Registration no: | | | | | | | | | | |

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M.TECH
PEPC201

2nd Semester Back Examination 2016-17

POWER CONVERTER-II

BRANCH(S): POWER ELECTRO, POWER ELECTRO & DRIVES, POWER ELECTRO AND ELECTRICAL DRIVES

Time: 3 Hours
Max Marks: 70
Q.CODE:Z498

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** (2 x 10)

a) What is the limitation of output frequency of a series inverter?
b) How is the dc side voltage controlled in case of three phase switched mode rectifier?
c) Outline the advantages of Current Source Inverter (CSI) over Voltage Source Inverter (VSI).
d) Give the advantages of Space Vector PWM over Sine PWM as applied to 3 phase Voltage Source Inverter.
e) How is the width of the band controlled in a variable band hysteresis current controller?
f) If the turn ratio of the primary and tertiary windings of the forward converter transformer are in the ratio of 1:2, what is the maximum duty ratio at which the converter can be operated? Corresponding to this duty ratio, what should be the minimum ratio of secondary to primary turns if the input dc supply is 400 V and the required output voltage is 15 V? Neglect switch and diode conduction voltage drops.
g) What is the advantage of using high switching frequency in case of dc-dcswitching regulator?
h) Draw the practical circuit diagram of a isolated forward converter (Buck). What is the maximum voltage appearing across the switch when it is off, given supply dc voltage is 200 V dc and tertiary to primary winding ratio being 3:2?
i) Give a comparison between forward and flyback converter.
j) What are the advantages of soft switched converter over hard switched converter?

Q2 a) What are the advantages of switched mode rectifier over phase controlled rectifier? Explain the operation of single phase switched mode rectifier with relevant circuit diagram and waveforms. (5)

b) Explain the operation of three phase series inverter with circuit diagram and relevant waveforms. (5)

Q3 Explain the principle of operation of Diode Clamped type 5 Level Inverter showing the relevant circuit diagram and switching control strategy. (10)

Q4 What is space vector hexagon? How is sequencing of inverter states done in case of space vector modulated VSI to have inverter switching frequency half that of space vector carrier frequency? (10)

It is required to generate a space vector of amplitude 0.5 at an angle of 150^{o} (anti-clockwise) from the a-axis. How much time should the inverter system spend in the bounding states to generate this equivalent space vector in a period of 50 μs? What are the bounding states?

Q5 a) Explain the operation of boost converter with relevant circuit diagram giving the inductor current and the switch waveforms. Derive the input output relationship for this converter operating in discontinuous mode. (6)

b) A boost converter that is switching at 50 kHz is supplied with an input voltage that varies between 5 V and 10 V. The output is required to be regulated at 15 V. a load resistor of 15 Ω (4)
Is connected across the output. If the maximum allowable inductor current ripple is 10 % of the average inductor current, estimate the value of the inductance to be used in the boost converter.

Q6 a) Draw the circuit diagram of a practical forward dc-dc converter and explain the operation of this converter illustrating the function of each component used. (6)

b) If the turn ratio of the primary and tertiary windings of the forward converter transformer are in the ratio of 1:2, what is the maximum duty ratio at which the converter can be operated? Corresponding to this duty ratio, what should be the minimum ratio of secondary to primary turns if the input dc supply is 400 V and the required output voltage is 15 V? Neglect switch and diode conduction voltage drops. (4)

Q7 Explain the working principle of actively clamped zero voltage switching Resonant dc link inverter with circuit diagram and relevant waveforms. (10)

Q8 **Write short note on ant two:** (5 x 2)

a) Modified series inverter
b) Hysteresis current controller
c) Push pull converter
d) Active power factor control