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B.Tech Part Time ELECTRICAL ENGINEERING. 5th SEMESTER

SUPPLEMENTARY EXAMINATION Feb. 2019

CEE -301-Power Electronics

Time: 3:00 Hours ***Maximum Marks:40***

Note:
- Q.1 and Q.2 are compulsory. Attempt other Three(3) questions from the rest
- Assume suitable missing data, if any
- Attempt all parts of a question at one place (*Marks may not be awarded otherwise*)

1. Giving reasons explain briefly, why (*attempt any four*)?

[a] Power semiconductor incur higher losses for obtaining high blocking voltage.

[b] Voltage drop becomes more prominent on the DC side of the Thyristorised AC-DC converters connected to weak power system.

[c] Full bridge AC-DC converters can regenerate only through reversal of voltage rather than current.

[d] For series connection of power switching devices the voltage equalization is effectively achieved in the presence of RCD snubbers.

[e] A short fast rising spike is sufficient for triggering of thyristor.

[f] Input current to Boost converter is always desirable to be continuous.

[g] 120° pulse output of inverter is advocated for home inverter vis-à-vis square wave (180° pulse) output despite of reduced voltage. **2x4**

2 [a] Draw a neat diagram to explain the triggering of thyristor by two transistor theory. Explain through two transistor theory the regenerative process of turn on of thyristor. Derive an expression for anode current in terms of common base-current gains of both transistors (α_1 and α_2). Draw a neat labelled I-V characteristics of thyristor. **2**

[b] Derive the expression for frequency of oscillation for UJT working as relaxation oscillator. Design a relaxation oscillator with UJT having following characteristics:
η=0.72; I_p=0.6mA; V_p=18V; V_v=1V; I_v=2.5mA; R_{BB}=5kΩ; I_{E0}=4.2mA
If the firing frequency is 2kHz, for C=0.04μF. Find the tuning resistance 'R', and external resistances R_2(bottom) and R_1(top). **3**

[c] Derive the expression form the fundamental for the R & C parameters of a RCD turn-off snubber. Design a turn-off RCD snubber for a transistor switch operating at 100kHz with a duty ratio of 50% and transistor turn-off time of 0.1μs. Operating voltage is 200V and load current is 10A. Use criterion that switch voltage reaches V_s, when switch current reaches zero. **3**

P. T. O.

3 [a] For a single pulse single phase inverter arrive at pulse shaping to avoid 3rd harmonic and triplens. Support your answer with appropriate analysis. 2

[b] Draw neat voltage waveforms for a phase full converter feeding to load having large inductance for the following firing angles:
[a] α=60°
[b] α=90°
[c] α=120° 3

[c] The single-phase ac voltage controller of has a 230 V, 50 Hz source. The load resistance is 10 Ω. Determine (i) the delay angle required to deliver 2000 W to the load, (ii) the rms source current, (iii) the power factor.
Given the relation between output voltage of AC voltage controller with firing angle 'α' for rms input voltage of 230V. 3

Voltage (V)	$230/\sqrt{2}$	$100/\sqrt{2}$	230/2
Delay (Rad)	1.6	1.97	2.39

4 [a] Derive the expression for requisite value resistance (R) and capacitance (C) for static and dynamic equalization for series connected thyristors.
A series connection of thyristor string is employed for 11kV system, where each thyristor is rated for 1.7kV. The string efficiency is 90%. If the maximum blocking current is 15mA and maximum charge storage (ΔQ_{max}) is 24 micro-coulombs, calculate the value of resistance and capacitance of equalizer circuit. 4

[b] Derive an expression for minimum inductance (*for continuous conduction*), and output voltage ripple for a buck converter. Draw appropriate waveforms to support the derivations. Calculate the % ripple for output voltage when the buck converter has following parameters.
V_s=50V; d=0.4; L=400μH; C=100μF; f=20kHz; R=20Ω 4

5 Derive an expression for the three phase inverter output voltage, line voltage and load voltage for 180° conduction thyristorized inverter. Draw a neat diagram to support the analysis. 8

6 Write short notes on the following.

[a] Operation of Type-D chopper with gating pulses alongwith voltage and current waveforms.

[b] Derivation of fourier components for single phase full bridge rectifier voltage output and compute the expression for voltage. 2x4

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