Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X10379

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2021

Sixth Semester

Electrical and Electronics Engineering

EE8004 – MODERN POWER CONVERTERS

(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. What is the main advantage of resistance emulation technique ?
2. What are the advantages of DCM ?
3. Define displacement factor.
4. What are the effects of saturation of supply transformer ?
5. List the advantages of MLIs over conventional VSIs.
6. Redundant switching states.
7. Define inter-harmonics.
8. What is scalar modulation ?
9. Define EMI.
10. Differentiate ZVT from ZCT.

PART – B **(5×13=65 Marks)**

11. a) i) Detail the SMPS circuits with and without isolation using suitable example. **(6)**

ii) Design a Buck-Boost converter circuit having parameters, input voltage = 24V, D = 0.4, load resistance = 5 ohm, L = 20mH, C = 80mF. Determine the output voltage, average inductor current, Maximum and minimum value of inductor current, Maximum and minimum value of inductor current and the output voltage ripple. Assume a switching frequency of 100 kHz. **(7)**

(OR)

b) i) The forward converter has the following parameters : **(9)**

V_d = 48V, R_L = 10Ω, output inductor = 0.5mH, C = 100μF, t_s = 35kHz,

N_1/N_3 = 1.5, N_1/N_2 = 1, D = 0.4, L_m = 5mH.

A) Determine the output voltage, maximum and minimum currents in the inductor and peak to peak output voltage ripple.

B) Determine the peak current in the transformer primary winding.

ii) Discuss the closed loop performance of the SMPS circuits. **(4)**

12. a) Explain how the efficiency of AC/DC converters can be improved through Synchronous Rectification. **(13)**

(OR)

b) i) Compare the performance of AC/DC converters with and without isolation. **(6)**

ii) Discuss how a boost converter can be used for PFC in ac-dc converters. **(7)**

13. a) i) Explain with the help of the mode diagrams, the working of flying capacitor MLI. **(8)**

ii) Discuss the principle of multicarrier PWM methods suitable for MLI. **(5)**

(OR)

b) i) Enumerate the working principle of cascaded H-Bridge multilevel inverter with the help of suitable diagrams. **(9)**

ii) Compare all three basic MLI topologies. **(4)**

14. a) i) Discuss the operation and control of the matrix converter. **(8)**

ii) Provide the performance comparison of matrix converter with DC link converters. **(5)**

(OR)

b) i) Enumerate how the SVM can be used to control matrix converter. **(8)**

ii) Explain how the matrix converter can be operated as AC-DC converter. **(5)**

15. a) i) Explain the operation of zero current switching Quasi-resonant boost converter with neat circuit and waveforms. **(8)**

ii) Draw and explain a typical resonant converter based SMPS. **(5)**

(OR)

b) i) Explain the operation of class E Resonant inverter. **(7)**

ii) The Zero Current Resonant Converter (ZCS) delivers a maximum power P_L = 400mW at V_o = 4V. The supply voltage V_s = 15V, the maximum operating frequency is f_{max} = 50 kHz. Determine the values of L and C. Assume that the intervals t_1 and t_3 are very small and x = 1.5. **(6)**

PART – C **(1×15=15 Marks)**

16. a) i) Develop a SVPWM scheme for a NPC inverter and include the state vector diagram in the discussion. **(10)**

ii) Consider a buck converter with a dc voltage source of 80V and a load resistance equal to 18Ω. It is required that this converter deliver at least 100W to the load. Assume the switching frequency is 150kHz. Determine (a) the inductor critical value, Lcrit, (b) the voltage gain for L = 0.1 Lcrit and 10Lcrit, (c) DI for L = 0.1 Lcrit, and the maximum inductor current at t = DT. **(5)**

(OR)

b) i) Explain the Venturini method applicable to matrix converter. **(10)**

ii) With the help of switching loci explain zero voltage and zero current switching. **(5)**

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