

--	--	--	--	--	--	--	--	--	--

**Seventh Semester B.E. Degree Examination, Feb./Mar. 2022**  
**Power Electronics**

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, selecting at least TWO full questions from each part.**

**PART - A**

1. a. Draw the control characteristics, circuit diagram and waveform of the following devices and explain it: i) SCR ii) GTO iii) MCT. (08 Marks)
- b. What are the different types of power electronic converter circuits and explain it. Also indicate the applications in each case. (08 Marks)
- c. Write a short note on peripheral effects associated with power converter. (04 Marks)
  
2. a. For the transistor circuit shown in Fig.Q.2(a). Find:
  - i) The value of  $R_B$  that results in saturation with an ODF of 5
  - ii) The  $\beta_{\text{forced}}$
  - iii) Power loss in the transistor. Given  $R_C = 11\Omega$ ,  $V_{CC} = 200V$ ,  $V_B = 10V$ ,  $V_{BE(\text{sat})} = 1.5V$ ,  $V_{CE(\text{sat})} = 1V$  and  $\beta_{(\text{mn})} = 8$ . (08 Marks)

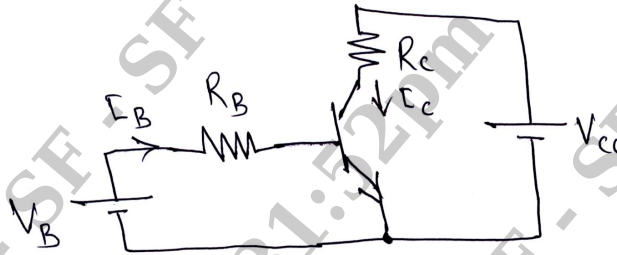


Fig.Q.2(a)

- b. With necessary waveforms, explain the switching characteristics of MOSFET. (06 Marks)
- c. What is base drive control? Discuss the different techniques for optimizing the base drive of a transistor. (06 Marks)
  
3. a. For the circuit shown in Fig.Q.3(a) with  $V_S = 200V$ , damping ratio is 0.7 and discharging current of the capacitor is 5A, determine:
  - i) The value of  $R_S$  and  $C_S$
  - ii) The maximum  $\frac{dv}{dt}$ . (06 Marks)

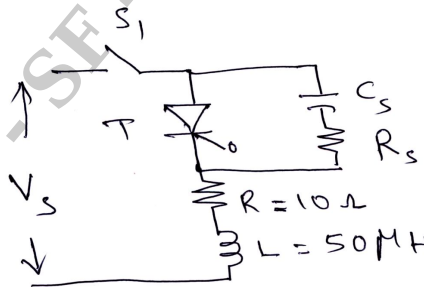


Fig.Q.3(a)

- b. Discuss the various methods of turn on the thyristors. (06 Marks)
- c. With necessary waveforms, explain the working of a UJT triggering circuit. (08 Marks)

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.

- 4 a. With a circuit diagram and waveforms explain the working of a single-phase semi converter with inductive load. (08 Marks)
- b. A single phase half wave controlled rectifier is used to supply power to  $10\Omega$  load from 230V, 50Hz supply at a firing angle of  $30^\circ$  find: i) Average output voltage ii) RMS value of output voltage iii) Average load current. (06 Marks)
- c. What are the functions of a free wheeling diode in a converter circuit? (03 Marks)
- d. What are the advantages of circulating current mode of a dual converters? (03 Marks)

**PART - B**

- 5 a. Derive the expression of  $t_{off} = \sqrt{L_1 C} \tan^{-1} \frac{V_s}{I_o} \sqrt{\frac{C}{L_1}}$  of a impulse commutation with accelerated recharging. (08 Marks)

- b. With a circuit diagram and waveforms explain the operation of a complementary commutation. (08 Marks)
- c. For the circuit shown in Fig.Q.5(c), find the peak value of resonant current and conduction time of a Thyristor. Assume  $V_0 = 200V$  (04 Marks)

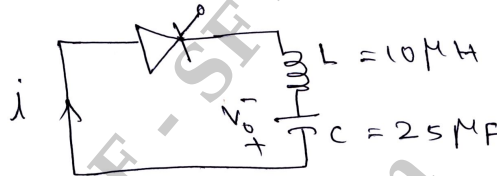


Fig.Q.5(c)

- 6 a. Explain the operation of a 1- $\phi$  controllers with inductive loads. (08 Marks)
- b. A 1- $\phi$  ac voltage controller shown in Fig.Q.6(b) has a resistive load of  $10\Omega$  and the input voltage  $V_s = 120V$ , 60Hz. The delay angle of thyristor is  $\pi/2$ . Determine:  
i) rms value of output voltage  
ii) Output power factor  
iii) Average output voltage  
iv) Average input current.

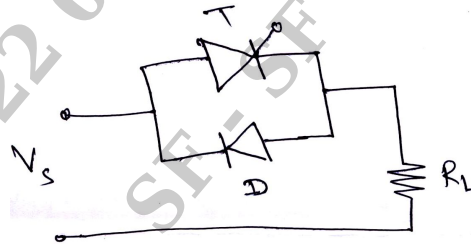


Fig.Q.6(b)

- (08 Marks)
- c. In an ON-OFF control circuit using 1- $\phi$ , 230V, 50Hz supply, the ON time is 10 cycles, and OFF time is 4 cycles. Calculate the RMS value of the output voltage. (04 Marks)
- 7 a. A step down chopper is feeding an RL load with  $V_s = 220V$ ,  $R = 5\Omega$ ,  $L = 7.5mH$ ,  $f = 1kHz$ ,  $K = 0.5$  and  $E = 0V$ . Calculate: i) Minimum instantaneous load current ii) Peak Instantaneous load current iii) Maximum P-P load current iv) Average value of load current. (08 Marks)
- b. With circuit diagram and waveforms explain the working of step up chopper. (08 Marks)
- c. Mention the applications of DC choppers. (04 Marks)



10EC73

- 8 a. What are the applications of current source inverters? (04 Marks)
- b. With circuit diagram and waveforms, explain the operation of a 1- $\phi$  full bridge inverter. (08 Marks)
- c. A 1- $\phi$  transistorized bridge inverter has a resistive load of  $R = 3\Omega$  and the dc input voltage of  $E_{dc} = 48\text{volts}$ . Determine:
- i) Transistor rating
  - ii) Total harmonic distortion
  - iii) Distortion factor
  - iv) Harmonic factor and distortion factor at the lowest order harmonic. (08 Marks)

\*\*\*\*\*