M.Tech. Electrical Power System (CBCS Pattern) Semester-II

PEPS21 - Advanced Power Electronics

P. Pages : 2 GUG/W/24/11021

Time : Three Hours * 4 1 7 0 * Max. Marks : 70

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Discuss the reaction, mechanism wherever necessary.
6. Answer **any five** questions as per internal given choice.
7. Use of non-programmable calculator is permitted.

1. a) Compare SCR, Power BJT, MOSFET and IGBT on the basis of following parameters: **7**

i) operating frequency ii) trigger circuit

iii) drop iv) snubbers

v) V-I rating vi) Applications

b) Derive the input-output relationship for a buck converter operating in DCM. **7**

OR

2. a) Derive the input-output relationship for a buck boost converter operating in DCM. **7**

b) A MOSFET is driving a 10 A resistive load from a 100 V DC supply. The base drive signal is switching at frequency of 100 kHz and duty cycle of 0.6. The MOSFET has the following datasheet specifications: RDS(N) =0.1 Ω , tr = 100 ns, tf = 150 ns. Calculate the conduction and switching power losses in the MOSFET. **7**

3. a) There are two types of dc-dc converters, which are non-isolated and isolated converter. List out THREE (3) examples of non-isolated and THREE (3) examples of isolated converter. **7**

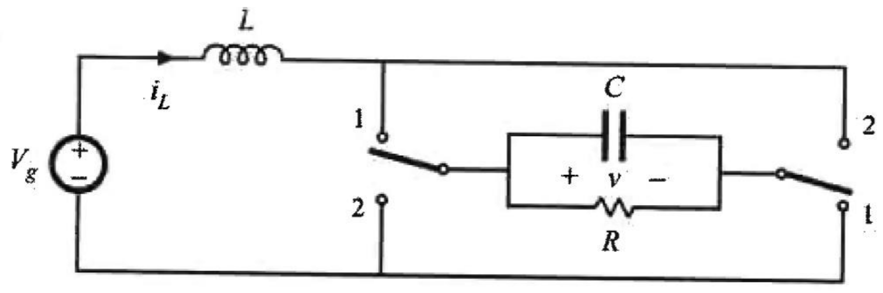
b) What are the advantages of isolated dc-dc converters? **7**

OR

4. a) With the help of neat structural diagram and suitable waveforms, explain the operation of isolated push pull converter. **7**

b) An isolated buck or forward converters has 150 turns in primary winding and 120 turns in the secondary winding. The dc input voltage is 160 V. Find the duration and the voltage across the primary and feedback windings during on and off periods. The converter operates at 25% duty ratio and 25 kHz. The number of turns of feedback winding, N_f = 180. **7**

5. a) **7**



The ideal current-fed bridge converter of Fig operates in the continuous conduction mode.

(a) Determine the nonlinear averaged equations of this converter.

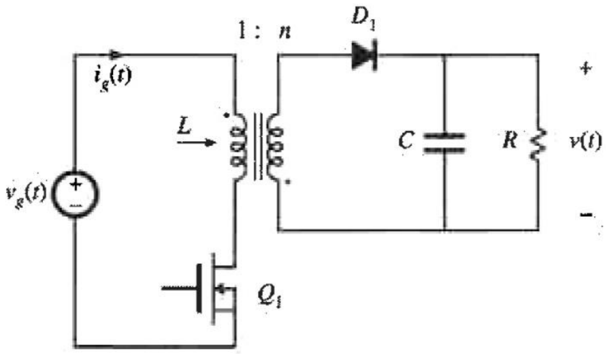
(b) Perturb and linearize, to determine the small-signal ac equations.

(c) Construct a small-signal ac equivalent circuit model for this converter.

b) Construct a complete small-signal equivalent circuit model for the Cuk converter. **7**

OR

6. a) **7**



Construct a complete small-signal ac equivalent circuit model for the flyback converter shown in Fig. operating in continuous conduction mode. The transformer contains magnetizing inductance L, referred to the primary. In addition, the, transformer exhibits significant core loss, which can be modeled by a resistor R_C in parallel with the primary winding. All other elements are ideal. You may use any valid method to solve this problem. Your model should correctly predict variations in $i_g(t)$.

b) Derive the small-signal dynamic equations that model the ideal Cuk converter. **7**

7. a) Explain the operation of ZCS converter with diagram and waveforms. **7**

b) Draw and explain briefly the operation of resonant dc link inverter. **7**

OR

8. a) What is a quasi-resonant converter? Differentiate briefly between resonant and quasi-resonant converter. **7**

b) With the help of neat circuit diagram and associated waveforms, explain the operation of class-E resonant inverters. **7**

9. a) With the help of neat circuit diagram and associated waveforms, explain the operation for half-wave mode of ZCS resonant buck converter. **7**

b) Draw and explain the various versions of zero-voltage switch topology. **7**

OR

10. a) Explain parallel resonant converter in discontinuous conduction mode. **7**

b) Draw and explain the various types of zero current switch topology. **7**

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