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B.E END SEMESTER EXAMINATION NOV/DEC 2013
ELECTRICAL AND ELECTRONICS ENGINEERING BRANCH
V SEMESTER –REG 2008
EE 9301- POWER ELECTRONICS

TIME:3 HRS **MARKS:100**

PART A (10 X 2 =20MARKS)

1. Explain the difference between device turn off time and circuit turn off time.
2. For 1 phase half wave rectifier feeding RLE load draw the load voltage and load current waveform for discontinuous current conduction.
3. What is recovery angle? What is its significance in inverter operation?
4. A single phase full bridge inverter uses a single PWM, determine the pulse width if the rms output voltage is 80% of the input dc voltage
5. Explain TRC and current limit control of chopper circuit
6. Name the type of chopper used for loads to be operated in forward motoring mode, forward motoring and braking mode and four quadrants.
7. What is the necessity of feedback diodes in inverter circuits?
8. A two stage sequence controlled single phase ac voltage controller is connected to a resistive load. Turns ratio from primary to each transformer secondary is unity. Draw the load voltage waveform for $\alpha = 30°$ for the upper group of thyristors
9. Draw the load voltage waveform for step up cycloconverter for $f_0=6f_s$ marking the conduction of the devices.
10. Compare IGBT and MOSFET in terms of operating frequency and on state voltage drop.

PART B (5 X 16 = 80 MARKS)

11. (i).Draw the load voltage waveform and derive an expression for Vrms for the converter shown in fig.1. Calculate the power delivered for $\alpha = 60°$ for source voltage v = 220 sin 314t.

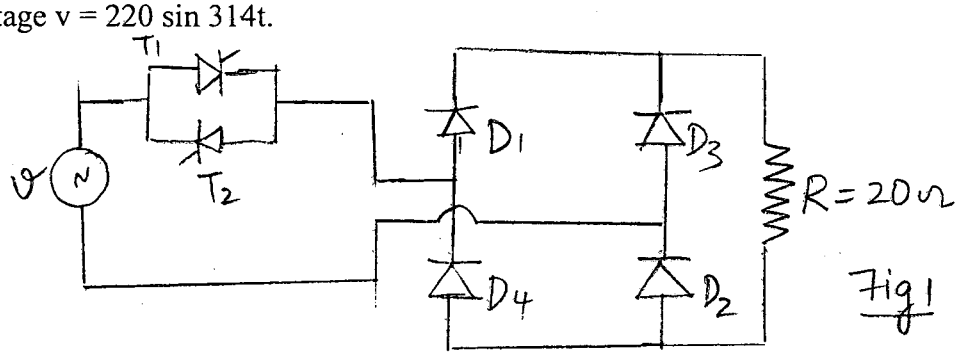

Fig1 (10)

(ii) For the converter shown in fig.2 with V_{in} = 28V and f = 50KHz. Calculate the ripple factor if the power delivered to the load is 35 watts at an average input current of 2A

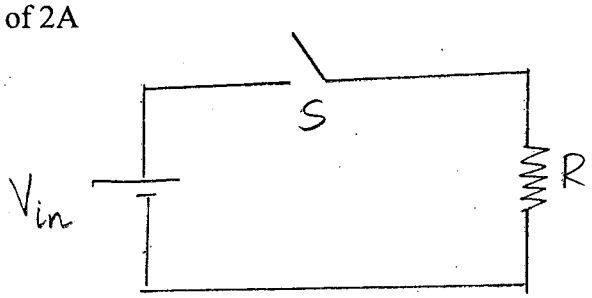

Fig2 (6)

12.a.(i) A Single phase fully controlled converter is connected to a 415V supply having an reactance of 0.4 ohm/phase and resistance of 0.05 ohm/phase. The converter is operating in the inverting mode at a firing advance angle of 35. Determine the mean generator voltage, overlap angle and recovery angle when the current is level at 60A. Assume a thyristor drop of 1.5V. (10)

(ii) Prove that a single phase converter can operate in two quadrants. (6)

(OR)

12.b. (i)Explain the operation of three phase full converter. Draw the load voltage, load supply current waveforms for $\alpha = 45$.Derive an expression for average voltage in terms of α. (10)

(ii) Explain the working of MOSFET with switching characteristics. (6)

13.a. Explain the different modes of operation of buck converter with waveforms. Derive expressions for inductor current ripple and output voltage ripple. (16)

(OR)

13.b.For class A chopper feeding RLE load derive expression for armature current ripple. Show that current ripple is maximum for $\delta = 0.5$. (16)

14.a.(i)Single phase to single phase cycloconverter of midpoint type is used for obtaining an output frequency fo=1/5 fs.Turns ratio from primary to upper secondary and lower secondary is 1:1. Derive expression for the rms value of the output voltage for firing angle α. For Vs=230 V, 50 Hz, R=20 Ω and $\alpha = 45$, find the load power. (8)

(ii) A single phase ac voltage controller has input voltage of 230 V,50 Hz and a load of R= 12 ohm. For 6 cycles on and 4 cycles off determine the rms output voltage and input pf. (8)

(OR)

14.b. A single phase ac voltage controller is employed for controlling the power flow from 230 V 50 Hz source into a load of 3+j4 ohm.Calculate

i)control range of firing angle

ii)maximum value of rms load current

iii)extinction angle for $\alpha = 75$ (16)

15.a.(i) Explain the operation of single phase modified series resonant inverter .A single phase series inverter has the following data V=220 V,R=2 ohm , L = 40 micro H and C = 8 micro farad and device turn off time is 12 microsecs. Calculate the maximum possible operating frequency taking a factor of safety of 2. (10)

(ii) Explain how harmonic reduction can be done by introducing notches in the output voltage waveform (6)

(OR)

15.b. (i) Explain 120 degree mode of conduction of 3 phase inverter with phase and line to line voltage waveforms. (8)

(ii) Describe how the stepped voltage waveform shown in figure below is to be realized by cascading the output of two inverters (8)