. Define different switching times associated with it. **(06 Marks)**

c. Sketch the output characteristics of power BJT indicating different operating regions **(06 Marks)**

4 a. Discuss the need for providing isolation of gate drive from power circuit and explain the methods of providing isolation. **(08 Marks)**

b. With a neat circuit diagram, explain the static characteristics of IGBT. **(06 Marks)**

c. Compare power BJT and power MOSFET. **(06 Marks)**

5 a. Derive an expression for the anode current of thyristor with the help of a two transistor analogy. **(08 Marks)**

b. Explain synchronized UJT triggering circuit with relevant waveforms. **(06 Marks)**

c. Explain the VI characteristics of SCR. Also define latching and holding current. **(06 Marks)**

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6 a. A string of thyristors each of rating 1600V/16A is operated from a 35.35KV supply. The maximum leakage current difference of SCRS is 35mA and reverse recovery charge difference is 25μC. If the string efficiency is 85% determine the number of devices to be connected in series and equalizing components. **(08 Marks)**

b. An SCR circuit is operated from a 300V DC supply has series inductance of 4μH. A resistance of 4Ω and capacitance of 0.2μF is connected across the SCR. Calculate the safe di/dt and dv/dt ratings of SCR. **(06 Marks)**

c. Explain the VI characteristics of triac. **(06 Marks)**

7 a. With the help of circuit diagram and waveforms explain the working principle of on–off type AC voltage controller. Derive the expressions for RMS output voltage and average thyristor current. **(10 Marks)**

b. A single phase AC voltage controller using triac shown in Fig.Q7(b) operates on a single phase supply of 230V, 50Hz. If the triac is triggered at a firing angle of 45° during each half cycle of input supply, calculate :

i) RMS output voltage
ii) RMS load current
iii) Input power factor
iv) Average and RMS Triac current.

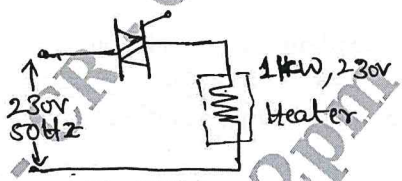

Fig.Q7(b) **(10 Marks)**

8 a. With a neat circuit diagram and waveform explain single phase dual converter operating in circulating current mode. **(10 Marks)**

b. Draw the circuit diagram of single phase half wave controlled rectifier circuit with RL load. Sketch the input voltage, output voltage and output current waveforms. **(10 Marks)**

9 a. A chopper circuit feeding an R – L load is shown in Fig.Q9(a). If V = 220V, R = 5Ω, L = 5mH, f = 1Hz, duty cycle d = 0.5 and E = 0. Calculate : i) I_{min} and I_{max} ii) Average value of load current.

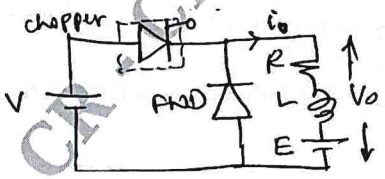

Fig.Q9(a) **(10 Marks)**

b. Explain the principle of operation of step up chopper with suitable circuit diagram. Derive the expression for average output voltage. **(10 Marks)**

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10 a. With circuit diagram and waveform explain the operation of single phase full bridge inverter supplying RL load. **(10 Marks)**

b. What are the advantages of PWM techniques? Explain multiple pulse width modulation and sinusoidal pulse width modulations with relevant waveforms. **(10 Marks)**

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