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M.E. / M.TECH. DEGREE EXAMINATIONS, DEC 2019

First Semester

PD18103 – ANALYSIS AND DESIGN OF POWER CONVERTERS*(Power Electronics and Drives)***(Regulation 2018)****Time: Three Hours****Maximum : 100 Marks**

Answer ALL questions

PART A - (10 X 2 = 20 Marks)

	CO	RBT
1. Write the techniques to improve power factor in phase controlled converters.	1	R
2. Sketch the thyristor current and voltage waveforms of a single phase fully controlled converter in inversion mode for $\alpha = 120^\circ$.	1	U
3. Identify the DC-DC converter named as an inverting regulator and draw its schematic.	2	U
4. What are the advantages and disadvantages of flyback converter?	2	R
5. Why are ferrites commonly used for high frequency reactances?	3	U
6. Differentiate hard and soft magnetic material.	3	AP
7. What are the advantages of soft switching over hard switching?	3	R
8. Compare ZVS and ZCS resonant converter.	3	U
9. State the merits and demerits of integral cycle control.	4	R
10. How a bi-directional switch is configured for a matrix converter?	4	U

PART B - (5 X16 = 80 Marks)

11. (a) The armature voltage of a dc motor is controlled from a single phase semiconverter. Derive the expressions for the output voltage of the converter in CCM and DCM modes with detailed modes of operation. The motor may be modeled as a back emf with a small series resistance and leakage reactance. (16) 1 AP

(OR)

- (b) (i) Explain the effect of freewheeling diode in detail. Also justify the statement "Freewheeling diode improves the power factor of a system" (8) 1 AP
- (ii) A 48V battery is charged with a 3 phase full converter. The supply line voltage is 230V, 50Hz. An inductance is connected in series with the battery making the current continuous at 10A. Determine the firing angle and the input power factor. (8) 1 AP

12. (a) The buck converter has a dc input voltage $V_s = 110V$, average load voltage $V_o = 60V$ and average load current $I_a = 20A$. The chopping frequency is 20kHz. The peak to peak ripples are 2.5% for load voltage, 5% for load current and 10% for filter L_c current. Design the values of L_c , L and C_c . Also, derive the necessary equations. **(16) 2 AP**

(OR)

- (b) (i) Derive the average output voltage expression of CUK converter with necessary diagrams and waveforms. **(8) 2 AP**
- (ii) Explain the working of forward converter. Deduce the voltage stress across the switch in forward converter. **(8) 2 AP**
13. (a) Derive the various equations based on which a filter inductor is designed for flyback converter and describe the step by step procedure in detail. **(16) 3 U**

(OR)

- (b) (i) Outline the procedure for design of transformer, with suitable equations. **(10) 3 U**
- (ii) Write short notes on selection of ratings for devices. **(6) 3 R**
14. (a) With the help of a neat circuit diagram and associated waveforms, explain the operation of ZVS resonant converter in full wave mode. **(16) 3 U**

(OR)

- (b) Discuss in detail the continuous and discontinuous modes of operation of series loaded half bridge resonant converter with neat waveforms. **(16) 3 U**
15. (a) (i) Discuss the operation of single phase full wave AC regulator feeding R load with the help of voltage and current waveforms. **(6) 4 U**
- (ii) A three phase resistive heating load is controlled by TRIACs from a 415V (line), 50Hz supply. If the maximum load is 15 kW, determine the required ratings and firing angles of TRIACs. If the TRIACs are replaced by thyristors, determine their rating. **(10) 4 AN**

(OR)

- (b) Discuss why a three phase to single phase cycloconverter requires positive and negative group phase controlled converters. Under what conditions, the group works as inverters or rectifiers? How should the firing angles of two converters be controlled? **(16) 4 AP**