MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

ONLINE EXAMINATIONS, JANUARY - FEBRUARY 2021

MODERN POWER CONVERTER [ELE-4010]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date:27 January 2021** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Design a boost converter with input voltage of 3V, output voltage is 5 V load current is 1Amp and Switching frequency 100kHz. Consider 40% peak current ripple and 80% efficiency. ***(04)***

1B. Design a buck converter for continuous inductor current with the following specification output voltage Vo= 18 V load resistance 10Ω, output voltage ripple less than 0.5%. The input voltage is 48V and switching frequency f=40kHz, Determine (a) duty ratio D (b) The value of inductor L and capacitor C. (c) The average value of I_L. The maximum and minimum value of inductor current. ***(04)***

1C. What are the problem of Hard switching? explain the possible solutions ***(02)***

2A. What kind of output rectifier and filter circuit is used in a fly back converter? With neat diagram and waveform explain the operation of fly-back converter. ***(05)***

2B. What are the assumptions are making for design and analysis of single switch forward converter used in SMPS? Mentions the benefits of two switch forward converters are used in SMPS. ***(05)***

3A. What are the different types of symmetrical converter? Why high frequency transformer used in Push pull converter. Derive an expression to estimate the output voltage in push pull converter. ***(04)***

3B. A Cuk converter has the following parameters: Vg = 10V, Vo = 24 V, Io = 1 A, fs = 100 kHz. Determine the value of the energy storing capacitor (C1) such that the capacitor voltage ripple should be less than 3%. ***(03)***

3C. Explain the steps in the manipulation of small signal AC model of the buck boost converter in to canonical form. ***(03)***

4A. What is the need of resonant converter in switched mode power supply? Explain the operation of Parallel loaded resonant DC-DC converter using suitable circuit diagram and waveform, If witching frequency is greater than resonant frequency ($\omega_s > \omega_0$). ***(05)***

4B. Zero current switch buck converter operates with input voltage of 18V, load current of1Amp, and resonant frequency of 1 MHz load is 10Ω. Determine the following (a) resonant inductor and capacitor. (b) Peak switch current (c) peak voltage rating of the capacitor (d) the linear charging period of the inductor ***(05)***

5A. Discuss in detail the basic constraints for the design of a high frequency inductor when the core geometrical factor Kg method is employed for the design. ***(04)***

5B. A series resonant dc-dc converter operates in continuous conduction mode with $\omega_s/\omega_0 = 1.3$. The input voltage is 100V, the resonant Inductor and capacitance are $L_r = 10\mu H$ and $C_r = 2\mu F$. The load resistance is 20Ω. Calculate the peak inductor current. ***(04)***

5C. What are the factors affecting the choice of zero voltage switching resonant converter in switched mode power supply. ***(02)***